



DURBAN UNIVERSITY OF TECHNOLOGY
INYUVESI YASETHEKWINI YEZOBUCHWEPHESHE

**AN EVALUATION OF THE WASTE
MANAGEMENT CYCLE UTILISED BY FRESH
PRODUCE MARKET INFORMAL TRADERS
IN DURBAN, KWAZULU-NATAL**

BY

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STUDENT DECLARATION

I, Renisha Sahathu, do declare that this dissertation is representative of my own work in both conception and execution. Where other people's work has been used or quoted, acknowledgement by means of complete references is indicated.

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DEDICATIONS

I dedicate this research work to my dear family and loved ones who have supported and stood by me through it all. Thank you for motivating me to never give up and always strive for excellence.

To the Almighty God, for the strength to push through all odds and come out stronger.

To my husband Niven for all the support, understanding and motivation. I appreciate and love you.

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ABSTRACT

BACKGROUND: Informal markets are located at various Central Business Districts (CBD) within the eThekweni Municipality with hundreds of individuals visiting these markets due to the fresh produce and low prices that are available at these markets. There are no storage facilities that are provided to the traders for extended life span of their fresh produce hence there are large quantities of food waste or organic waste which is disposed of on a daily basis. These wastes are collected by Durban Solid Waste (DSW) regularly and are disposed of at one of the three active landfill sites within the municipality. Proper waste management of these wastes are imperative as the impacts of negative waste management has dire consequences to health, and the environment and can take up a large proportion of the municipal budget to correct those situations. Solid waste emanating from informal markets are the second highest municipal solid wastes after residential wastes that are landfilled. These wastes contain a high fraction of waste for which diversion alternatives exists however, these practices have not been implemented.

AIM: This study aimed to evaluate the waste management cycle utilized by fresh produce market informal traders in Durban, KwaZulu-Natal.

METHOD: A descriptive, cross sectional study was conducted using questionnaires that were administered to the participants. The questionnaires were the main research tool utilized for the study. The study was conducted at two markets within the Durban Municipality. These were the Early Morning Market and the Verulam Market of a total of seventeen markets within the municipality. Simple random samplings were used in order to achieve a degree of accuracy and representativeness. To achieve a 95% confidence level, participants were invited to respond to the study having signed the informed consent form. Descriptive statistics were presented in the form of graphs, cross tabulations and other figures for the quantitative data that was collected. The Pearson's Chi-squared test was used where applicable for bivariate associations between categorical variables.

Confidence intervals of 95% were calculated and $p < 0.005$ were considered to be statistically significant.

RESULTS: A total of 197 of informal traders within the two markets responded to the questionnaire. The results indicated that 89.2% (n=173) were females while 10.8% (n=21) were males. The data revealed that 41.6% (n=82) of the informal traders did not have a formal education while 33.0% (n=65) had partial secondary education with 39.9% (n=77) being within this sector for between six to seven years. Only 0.5% (n=1) of the respondents indicated that they had additional occupations. Respondents sought information relating to their business and waste management mainly via the radio (n = 166, 84.3%) and word of mouth (n = 148, 75.1%). A portion of 39.6% (n=78) indicated that they received information via city brochures and pamphlets. Food waste was found to be the most prevalent waste stream that was generated by the informal traders as was reported by 99.5% (n=196) of the informal traders that responded. This was followed by the waste streams of paper (n=180, 91.4%), cardboard (n=176, 91.4%) and plastic packaging (n=171, 86.8%). Disposing of their waste at the storage facility that was provided by the market management was the most prevalent disposal method that was identified by the respondents (n=195, 99.0%) while 2.5% (n=5) identified that their wastes were landfilled while 4.1% (n=8) stated that they disposed of their waste via open dumping.

CONCLUSION: This study concluded that the most prevalent waste streams that are generated by the fresh produce market informal traders do have alternative disposal methods instead of landfilling. The informal traders indicated that they would be willing to participate in recycling and composting programmes which must be implemented by the market management in conjunction with the local authorities. The study further indicated that the practices of waste management undertaken by the informal traders are influenced by the facilities that are provided by the municipality ($p < 0.005$).

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ABBREVIATIONS

DSW – Durban Solid Waste

EU – European Union

GDP – Gross Domestic Product

GHG – Green House Gases

IWMP – Integrated Waste Management Plan

KAP – Knowledge, Attitudes and Practices

MSW – Municipal Solid waste

MSWM – Municipal Solid Waste Management

NGOs – Non-Governmental Organizations

NWMS – National Waste Management Strategy

POP – Persistent Organic Pollutants

SWM – Solid Waste Management

USA – United States of America

CHAPTER ONE

INTRODUCTION

1.1 INTRODUCTION

Waste is subjective. It is viewed can be viewed as garbage by some whilst others might view it as a resource. Waste is seen in various ways. Some view it to be an environmental issue, a health issue, or an aesthetic issue. Waste management is described as the systematic control of the generation, collection, transportation, separation, recovery, treatment, and disposal of waste (Seadon, 2010: 1639). Waste can be in any form from a liquid, to a solid or gas and is known as any material that is no longer wanted by the owner and is about to be discarded or is discarded (Rushton, 2003: 183). Uncontrolled waste or poor waste management can create an environment which allows flies, vermin, and rats to thrive which may exacerbate poor health outcomes in communities. The local municipality is responsible for the waste management function that is provided to communities as well as the retail markets which fall under the jurisdiction of the municipality. The National Environmental Management Act: Waste Act (Act No. 59 of 2008), hereafter referred to as The Waste Act, delegates the responsibility of waste management to local government bodies. In developing countries, waste generation rates are increased significantly due to factors such as urbanization, booming economies and increase in populations. This can significantly impact the level of service that is delivered by the local municipality who are already negatively impacted by other issues surrounding a lack of financial resources and organization thereby further negatively impacting the provision of a basic service (Guerrero, et al; 2013: 230). The National Waste Management Strategy (NWMS) aims to establish a plan to address the issues stated above and more. However, the NWMS aims its consideration towards communities and household waste which leaves retail markets unaccounted for.

1.2 BACKGROUND

Durban is the largest city within the province of KwaZulu-Natal and is the third largest in the country with a land area of 2 297 square kilometers. As per the Census done in 2011, the city was home to over 3 442 398 people with an unemployment rate of approximately 27% (About eThekweni Municipality Anon. 2011). The city's administration which is led by the City Manager, comprises of various service delivery sectors including the business support, tourism and markets unit. These sectors are responsible for the provision of an integrated business support service to existing and potential businesses within the municipality which could result in job creation and economic growth. This service includes the management of stall allocation for the various informal markets that are located at various points within the municipality. There are currently eighteen retail markets within the region. These markets can house from fifty stalls up to over six hundred stalls which could result in a significant amount of waste generation. The products sold by these traders range from fresh produce to cooked food, clothing and jewelry. Anecdotal evidence suggests that the majority of these waste streams may be recycled or reused in some way or another, however, the limited services that are provided by the municipality does not allow for that. This may result in stall owners or traders recycling their waste on their own or all waste being landfilled which can lead to space restrictions at landfill sites. Durban has four active domestic waste municipal landfill sites which are the Bisasar Road, Mariannhill, Buffelsdraai and the Lovu landfill sites. For a city with approximately 3 442 398, according to the 2011 Census (About eThekweni Municipality Anon, 2011), the amount of municipal waste generated can be significant with all wastes going to one of the three active landfill sites.

1.3 RATIONALE OF THE STUDY

Currently, there is very limited literature surrounding the knowledge, attitudes and practices of informal traders from retail markets within South Africa. This study will assist in addressing certain aims of the NWMS which are to promote waste minimization, recycling, reuse and recovery of waste products and to ensure that individuals are aware of the impact of their waste to the environment by providing information to enable municipalities to understand the gaps and develop awareness programs and waste reduction strategies aimed at informal traders. This study will also provide the basis for the development of waste recycling and reuse strategies for the many retail markets within the municipality. By recycling and reusing the waste products generated, the municipality would be able to flourish the recycling industry and create

employment whilst also reducing the burden and strain to the three landfill sites currently being used.

1.4 SIGNIFICANCE OF THE STUDY

The findings of this study can be utilized by the municipality to develop waste management strategies according to the most prevalent waste stream and create awareness programs to empower the informal traders to find methods of reducing, reusing and recycling their waste. This study can also aid in the development of policies surrounding the strategies of waste management for retail markets which can be utilized throughout the municipality.

1.5 AIM AND OBJECTIVES OF THE STUDY

1.5.1 AIM

The aim of this study was to conduct an evaluation of the waste management cycle utilized by fresh produce market informal traders at the Early Morning Market and the Verulam Morning Market in Durban, KwaZulu-Natal.

1.5.2 OBJECTIVES

The objectives of the study are:

- To determine the generation of the waste streams of fresh produce by market informal traders.
- To determine the knowledge of the waste management cycle among fresh produce market informal traders.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

Poor management of waste may potentially lead to the contamination of water, soil and the atmosphere resulting in a major impact to human health (Giusti 2009: 2228). Solid waste management is a growing concern in developing and developed countries alike. This can be attributed to rapid growth in population, urbanization and industrial growth. The growth in population within cities poses serious challenges to the provision of Municipal Solid Waste (MSW) management services by municipalities that are already experiencing internal issues such as lack of funding and poor or aging equipment (Mbuligwe 2002: 132, Narayana 2009: 1163, Parrot, Sotamenou and Dia 2009: 987). While Paul *et al.* (2012: 2018) stated that the services rendered by municipalities in developing countries were found to be lacking although it is a legal requirement in most countries. Abila and Kantola (2013: 303) stated that efficient management required the discovery of a newer application for a sustainable and environmentally sound management. In a study on the waste management in Africa, Godfrey *et al* (2018: 6) listed the contributors towards an increase in waste generation being urbanization, increase in population growth, a growing middle class and consumption habits, economic development as well as global trade.

Sustainable waste management methods can be defined as those methods or efforts that are made in order to reduce waste, recycle or reuse items that are deemed as wastes (Abadi, Mahdavian and Fattahi 2020:2). More and more generated wastes are being added to landfills on a daily basis in an already space constrained country. In Cameroon, MSW management is intensified due to the incessant population growth and blooming of the informal sector which accounts for more than half of the Gross Domestic Product (GDP) of the country. This study stated that waste generation was directly proportional to the population hence an increase in population would result in an increase in waste generation as was demonstrated in the city of Yaoundé (Parrot, Sotamenou and Dia 2009: 987).

In African countries, between 20 to 80 percent of solid waste is not disposed of in a controlled manner which results in dumping in open spaces, pollution of water sources and drains being blocked (Boadi and Kuitunen 2005:32).

The informal sector, a term which was coined by Keith Hart to describe the wide range of activities of the urban poor of the 1970s has evolved to describe that part of the working class which is exempt from tax and is unregulated by government (Skinner 2008: 227). Willemse (2011:7) defined informal traders as those who conduct informal street trading on a small scale, mostly from pavements and who offers a large variety of products and basic services to prospective clients.

Due to a non-requirement for an upfront large start up fund, several individuals join and exit the informal sector during the year. The fluctuation is mainly attributed to the lack of employment within the formal sector. The informal sector ranges from the sale of fruits and vegetables to clothing, jewelry, religious goods and includes stalls which sell cooked meals. These informal traders may be based at markets, which is a service that is provided by the municipality or on roadsides. The informal sector contributes significantly to the employment of people in developing countries such as South Africa as it allows individuals to obtain a foothold into the urban economy (Willemse 2011:7). Markets may be classified into traditional and modern markets. Modern markets are more organized than traditional markets and have a greater variety of goods that are sold (Hartono, Kristanto and Amin 2015:838).

There are eighteen retail markets within the region of eThekweni which house informal traders whose services vary from the sale of fruits and vegetables; meat and fish; clothing and medicines amongst others (Anon. 2011). The number of stalls within a market can range from fifty to over six hundred thus generating a significant amount of waste.

2.2 INFORMAL TRADERS

The informal sector is a wide-ranging term for various enterprises. Enterprises that comprise of the informal sector are street vendors, backyard activities such as knitting, vehicle repairs, panel beating, hair care and beauty therapy, photography, painting and other enterprises (Fundie and Chisoro 2015:48).

Informal traders often depend only on the sale of their goods as their income which is not consistent and regular based on the needs of the customers and growth of produce. Skinner (2008:227) reported in a review of the inclusion and exclusion process of street traders in Durban, that data suggests a close correlation between street trading or carrying out informal work and being poor. Further investigations of a census and street survey which was conducted within the Durban Metropolitan Area found that majority of the traders were women and almost half of them sold food (Skinner 2008: 229). An investigation into cross border informal trading

also found that women comprised a significant proportion of individuals that were active within this trade (Perbedy 2002:37).

While Skinner (2008: 227) stated that the informal sector fluctuated in numbers due to the lack of jobs within the formal sector, Cohen (2010:280) further confirmed this during a study of thirty-one street traders where sixty percent of the traders that were interviewed stated that they started their business due to unemployment.

The average trading time was found to be between six to ten years which brought a sense of stability in terms of employment to the traders (Cohen 2010:280; Ngiba, Dinckinson and Whittaker 2009: 463) and Fundie and Chisoro 2015:56). Once in this space, they found it difficult to go back into the formal sector due to the initial investment into their business. Most informal traders use their savings as an initial startup investment for their business. While on the positive side, the informal sector creates jobs and alleviates poverty (Selepe 2019:366).

Waste generated by traditional markets in Indonesia were found to be the second highest after household waste generation. Anecdotal evidence suggested that traders did not separate and recycle their waste. Hence the municipalities are required to provide the facilities for efficient waste separation at source so that they may reduce their environmental impact and possibly introduce a secondary method of income via the selling of recycling products to formal recyclers or composting of their waste for the growth of their future produce.

Studies conducted in India and Indonesia revealed that traditional markets were the second largest contributor of MSW containing organic waste, hard plastics, papers and soft plastic amongst others. These wastes contained a high organic fraction after household waste (Mboowa *et al.* 2017: 386; Aye and Widjaya 2006: 1180).

A study conducted by Saeed, Hassan and Mujeebu (2009: 2212) showed that food or organic waste constituted a major component of the MSW followed by mixed paper and plastics. Okut-Okumu and Nyenje (2011: 537) stated that in Africa, the main sources of wastes were households, markets, institutions, streets, public areas, commercial areas, manufacturing and industries. The study showed that markets contributed towards 20% of waste in weight to landfill just behind domestic waste which weighed in at 52%. The major constituents of the waste were stated to be vegetable wastes and spoilt fruits while the minor constituents comprised of damaged packaging materials. Oelefse and Nahman (2013: 80) stated that organic and food waste were problematic at landfill sites as these contributed towards greenhouse gases. This was supported by Masullo (2017: 85) which stated that landfilling of organic matters hinders the

biological utility of the organic matter by producing methane which has a global warming potential. Alternatives must be investigated to reduce the impact to the environment.

A study conducted in Indonesia stated that solutions for applying an integrated waste management system was identified as a greater effort and time to be fruitful due to the low-level education. An inference can be drawn that the level of education is directly proportional to proper waste management practices (Aye and Widjaya 2006: 1182). A well-informed population can make a larger difference in the quantities of wastes that are recycled or reused. However, the lack of formal education can be alleviated via the educational campaigns in terms of waste and waste management techniques.

Parrot, Sotamenou and Dia (2009: 994) concluded that public awareness was required on domestic waste management, urban sanitation and recycling. However, this may only be successful if the local operators or municipalities supports these processes. Informal traders are required to ensure that their sites of trading are kept clean (Selepe 2019:366). In the Polokwane municipality, a policy was developed to enable efficient management of the informal traders, deemed as street traders, with the activity being approved, regulated and monitored.

2.3 WASTE

Rushton (2003: 183) defined waste as being anything that is discarded by an individual, household or organization while the Waste Act defines waste as any substance whether or not that substance can be reduced, recycled or reused for which the generator has no further use of for the purpose of production. Vergara and Tchobanoglous (2012:279) defined MSW as materials that were discarded from residential and commercial areas. Waste is defined as garbage, rubbish and discards. However, it also depends on who is defining the waste. To an individual, waste is valueless however to a waste picker, it has value and can provide a source of income for them. Hence, it can be deduced that the items which are discarded by market informal traders, whether it may be recycled, reused or not, are deemed as waste.

Indonesian traditional markets were found to be the second largest contributors of municipal solid waste despite there being alternatives for certain waste streams. The waste was being open dumped leading to detrimental impacts to the environment (Aye and Widjaya 2006: 1189). Waste, when not managed, can result in many environmental and health issues such as providing a breeding ground to rodents and vermin as well as clogging up the drainage systems and being unsightly in areas where dumped. A Kenyan case study conducted by Henry, Yongsheng and Jun (2006: 98) suggested that the lack of municipal waste management

resulted in the dumping of waste on open grounds which may lead to contamination of ground water sources or the leachate could leach into and pollute surface water. Hartono, Kristanto and Amin (2015:839) stated that a lack of waste management can cause various environmental problems leading to degradation of the market's public health, hygiene and aesthetics including water and air pollution.

Hoornweg and Bhada-Tata (2012: 16) defined South Africa as an upper – middle income country, broke down MSW and the sources that contributed to the entirety of the waste stream was determined. This is represented in Table 2.1 below. Organic waste was comprised of food scraps, garden waste, wood and process residues.

Type	Sources
Organic	Food scraps, yard (leaves, grass, brush) waste, wood, process residues
Paper	Paper scraps, cardboard, newspapers, magazines, bags, boxes, wrapping paper, telephone books, shredded paper, paper beverage cups
Plastic	Bottles, packaging, containers, bags, lids, cups
Glass	Bottles, broken glassware, light bulbs, coloured glass
Metal	Cans, foil, tins, non-hazardous aerosol cans, appliances (white goods), railings, bicycles
Others	Textiles, leather, rubber, multi-laminates, e-waste, appliances, ash, other inert materials

Table 2.1 Composition of wastes within MSW (Hoornweg and Bhada-Tata (2012:16))

2.4 WASTE MANAGEMENT

Waste management can be defined as the process generation, collection, transfer, transporting, processing and disposal of waste. This process may also include resource recovery, recycling and reusing of waste (Seadon 2010: 1639; Sharholly *et al.* 2008: 459; Abila and Kantola 2013: 304).

There are four main drivers for the development of waste management systems. These are public health, environmental protection, resource recovery and climate change. Countries also implement or improve on their waste management systems for aesthetic reasons however the four main drivers are of most importance. Public health seemed to be the motivating factor to the development of waste management strategies due to the negative health impacts of practices such as open dumping and burning of wastes. Environmental protection informed waste management strategies where there was a strong presence of legislation protecting the air, water and land but also in areas where environmental degradation was visible. Resource recovery drives waste management strategy development from an economic perspective.

Where resources are scarce, materials can be reclaimed via recycling, recovery and reuse. While climate change has emerged as a driving force in developing waste management strategies in both industrial and industrializing nations. Aesthetics emerged due to the desire to provide a clean and modern city (Vergara and Tchobanoglous 2012:286).

The Waste Act mandates that local municipalities are responsible for the waste generated within the municipality. Waste management for municipal waste is considered a public service of which the aim is to provide citizens with a system of disposing their waste in an environmentally sound and economically feasible method (Beigl, Lebersorger and Salhofer 2008: 200). Most cities MSW management includes three activities which are the collection, transportation and disposal of waste (Abila and Kantola 2013: 304). Hence the recovery and recycling of wastes are not done and thus exacerbating the quantities of wastes that are disposed of at landfill sites.

Jha *et al* (2011: 127) schematically described the various waste management steps that are taken with the interrelations between these steps depicted in Figure 2.2 below. It defines the way in which the informal waste sector can be integrated into a formal waste management system thereby reducing the waste collected by municipality and significantly reducing the amount of wastes that are landfilled. Waste pickers, depicted as “rag pickers” in Figure 2.2 below, collect recyclable wastes and sell these to “whole sellers” or middle men. These whole sellers then sell these recovered materials to larger, formalized recyclers for a profit. Within the typical waste management process utilized by municipalities, transfer stations are used are used to compact the waste which is then transported to landfill sites. The wastes are compacted to alleviate transportation costs by maximizing space within transportation containers.

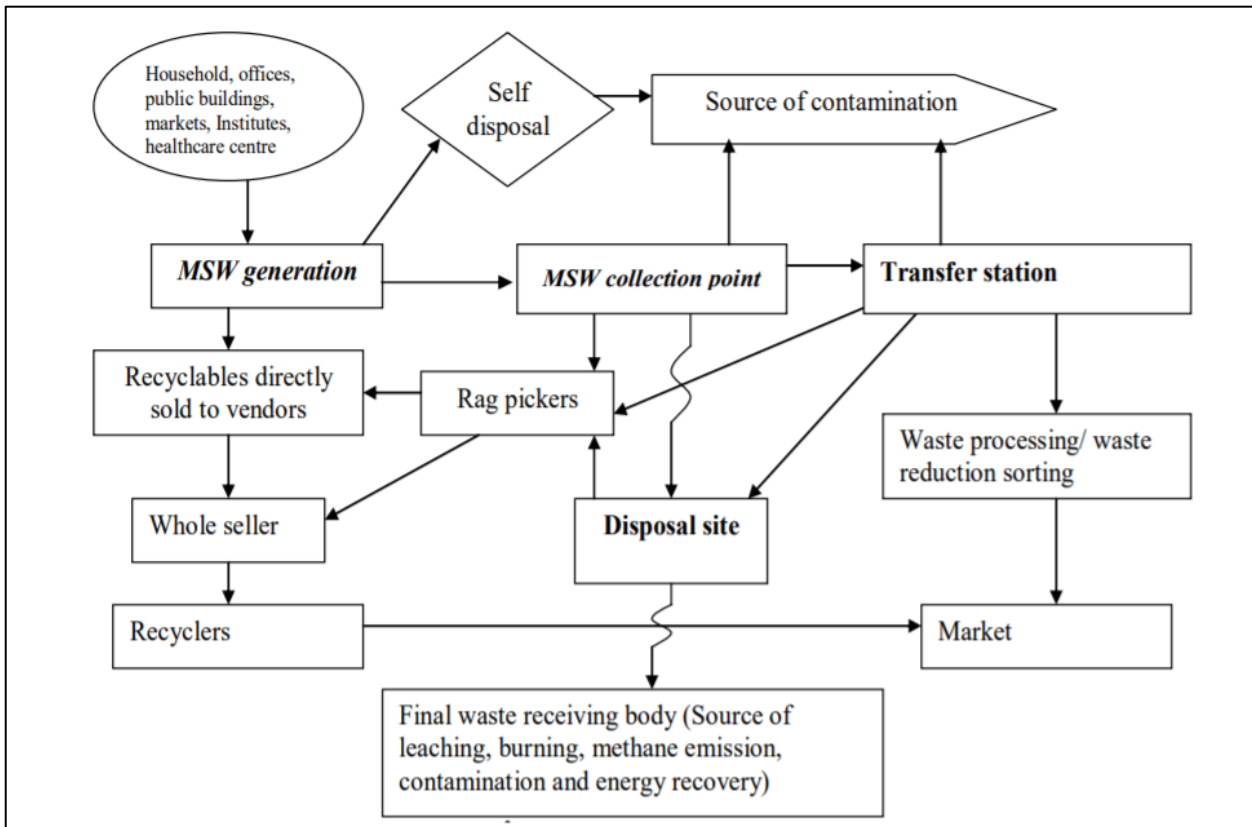


Figure 2.1 Schematic representation of the waste management process flow (Jha *et al.* 2011:127)

Minghua *et al* (2009:1230) reported that the waste management process that is followed in the city of Pundong, China, was that of storage, collection, transportation and final disposal. Waste receptacles were found to be available at collection points, streets and public places. Storage of wastes were carried out via these receptacles until the scheduled collection. The analysis of the waste treatment methods between 2004 and 2006 found that waste that was incinerated was steady for the three-year period while composted waste was found to increase by over fifty percent from 2004 to 2006 and waste that was landfilled fluctuated between the years.

Magrinho, Didelet and Semiao (2006:1478) stated that in Portugal, municipalities were responsible for the collection of mixed waste whilst the separation, treatment, recovery and disposal were the responsibilities of other entities as defined by the MSW structure. Inadequate solid waste management is directly linked to the restricted funding of public services, lack of technical and human resources and a lack of awareness of municipal waste management authorities regarding environmental and public health impacts of mismanagement of solid waste (Couth and Trois, 2010:2338).

A study conducted to provide trends and determinants of waste mechanisms within households in Sri Lanka over the period of 2007 to 2016 found that 44.91 percent of households burnt their

waste which decreased from 50.47 percent in 2007, 29.17 percent of households dumped wastes within their own premises which was an increase from 16.61 percent in 2007 whereas those dumping their waste outside the premises decreased from 9.87 percent in 2007 to 1.87 percent in 2018. The results also showed that the level of education informed the decisions made in terms of waste management methods undertaken. Those with a higher education level were less inclined to burn or dump waste (Kumara and Pallgedara 2020:65).

Awasthi *et al* (2019:99) stated that based on studies conducted in Brazil in order to achieve effective solid waste management, public awareness and participation is required. Amongst this, stringent laws and policies are also required at municipal and provincial levels. Impacts of socioeconomic statuses cannot be ignored and must also be factored in when developing a plan addressing solid waste management.

Desa, Kadir and Yusooff (2011:647) reported that sixty four percent of the five hundred and eighty nine first year students sampled for the KAP study perceived that the solid waste issue is not effectively managed, water and food borne disease will escalate and could thus result in heightened morbidities and mortalities affecting communities while only 16.6 percent of the students strongly agreed that implementing proper and sustainable waste management was a practical method to maintain high levels of cleanliness around their campus and the health of students. This indicates an urgency to educate students and raise their awareness of waste management issues. Adeolu, Enesi and Adeolu (2014:70) revealed that secondary school learners were aware that waste management was a serious environmental issue within schools. Godfrey *et al* (2018:9) stated that the environment will be impacted negatively due to decomposed solid waste in open spaces, uncontrolled dump sites or storm water drainage and open burning waste. The impacts of these are pollution of air, soil and water streams. Wastes that contain toxic chemicals and persistent organic pollutants (POPs) linger in the environment, are likely to accumulate within the environment and can travel long distances. Further to this, human health impacts are dependent upon factors such as the nature of waste, disposal methods, duration of exposure and the population exposed (vulnerable population). The impacts can vary from mild psychological effects to severe morbidity, disability or death. Uncollected and accumulated wastes near houses, markets, streets or within drainage channels can become a breeding ground for vectors such as malaria carrying mosquitoes. And the burning of wastes can cause inhalation of toxic chemicals and fumes. Open dumping can result in leachate polluting nearby water sources and the soil.

In a global review on MSW, it was ascertained that waste affects air and water quality, public health and contributes to climate change with open dumping of wastes resulting in

contamination of nearby water bodies with organic and inorganic pollutants. Public health is affected by the attraction of disease vectors and exposure to harmful products of nearby people living near the waste (Vergara and Tchobanoglous 2012:279).

An overview of the barriers to MSW management in China found that the safe disposal rates were relatively unchanged from 1995 during which it was fifty-five percent. Other barriers included the demographics which varied from city to city hence a “one size fits all” approach to waste management would not be efficient, research and surveys on waste generation and waste properties were found to be lacking and commercialization posed multiple risks to the market which could hinder the development and enactment of the various policies regarding MSW management. However, these issues could be rectified with an integrated waste management approach which can be achieved via the implementation of multiple methods and collaboration of all necessary stakeholders (Chen, Geng and Fujita 2010:722).

2.5 GENERATION OF WASTE

A study conducted on the environmental and economic analyses of waste disposal options for traditional markets in Indonesia found that the markets are the second largest contributors of MSW containing a higher organic fraction, mainly due to predominant food and garden waste, after household waste (Aye and Widjaya 2006:1189; Oelofse and Nahman 2013:3). Meanwhile a review of 23 case studies by Troschinetz and Mihelcic (2009:920) found that organic waste was found to be the most prevalent generated waste stream among paper, textiles, plastics, glass, metals and other amongst the USA, EU and developing countries. Parfitt, Barthel and Macnaughton (2010:3065) defined food waste as good, edible items which are intended for human consumption at any point within the food supply chain which is lost, discarded, degraded or consumed by animals or pets. In the review conducted, post-harvest losses were found to be influenced by the facilities provided by the markets for agricultural produce such as cold rooms or fridges which will allow the storage of the produce and expand the life span without the produce spoiling. It was further established that a large proportion of fresh fruits and vegetables are spoiled even before it reaches the customers. This finding was reported in both the United Kingdom and United States of America.

In Kermashah City, Iran, physical combinations of waste were surveyed, and it was noted that food waste was an important waste stream being generated in the city (Almasi *et al* 2019:333). A study conducted in Iloilo City, Phillipines, found that sixty percent of the MSW that was taken to the dumpsite comprised of organic waste including paper, cardboard and packaging material (Paul *et al.* 2012:2021). In South Africa, municipal solid waste is classified as general waste

and is comprised of business waste, building and demolition rubble, inert waste and domestic waste (South Africa, Department of Environmental Affairs 2011:12).

These wastes are more uniformed and less hazardous thus allowing them to have a larger potential to be managed. In Nigeria, 25 million tonnes of municipal waste were reported to have been generated annually (Abila and Kantola 2013:304). In Portugal, it was reported that in the year 2002, 4 746 021 tons of waste were generated which amounted to a range of 0.75 to 1.98 kg/capita/day. Of the total amount of mixed waste collected, only 4% were separated at source allowing for the waste streams to be diverted for recycling or reuse (Magrinho, Didelet and Semiao 2006:1481). The MSW generation in 2004 was reported to have been 2418 tons per day which increased to 2854 tons per day in 2005. This is a significant increase that is attributed to the economic growth of the city (Minghua *et al* 2009:1228).

Parrot, Sotamenou and Dia (2009:989) stated that in the city of Yaoundé, it was reported that waste generated ranged from 0.6 kg/capita/day to 0.98 kg/capita/day. However, of the total amount of waste generated, approximately only 5% of waste was estimated to be recycled. In Kuala Lumpur, Malaysia, it was deduced by Saeed, Hassan and Mujeebu (2009:2209) that the amount of waste generated on a daily basis per capita was found to be 1.62 kg with the national annual average being 0.8 – 0.9kg/capita. This is expected to increase to 2.23kg/capita by the year 2024. Troschinetz and Mihelcic (2009:917) reported that the relationship between MSW generation and the developmental stage of a country was found to be directly proportional. As the country developed, the amount of waste generated was found to increase.

An outlook into the waste management within African cities undertaken by Godfrey *et al* (2018: 8) predicts that between 2010 and 2025, the amount of organic waste that is produced will decrease while there will be an increase in the amount of packaging and paper waste that is generated. This estimation was based on correlations between MSW generation and wealth, income, family, lifestyle and a growth in the middle-class population. This is represented in Figure 2.3 while Figure 2.4 estimated that most of the waste generated in the cities of Africa were expected to increase. However, South Africa was within the same region of 1.51 to 2.00 kg/capita/day. Figure 2.4 indicates the waste generation is expected to increase in tonnes per year. As per the Figure 2.5, South Africa will continue to generate greater than 20 000 tonnes of MSW each year with most of this waste being landfilled. Vergara and Tchobanoglous (2012:279) stated that demographic changes resulted in concentrated waste in cities. Waste production tended to increase with wealth, urbanization and population.

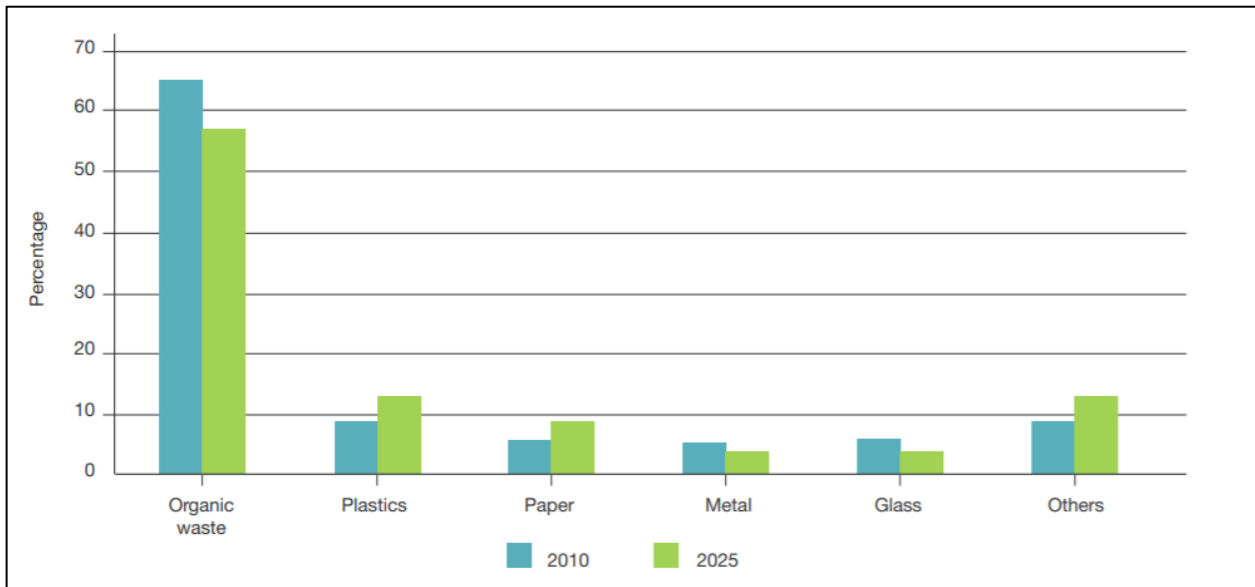


Figure 2.2 Expected changes in waste composition in African cities between 2010 and 2025 (Godfrey *et al* 2018:8).

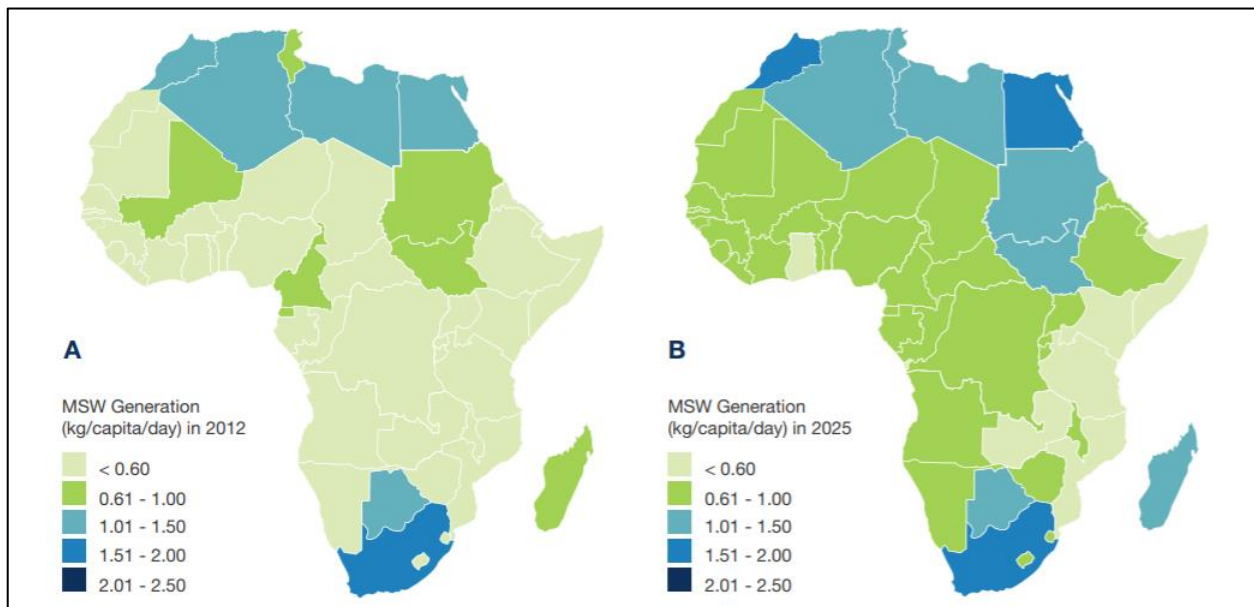


Figure 2.3 Expected waste generation increase in Africa from 2012 to 2025 (Godfrey *et al* 2018:24).

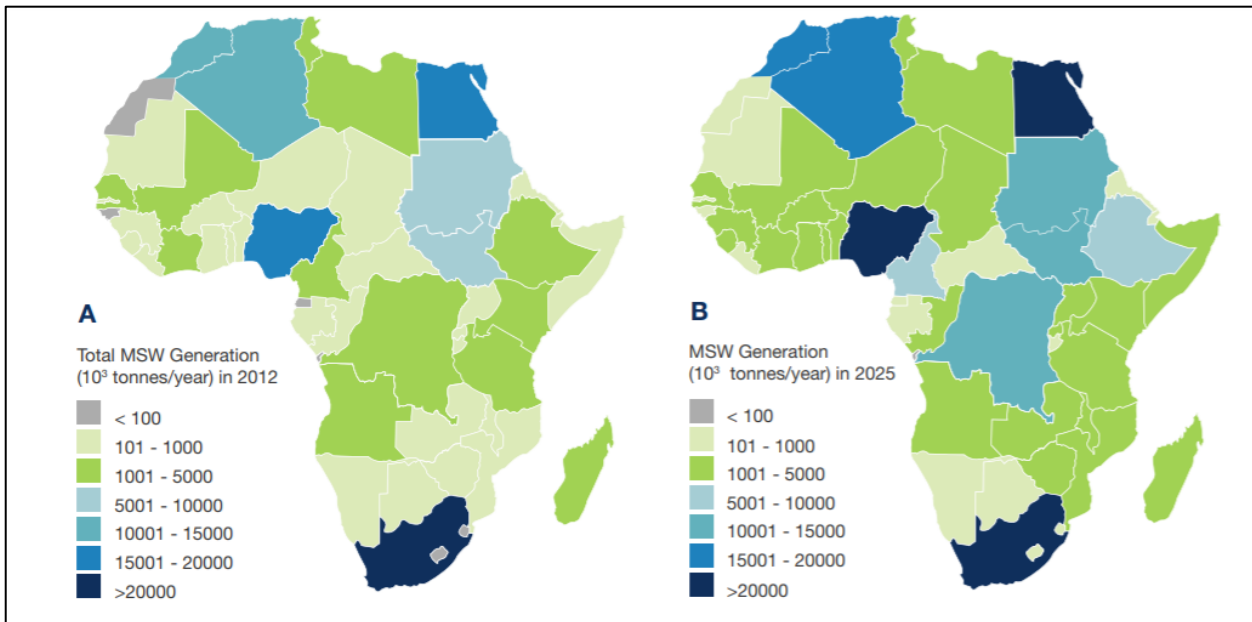


Figure 2.4 Total MSW generated in Africa from 2012 to 2025 (Godfrey *et al* 2018:25).

A study conducted between a traditional and a modern market found that the waste generated by the modern market was significantly less than that of the traditional market. This variation was attributed to the difference in crowd and operational times. The traditional market tended to have much more people with a longer operational time than the modern market (Hartono, Kristanto and Amin 2015:840).

A study conducted on fruit and vegetable waste in a traditional market in Bandung, Indonesia found that 62% of the waste was attributed to fruit and vegetable waste. The waste also consisted of 18.7% other organics, 13% plastics, 1.5% paper and 3.8% inert materials (Padmi, Dewiandratika and Damanhuri 2018:11).

Within the Integrated Waste Management Plan (IWMP) for the Durban Municipality drafted in 2016, the amount of wastes that were disposed of at the four landfill sites that were operating at the time was recorded and noted graphically represented in Figure 2.6 for the years of 2013, 2014 and 2015. It was noted that the DSW contributed towards most of the waste that was landfilled. DSW was classified as domestic, commercial and industrial waste (non-hazardous) that is collected by DSW, including subcontractors. This was followed by sand and cover material which was defined as excavated soil and ground that can be used for concealment material for the landfill cell (Bosch Munitech 2016:56).

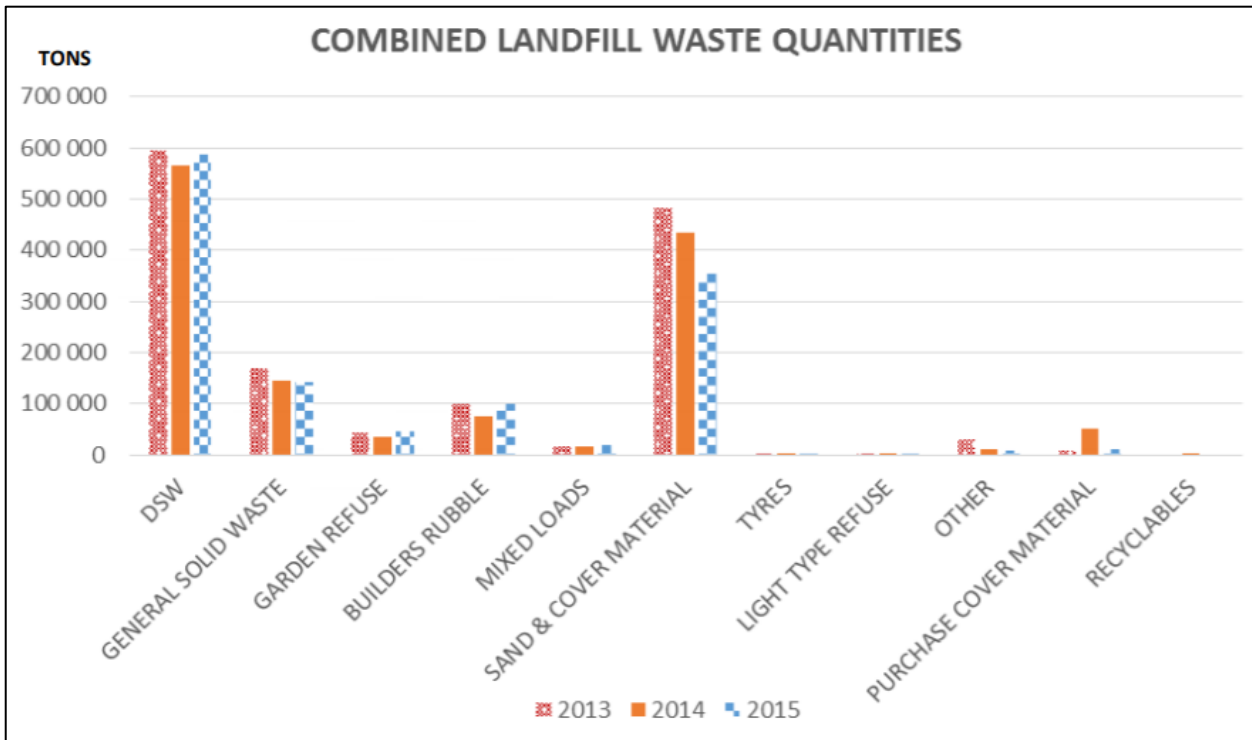


Figure 2.5 Combined landfill waste quantities from 2013 – 2015 (Bosch Munitech 2016:56)

2.6 COLLECTION AND TRANSPORT OF WASTE

According to a report by Bosch Munitech (2016:66), Durban had four active landfill sites and utilized seven transfer stations at various locations within the municipality. Waste is brought to these transfer stations and is then transferred into hoppers. The waste is then compacted into long haul containers which are 27 cubic metres. These are then transported to the landfill sites using the appropriate vehicles for transportation. Since this assessment, one of the landfill sites was closed due to space constraints.

Collection of wastes is seen as that point at which the waste generator interfaces with the waste management system. It is the process of the removal of the waste from the storage facilities of generators and allows for the treatment thereof. This process is to reduce accumulation of waste at the point of the generator. Waste was found to be collected on a regular basis (Vergara and Tchobanoglous 2012:291).

According to Awasthi *et al* (2019:81) storage and collection services are provided by municipality in the form of bins, plastics and trucks. These main aspects of a sustainable solid waste management plan fall within the jurisdiction of the local municipality requiring strict regulations and enforcement. Waste collection in the commercial areas including the CBD, are serviced by DSW or private companies that are contracted to DSW. The frequency of the

collection is minimum once per week. however, this can be increased by making the necessary arrangements with the department (Bosch Munitech 2016:63).

A study conducted by Magrinho, Didelet and Semiao (2006:1487) found that the most common method for separate collection is based on the use of separate containers for glass, plastic, metals, papers and cardboards. Separate collection can be seen as a vital role in ensuring recycling becomes an integral role of MSW management.

In Portugal, the separate collection of packaging waste materials was achieved by strategies of campaigning to bring about citizen awareness on environmental issues and the need to recycle, collection of specific materials near trading shops and schools and the last strategy being door to door collection. Municipalities are required to supply the areas they service with waste receptacles which are accessible to the public and for collection, this may also include receptacles for recycling components (South Africa, Department of Environmental Affairs 2011: 38).

A study conducted in the city of Accra, Ghana found that house to house collections were done for middle to upper income areas. These areas were defined as low-density areas where the infrastructures in place are favorable. Communal container collections were done for low income, high density classified areas. The study also found that within the low income, high density areas, waste was often dumped into gutters, drains and streams due to communal containers not being collected regularly (Oteng-Ababio, Arguella and Gabbay 2013:98).

The cost of waste collection was found to average between fifty to sixty percent of the budget within middle income countries with low income cities spending approximately eighty percent (Vergara and Tchobanoglous 2012:291).

2.7 TREATMENT AND DISPOSAL OF WASTE

2.7.1 LANDFILLING

Landfilling is the most traditional and economical method of waste disposal in developing countries. Landfilling involves the pitching of waste into pits or depressions within the land with the aim being to avoid any contact between the waste and the surrounding environment which is most often considered to be the most cost-effective method of disposal. However, many have deemed this to be incorrectly quantified based on the environmental impacts and space constraints posed by landfill sites (Taiwo 2011:95 and Narayana 2009:1164).

Narayana (2009:1165) stated that there are three types of landfills. These are open dumps, semi controlled or operated landfills and sanitary landfills. Of the three stated, open dumps are used mostly in developing countries and is the most harmful to the environment with sanitary landfills ensuring there are facilities for the interception and treatment of leachate and gases. Landfilling has a great negative environmental impact however this can be mitigated by the implementation of sanitary precautions. The leachate that is produced at landfill sites as a result of rain and surface water or ground water contains concentrated toxic chemicals. This can result in contamination of ground water supplies and surface water ecosystems.

Manaf, Samah and Zukki (2009:2904) stated that at the time, the current method of disposal was landfilling with most landfill sites being open dumping areas posing serious environmental issues. In a study conducted in South Africa to investigate the association between exposure to waste sites and asthma, tuberculosis, diabetes and depression it was reported that the mean distance between households and waste sites had decreased by approximately 87% from 2008 to 2015. It was further stated that households residing closer to waste sites had a higher expectation of experiencing asthma, diabetes, tuberculosis and depression. The study relied on self-reporting health issues and did not include clinical diagnosis however it was mentioned that a study conducted in India concluded that self-reporting substantially understates true disease prevalence (Tomita *et al.* 2020:228). The establishment of new landfill sites were also hampered due to land scarcity and increase in land prices.

It was estimated that in the year two thousand and seven, landfills were responsible for forty-nine percent of England's methane emission (Abila and Kantola 2013:304). When organic waste is landfilled, it undergoes anaerobic decomposition due to the lack of oxygen and thus produces a greenhouse gas, methane.

Oelefse and Nahman (2013:4) stated that landfilling was found to be the cheapest and most practical waste disposal method in South Africa. However, the scarcity of available land in close proximity of waste generation activities and emissions of landfill gases have made landfill a less attractive disposal option with organic waste disposal being estimated to be a contributor of at least 4.3% of South Africa's greenhouse gas emissions. Narayana (2009:1165) stated that people living in close proximity to landfills where landfill gas migrates through the soil were found to have reported several types of cancer.

A Kenyan case study conducted by Henry, Yongsheng and Jun (2006:98) found that dump sites were not inspected nor monitored with no sanitary measures applied. It was also stated that none of the dump sites in Nairobi met the basic requirements in protecting ground water

from pollution by leachate as they did not have liners. It was further stated that an outbreak of diarrhea was traced to a vegetable farm which used surface water which was contaminated because of the municipal solid waste dumping. This study depicted the health concerns surrounding the correct disposal of waste and the impact that improper waste management can have to actions of waste generators and the health impacts thereof.

Awasthi *et al* (2019:84) stated that in Dhaka, Bangladesh, the Dhaka City Corporation has the capacity to only collect 50% of wastes generated which resulted in other wastes being disposed of in open spaces which then resulted in environmental health issues such as drain blockages, bad odors, water pollution and mosquitoes. A KAP study conducted in Nigeria among secondary school learners concluded that open burning (78.6%) was the most prevalent method used for waste disposal while a few (4.3%) identified recycling and composting (Adeolu, Enesi and Adeolu 2014:68).

A KAP study conducted in Kermanshah City, Iran, on one thousand seven hundred and fifty women found that the knowledge of individuals about diseases transmitted by unsafe landfilling and its effect on the environment was moderate while sixty-five percent of interviewees believed that unhealthy landfilling of MSW led to contamination of surface and ground water, soil and air pollution (Almasi *et al* 2019:333).

The major components of the waste were stated to be vegetables wastes and spoilt fruits and minor components comprised of damaged packaging materials (Okut-Okumu and Nyenje 2011: 538).

2.7.2 INCINERATION

Incineration can be defined as the high temperature combustion of waste in a high efficiency furnace to produce ash residue and air emissions (Narayana 2009:1163). Within this process, all carbon waste is converted to carbon dioxide, all hydrogen to water, and all sulfur to sulfur dioxide. By products include ash, and air emissions (Vergara and Tchobanoglous 2012:282). This waste management treatment allows waste quantities to be reduced greatly as the ash can then be disposed of via landfilling. However, this method does not eliminate waste, it merely transforms the waste to another form. The negative impacts of incineration are the air emissions, which may contain heavy metals, dioxins and other volatile organic compounds which can accumulate in the environment for decades resulting in adverse health impacts such as cancer and liquid discharge which are far more difficult to deal with (Narayana 2009:1164 and Taiwo 2011:95).

A study conducted by Eriksson *et al* (2005:251) evaluated a combination of incineration, materials recycling of plastic and cardboard containers and biological treatment in comparison to landfilling. The findings of the study concluded that several waste treatments were possible and better in terms of environmental impacts, use of energy and economic impacts. A combination of the waste treatment strategies would be best applied to deal with the various waste streams as the study found that a “one size fits all” approach was not viable. However, the avoidance to landfill can be achieved.

2.7.3 COMPOSTING OF WASTE

Composting can be defined as that biological process whereby regular introduction of air by mechanical turning stimulates aerobic microorganisms to reduce organic materials such as manure to a more stable environmentally friendly manner (Taiwo 2011:96). While Vergara and Tchobanoglous (2012:281) defined composting as the decomposition and stabilization of the organic fraction of MSW carried out by a microbial community under controlled, aerobic conditions with most biogenic matter having the ability to be composted and being used as soil fertilizer. Aerobic digestion is a bacterially mediated process which occurs in the absence of oxygen. Microbes consume biomass and release gas in the form of carbon dioxide and methane. Composting involves the mixing of vegetable residue, animal matter, soil and water to form humus. In developing countries, organic materials comprise 50% of solid waste therefore rendering composting as the most economical and efficient waste management technique for municipal solid waste (Taiwo 2011:96) while Narayana (2009:1165) stated that approximately 80-85% of compostable material made up the waste generated in developing countries making it clear that the best possible option to deal with MSW is composting.

However, MSW is generally mixed waste and must first be sorted through to separate the organic materials which can be composted. Parrot, Sotamenou and Dia. (2009:992) reported that based on studies conducted in Burkina Faso, the paucity of equipment and adequate organic material for making compost, land lease issues and the exhaustive labor required for making compost are major constrictions to the establishment of successful composting programs. Couth and Trois (2010:2339) stated that the benefits of composting includes the reduction in volumes of waste being disposed, organic matter content within local landfill sites, production of organic fertilizer, reduction in the application of chemical fertilizer, additional employment opportunities and a reduction of ground and surface water pollution.

Babaei *et al* (2015:97) stated that of the total respondents, only 0.3% participated in backyard composting with most of the participants assuming it to be an ineffective method of waste disposal thus exposing the lack of awareness on possible waste management techniques.

Padmi, Dewiandratika and Damanhuri (2018:9) stated that due to the majority of waste from traditional markets being high in moisture and perishable, composting or anaerobic digestion could be considered as appropriate sustainable methods of treatment for the wastes. They further elaborated that the traditional markets would benefit from either of the treatment methods in terms of environmental impacts when compared to the current practice of landfilling. Further to this, should the composting or anaerobic treatment be conducted on site or within proximity to the source, transport and collection costs could be reduced with the added advantage of reduced GHG emissions from landfills, and collection and transportation activities.

The MSW generated in Pundong had a high organic content and a low calorific value. This meant that the waste was ideal for composting however the opposite applied for incineration of the waste. The waste contained a large amount of organic waste with food wastes comprising of almost half of the total waste. The waste was found to be heterogeneous indicating that source separation was not being conducted (Mighua *et al* 2009:1228).

2.7.4 RECYCLING AND REUSE

Vergara and Tchobanoglous (2012:282) defined recycling as the reclaiming of rejected resources into new products. Waste recovery can be defined as the resource materials that are extracted from a waste stream with the intention to use them as inputs for a different product. Reuse can be defined as materials which are used in a similar or different purpose without changing the form or properties of the material (Dlamini, Rampedi and Ifegbesan 2017:4).

A review of four case studies showed that in developing countries, the recycling rates were found to be significantly high in the region of 20% to 50%. This was mainly attributed to the discovery of alternatives for waste streams such as organic waste which can be used for composting (Wilson *et al.* 2009: 630). There were twelve identified factors which may influence recycling in a developing country. These were found to be government policy, government finances, waste characterization, waste collection and segregation, household education, household economics, MSWM administration, MSWM personnel and education, MSWM planning, local recycled-material market, technological and human resources and land availability. Of these 12, MSWM personnel and education, waste collection and segregation

and government policy were found to be most prevalent barriers in all studies under review (Troschinetz and Mihelcic 2009:923).

Oteng-Ababio, Arguella and Gabbay (2017:101) found that whilst informal recycling and reuse systems were discouraged in Accra, these systems played an imperative role in waste management and the amalgamation and integration of both the formal and informal sectors can invoke a better, efficient MSWM system. Although recycling and reuse are imperative for a circular economy, it is equally important to ensure waste prevention to control wastes which fall off from the circular economy.

Waste prevention, as defined by Zorpas and Lasaridi (2013:1047) is the elimination or reduction of the amount or toxicity of waste including recyclables while a circular economy can be defined as a systematic approach to economic development designed to benefit business, society and the environment (Anon. 2017).

Almasi *et al* (2019:335) reported that while approximately 56% of participants were willing to participate in a recycling program, only 11.3% of the individuals always separated their wastes while 27.9% occasionally separated their waste.

2.8 KNOWLEDGES, ATTITUDES AND PRACTICES TOWARDS WASTE MANAGEMENT

KAP of people in communities are crucial to the management of waste (Adeolu, Enesi and Adeolu 2014:67). Waste generator participation in waste management interventions is deemed as a crucial element for the success of any implemented interventions.

A cross-sectional study conducted in Iran with an aim to investigate the contributing factors towards fruit and vegetable waste concluded that attitude towards behavioral intention had an impact on waste management. The reason for this was that attitudes effectively shape the decisions taken on the methods of supply and storage of the produce to prevent wastage. It was further stated that strategies implemented must be convenient to allow for the individuals to comply (Abadi, Mahdavian and Fattahi 2020:9).

In Dublin a study was conducted to determine if attitudes regarding the management of biodegradable municipal waste was spatially variable which could have resulted in target areas and specific interventions for dealing with waste (Purcell and Magette 2010:1988). This study was based upon a previous study conducted by Purcell and Magette (2009:22) which concluded that waste generated varied based on demographic area hence waste generation was deemed as being spatially variable. The study found that mostly the local authorities' services were

utilized for waste management, a vast majority of the respondents were satisfied with their collection service and concluded that the attitudes held within the various residential sectors did vary in terms of their demographic area. Hence, a “one size fits all” waste management strategy would not be effective due to the varying attitudes. Site specific interventions were recommended for effectiveness (Purcell and Magette 2010:2004).

A study conducted in South West Sweden found that residents did not want to pay additional for local authorities to collect their waste and sort out the recycling aspect and preferred to take this responsibility upon themselves (Bartelings and Sterner 1999:486). A study on the KAP of householders in Abadan, Iran, depicted the low knowledge of respondents towards waste reduction, source separation and recycling (Babaei *et al.* 2015:97). The study further found that most of the respondents preferred to separate their wastes into dry and wet portions rather than into putrescible, cardboard, plastic and other with 1.7% of the participants reporting that they practiced source separation and recycling. Reasons stated for non-participation in recycling programs were stated as being due to the inaccessibility to recycling bins, lack of awareness towards recycling programs, lack of municipal services encouraging recycling in the form of organized and cooperative plan and the lack of financial incentives in the form of either rewards or penalties (Babaei *et al.* 2015:97 and Almasi *et al* 2019:335). The study further investigated and concluded that age may also influence the participation in recycling programs with mostly middle aged and older people being likely to participate in recycling programs.

Almasi *et al* (2019:333) found that the level of education was directly proportional to the knowledge and attitude level regarding waste management and a significant correlation between knowledge and attitudes although the practices were poor. A KAP study amongst first year students in Malaysia concurred that the attitudes of the students regarding SWM were affected by their education and hence reflected a growing urgency to educate students on SWM (Desa, Kadir and Yusoff 2011:646).

The level of attitude and perceptions of an individual can be correlated to their level of formal education. A study conducted amongst secondary school learners in Ibadan, Oyo State in Nigeria stated that while there was not a significant difference between the knowledge of waste management between the male and female students, it was noted that the females reported a higher score in terms of attitudes and practices than the males. A significant relationship between sex, age and education with environmental practices was found (Adeolu, Enesi and Adeolu 2014: 70).

2.9 THE INFORMAL WASTE SECTOR – WASTE PICKERS

Vergara and Tchobanoglous (2012:289) reported that globally, approximately 2% of people depend on waste for their livelihood. The informal waste sector comprises of individuals who separate, collect, and resell waste as an income. The work is generally done on a smaller scale when compared to private waste management organizations. Waste pickers collect waste from households and or areas of waste generation and transport it to formal waste recyclers that are willing to purchase these reclaimed materials. The informal sector is most involved in waste recycling of itinerant buyers, street pickers, dump pickers, truck pickers, workers in junk shops and processors of waste material. Wilson, Velis and Cheeseman (2006:787) defined the informal waste management sector as being those waste recycling activities whereby recyclable and reusable materials are extracted from mixed wastes by scavengers and waste pickers. These activities are labor-intensive, low income and unregulated work done by individuals or family groups. The informal waste sector could reduce the amount of waste that goes to landfill, reduce waste management costs incurred by local authorities, and provides a source of income for the poor or unemployed. Figure 2.7 depicts the flow of recyclable materials from the various sources via itinerant buyers, scavengers and municipal workers. Wastes that are collected are sold to local waste recyclers however, these wastes are then sold at a higher rate to larger recyclers. Therefore, the income from the primary sale of the materials is lower than that of the secondary sale. While most of the informal recycling activities are unregistered, the larger enterprises and intermediates were found to be registered (Sembiring and Nitivattananon (2010:806).

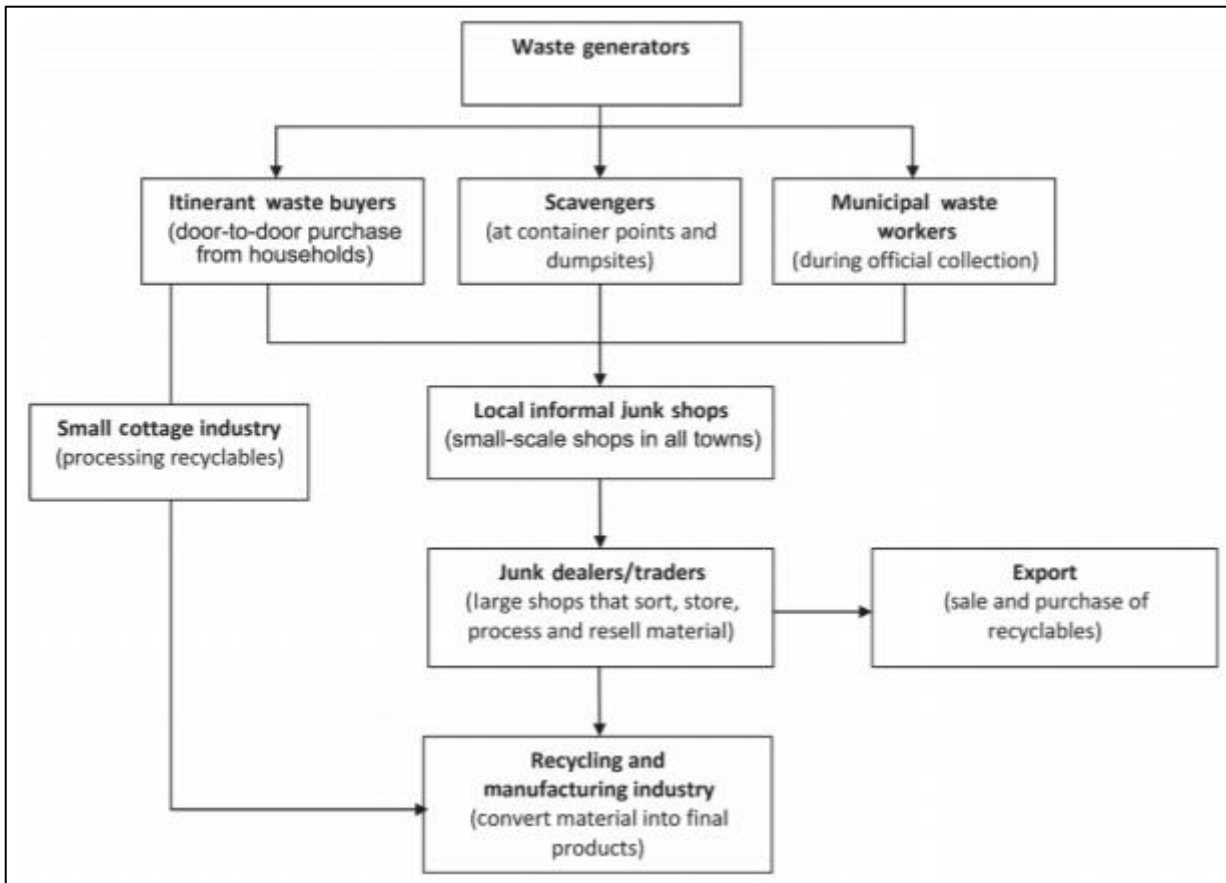


Figure 2.6 Flow of recyclable materials from the informal recycling system (Masood and Barlow 2013:95)

Integration into the formal sector is not a one-step approach, it must be investigated, and a proper implementation plan developed. A study conducted by Masood and Barlow (2013:99) found that the integration of the informal waste sector into the formal waste sector is one that is complicated and a multistep process requiring strong policies which could possibly take years to streamline. It was also stated that NGOs were often the initiators of waste picker driven co-operatives with local authorities assisting in the process. For an efficient integration, the local authorities must initiate these processes with NGOs assisting. The successful integration could be hindered by the attitudes of both sectors due to a lack of trust on both sides including the public.

Despite the economic and environmental positives, the social issues surrounding informal waste services included poor working and living conditions, child labor and the absence from school. Informal waste activities involved families working together collecting waste. The main contributor to this is due to unpaid labor that the head of the family would need to pay to any external individual that was recruited to assist in the waste collection and transportation

activities (Wilson, Velis and Cheeseman 2006, cited in Aparcana 2016:595). Waste pickers were also found to often work without the correct personal protective equipment thus exposing them to numerous health hazards.

In Bandung, Indonesia, waste collection crews often collected recyclable materials whilst collecting waste to supplement their monthly income. The flow of the waste materials that was depicted in the study conducted by Sembiring and Nitivattananon (2010:805) was found to be like that of Masood and Barlow (2006:95). Most recyclable materials are sold to primary enterprises which are then sold to larger enterprises.

A review of literature on the informal waste management system in Nigeria stated that most of the informal waste collectors and recyclers were from developing countries. The barriers for integration of the formal and informal waste sectors were noted to be due to poor hygiene practices and methods of operation within the informal sector. Thus, causing apprehensions by the formal sector to adopt a more positive outlook on the process, regressive and negative public attitude towards the informal waste sector. The informal sector is often viewed as shameful and looked down upon, the low quantity and quality of recyclable materials and limited data was available on the numbers and activities of informal waste collectors within Nigeria with most data being estimated. Hence a strong case for integration into the formal sector cannot be made. However, these barriers could be overcome by formalizing the informal sector and providing the necessary procedures and infrastructure to carry out their activities, awareness of the public on the role of the informal sector should be done to ensure that their activities are not looked down upon. Should the informal sector be formalized with efficient integration into the formal sector, quantities and the quality of recyclable materials that are collected could be increased from awareness of the public. This would also assist in obtaining relevant and accurate data in terms of the waste that is diverted and the positives of the recycling sector to the environment, health and economy (Oguntoyinbo 2012:444).

2.10 WASTE MANAGEMENT HIERARCHY

The waste management hierarchy is a guide to decision making regarding waste management. The hierarchy consists of four tiers, namely reduction and reuse, recycling or composting, recovery and lastly treatment and disposal. The most preferred methods are at the base of the hierarchy with the least preferred methods represented at the apex of the hierarchy. This is depicted in Figure 2.8 (Anon. 2018).

- Reduction – the sourcing and design of material and products which is reduces their waste components or has a decreased toxicity potential.
- Reuse – Using materials for similar or different purposes while maintaining the shape and properties of the material.
- Recycle – This includes the separation of material from their waste streams and processing them as new products or raw materials.
- Recovery – Reclaiming specific components or materials from waste or using the waste as fuel.
- Treatment and disposal – The last resort of the waste management hierarchy, treatment is any process which, by design, reduces the environmental impact of waste by changing properties of the waste. Disposal refers to the burial of waste onto or into land.



Figure 2.7 Waste Management Hierarchy (National Waste Management Strategy, 2011).

2.11 LEGISLATION IN SOUTH AFRICA

Selepe (2019:366) stated that the government is required to ensure the provision of services to communities in a sustainable manner whilst promoting social and economic development. He further stipulates that the municipality is responsible for structuring and managing its administration, budgeting and planning process in order to prioritize the basic needs of the community. According to the Waste Act, the responsibility of waste management is mandated to each municipality. Local municipalities provide the infrastructure for the management of waste that is generated. This means that the local municipality must have an integrated waste management plan which defines the provision of all waste management facilities which include receptacles in the form of bin bags or wheely bins and the collection and transportation of waste from the point of collection to the treatment site. Waste may also be taken to transfer stations where certain recyclable waste is separated while the rest is then disposed of via landfilling. The eThekweni IWMP defined waste minimization as a national objective which will be complied with while promoting recycling and composting. In Malaysia, under the Local Government Act 1976, the responsibility for the provision of public cleansing and sanitary waste disposal is within the jurisdiction of the local government (Manaf, Samah and Zukki 2009:2904).

Anecdotal evidence suggests local municipality provides the bin bags for waste to be stored in until collected. Collection takes place on fixed days in the week for residential areas and more frequently for areas of mass waste generations such as markets. These wastes are collected in compaction trucks and are transported for disposal to landfill sites. Durban has four active municipal landfill sites which are the Bisasar Road, Mariannahill, Buffelsdraai and the Lovu landfill sites (Anon. 2011). For a city with approximately 3 442 398, according to the 2011 Census, the amount of municipal waste generated can be significant with all wastes going to one of the three active landfill sites. The services provided by the municipality does not promote or facilitate separation of waste at source. It is up to the traders or residents to separate their waste and arrange for the recycling of their wastes (Anon. 2011).

The Constitution of South Africa, 1996, provides the foundation for environmental regulations and policy in South Africa. The right to environmental protection and to live in an environment that is not harmful to health or well-being is set out in the Bill of Rights – Section 24 of Chapter 2. This fundamental right underpins environmental policy (South Africa, Department of Environmental Affairs 2011:6) and law the framework environmental legislation established by the National Environmental Management Act, 1998 (Act No. 102 of 1998) (South Africa, Department of Environmental Affairs 2011:6).

The National Waste Management Strategy was developed to assist in achieving the goals of the National Environmental Management Act: Waste Act. These goals were to ensure the protection and well-being of the environment by enforcing the use of the waste management hierarchy to enable waste reduction and increase recycling and reuse rates of wastes.

The National Waste Management Strategy is a legislative requirement of the Waste Act of which the purpose is to achieve the objectives of the waste act. All affected and organs of states are required to enforce these requirements. The NWMS aims to develop a plan to address the numerous waste management challenges encountered by South Africa (South Africa, Department of Environmental Affairs 2011:6).

There are ten main challenges listed which the NWMS aims to address. However, of these ten, with most relevance to the study are the challenges of the absence of a recycling infrastructure which will enable separation of waste at source and diversion of waste streams to material recovery and buy back facilities; and too few adequate, compliant landfills and hazardous waste management facilities, which hinders the safe disposal of all waste streams. Although estimates put the number of waste handling facilities at more than 2000, significant numbers of these are unpermitted. These challenges, once addressed, will enable waste to be separated at source, recyclable materials will be uncontaminated and recycled as opposed to being landfilled. This would also reduce the amount of waste being landfilled as South Africa is running out of space for landfill sites. The current landfill sites have been running for years and will soon reach their expected life span (South Africa, Department of Environmental Affairs 2011:5).

2.12 CONCLUSION

Waste generated by traders are uniformed and can be easily managed in a more environmentally sustainable method. These wastes are dominated by the presence or organic waste, paper, plastic and cardboards. However, local municipalities will need to develop methods of efficient waste management to reduce waste to landfill. This study will look at the waste management practices undertaken by informal traders as well as undertake an analysis of their knowledge and attitudes towards waste management. Knowledge, attitudes and practices can be influenced by awareness programs to increase recycling rates. Along with waste management interventions, municipalities should investigate waste reduction strategies that aims at reducing the amount of waste that is generated by understanding the waste generation influencers.

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

This chapter aims to detail the methodology followed whilst conducting this study. Research can be described as a systematic investigation whereby data is collected, analyzed and interpreted to achieve relevant research aims and objectives (Mackenzie and Knipe, 2006:2). This study analyzed the waste management practices undertaken by informal traders located at the Early Morning Market situated in Warwick Avenue and the Morning Market located in Verulam. The study consisted of a questionnaire being administered to the traders located at the markets by students who were trained along with the researcher. Authorization to conduct the survey was sought and gained by the Municipal Institute for Learning (MILE).

3.2 STUDY LOCATION

3.2.1 EARLY MORNING MARKET

The Early Morning market commenced trading on the 1 February 1934 at Julius Nyerere Avenue. The market boasts 670 stalls selling a variety of fresh produce, spices, flowers and live poultry. Each stall has between two and three assistants (Asiye etafuleni. 2019:1).

3.2.2 VERULAM MARKET

Located at 15 Wick Street in Verulam, the Verulam Morning Market which was established in 1884, for 12 stalls has exponentially grown over the years to now service approximately 257 stalls. Individuals from all walks of life and parts of Kwa Zulu-Natal commute to visit the market due to the farmers selling their fresh produce at low prices (Anon. 2018).

3.3 STUDY DESIGN

A cross sectional, quantitative, descriptive research study was conducted to analyze the current waste management practices of the traders and to explore the possible feasibility of recycling, reuse and reducing the quantities of waste generated.

3.4 STUDY POPULATION

The study population comprised of stall owners as well as stall assistants who assisted the traders with tasks such as minding the stall, removing waste and cleaning. At the Early Morning Market, a total of 178 Stalls were sampled and 19 stalls at the Verulam Morning Market were sampled.

3.5 SAMPLING STRATEGY

Every third stall was chosen to participate in the study to reduce any prejudice in the study. Where a trader declined to participate in the study, the next stall was selected and the normal sampling strategy followed. The third stall at the entrance of the market was used as the first and the benchmark for the following participant. Only traders who traded at the market were allowed to participate in the study. The study excluded market management staff.

3.6 INCLUSION AND EXCLUSION CRITERIA

3.6.1 INCLUSION CRITERIA:

- Vegetable and fruit stall owners/ traders
- Vegetable and fruit stall assistants

3.6.2 EXCLUSION CRITERIA:

- Food vendors
- Clothing and jewelry vendors/ traders
- Poultry and meat vendors

3.7 ETHICAL CONSIDERATIONS

3.7.1 ETHICS

The study was reviewed by the Research and High Degree Committee (RHDC) of the Faculty of Health Sciences at the DUT. Ethical approval was also sought from the Institutional Ethics Committee (IREC) and was allocated the study number IREC 10/18. Consent letters were also given to participant's prior participation in the study. The consent letter was explained to them and was also translated to isiZulu.

3.7.2 INFORMED CONSENT AND CONFIDENTIALITY

Consent forms were administered to the participants, Annexures F and G, prior to them responding to the questionnaire. Participation to the study was voluntary and withdrawal from the study was possible on request at any point during the study. The consent form was explained verbally in English or isiZulu where required by the researcher and her assistants. Confidentiality was maintained for the duration of the study by ensuring all data collected were under storage and only the research team had access to these records. No financial incentives were provided by the researcher for the participation in the study.

3.8 RECRUITMENT AND TRAINING OF ASSISTANTS

Two assistants were recruited from the Environmental Health programme for the purpose of collecting data from the traders. Students were requested to volunteer. The students from the Environmental Health programme were selected as they understand the concepts of waste management and research methodology as it forms part of their curriculum. The two assistants attended a half day training workshop on ethics, data collection and questionnaire administration. The training was conducted by the researcher.

3.9 DATA COLLECTION TOOL

A questionnaire was used to collect data from the traders regarding their knowledge, attitudes and practices towards waste management and recycling at the market. The questionnaire was developed by the researcher and was piloted at the Phoenix Millennium Market. The questionnaires contained various questions surrounding demographics, knowledge on waste management and the processes as well as willingness to recycle and reuse waste. The questionnaire included both closed and open-ended questions. The questionnaires were administered by the researcher and assistants after signed informed consent letters were obtained from all participants.

3.10 PILOT STUDY

The data collection tool, Annexure A, was piloted among five fresh produce traders at the Phoenix Millennium Market prior the commencement of the study for suitability, reliability and validity purposes using SPSS version 26.0. The data that was obtained during the pilot study was not used for the analysis.

3.11 DATA ANALYSIS AND MANAGEMENT

Data collected during the study was coded on a Microsoft Office Excel and was further analyzed. The data collected from the respondents were analyzed using SPSS version 26.0. Data was analyzed with the assistance of a statistician and the supervisor. Results were presented as descriptive statistics in the form of tables, graphs and cross tabulations. Inferential techniques include the use of correlations and chi square test values, which are interpreted using the p-values. The traditional approach to reporting a result required a statement of statistical significance. A *p*-value is generated from a test statistic. A significant result is indicated with " $p < 0.005$ ". Data collected during this study is kept in a secure, lockable area within the Community of Health Sciences department at the DUT. These records will be stored for a period of fifteen years after which they will be shredded and destroyed. Only the researcher and her supervisor shall have access to these records for validation purposes.

3.12 CONCLUSION

A descriptive, quantitative research study design was chosen to accomplish the aims that were set out in this study. Approval was sought from the local authority following which ethical approval was received from the DUT Ethics Committee. A total of 197 respondents participated in this study between the Early Morning Market and the Verulam Market. Participants were only allowed to participate in the questionnaire after completing the informed consent form. The questionnaire was the main research tool used for data collection. The data from the questionnaires were coded using Microsoft Excel and was then analyzed using SPSS version 26.0. Data was analyzed and presented in the form of graphs, tables and cross tabulations.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 INTRODUCTION

This chapter represents the results and presents the findings obtained from the questionnaires in this study in the form of tables and figures. The questionnaire was the primary data collection tool utilized and was distributed to 197 participants. The data collected from the responses were analyzed with SPSS version 26.0.

4.2 DEMOGRAPHIC DATA

Demographics characteristics of age, education level and occupation are very important in knowledge, attitudes and practices (Almasi *et al* 2019:332). A total of 194 informal market traders responded to the questionnaire. The largest proportion of respondents were within the age group of 51 – 60 years (n= 80, 41.2%). The age distribution of the traders is depicted in Table 4.1 below. The age distributions were found to be unlike due to the distribution as there were more respondents that were above the age of 40 years.

Table 4.1 Informal traders in age

Informal trader in age	Frequency	Percent (%)
21 – 30	7	3.6
31 – 40	26	13.4
41 – 50	51	26.3
51 – 60	80	41.2
>60	30	15.5

Overall, the ratio of males to females is approximately 1:9 (10.8: 89.2) Within the age category of 51 to 60 years, 6.3% were male. Within the category of males (only), 23.8% were between the ages of 51 to 60 years. This category of males between the ages of 51 to 60 years formed 2.6% of the total sample. The age distributions are not similar as there are more respondents older than 40 years.

Table 4.2 Overall gender distribution by age

Age group (years)		Total
21 - 30	Count	7
	% of Total	3.6%
31 - 40	Count	26
	% of Total	13.4%
41 - 50	Count	51
	% of Total	26.3%
51 - 60	Count	80
	% of Total	41.2%
> 60	Count	30
	% of Total	15.5%

Figure 4.1 below indicating the historical race group of the participants. More than three quarters of the informal traders were African (n = 178) followed by Indians (n = 13), Coloureds (n = 5) and other at n = 1.

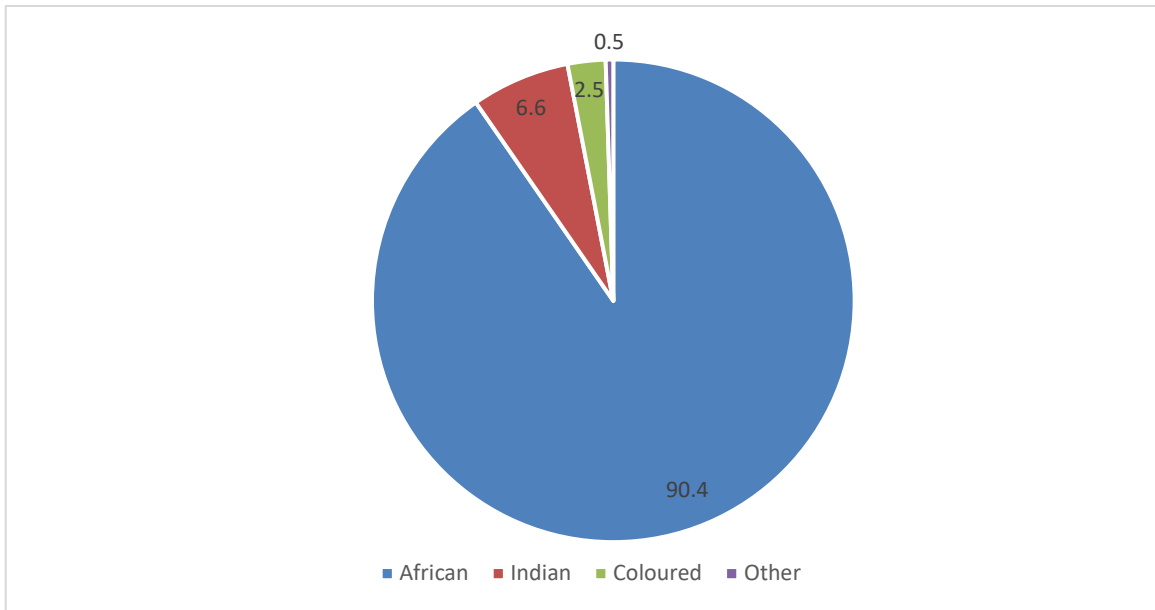


Figure 4.1 Historical race group of informal traders

Figure 4.2 indicates that a large proportion of the informal traders preferred to retain their monthly income as confidential (n= 132) The second largest proportion of informal traders preferred to not respond to the question (n= 30) while 4.1% responded with their average household income ranging from R1001 – R2000 (n=8).

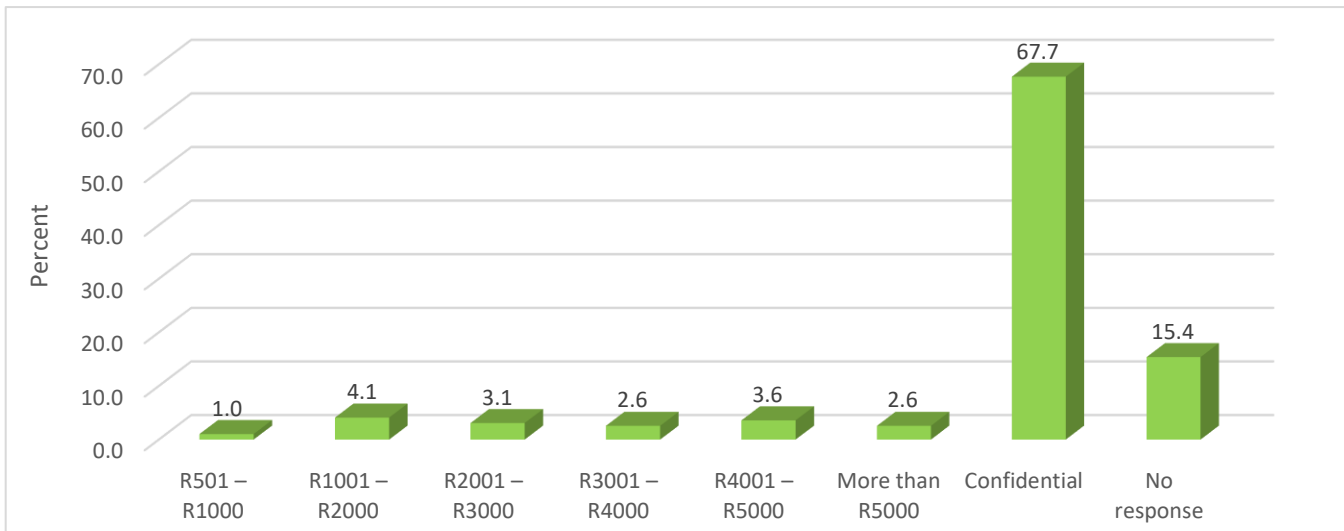


Figure 4.2 Average household income of informal traders

Figure 4.3 depicts the informal traders' level of education. More than one thirds of the informal traders did not have any formal education (n = 82) while approximately a third of the participants responded as having completed partial secondary education (n=65). Some had completed primary school education (n = 27), a few had completed matric (n = 22) and one responded having completed an undergraduate study (n = 1).

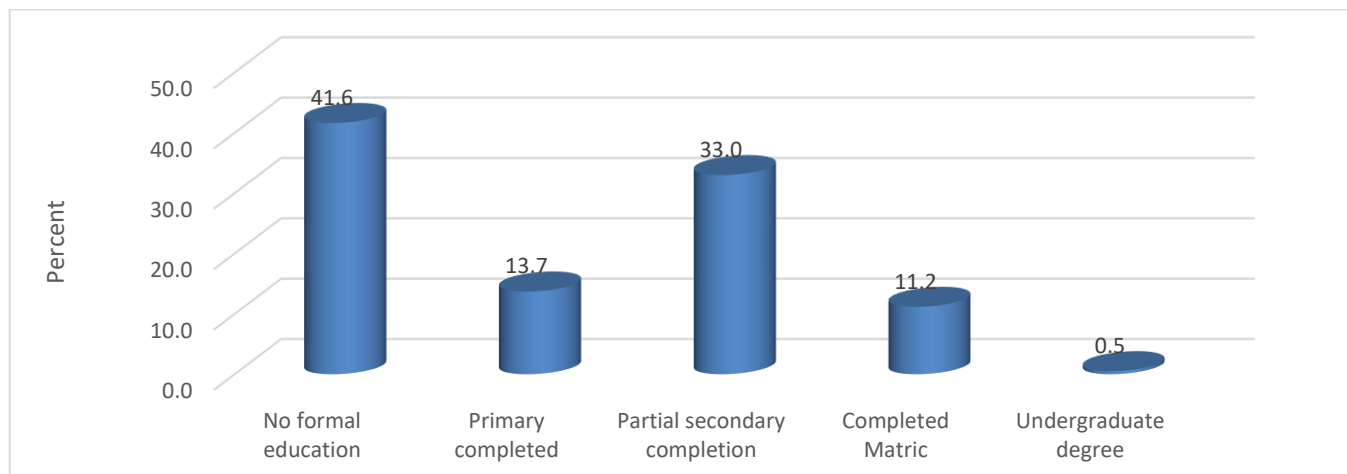


Figure 4.3 Level of education of informal traders

Table 4.3 shows the highest grade completed in school by the informal traders. Grades two, nine and twelve were the most recurring grades being completed (n – 23). Grade seven was the second frequent grade that was completed (n = 18). Grade ten was the third most frequent grade to be completed (n = 15). This was followed by grades three, five and six (n = 12), grade four (n= 11), grades eight and eleven (n = 9) and lastly grade one (n = 7).

Table 4.3 Highest grade completed in school by informal traders

Grade	Frequency	Percent
1	7	4.0
2	23	13.2
3	12	6.9
4	11	6.3
5	12	6.9
6	12	6.9
7	18	10.3
8	9	5.2
9	23	13.2
10	15	8.6

11	9	5.2
12	23	13.2

More than two thirds of the participants were the owners of the stall from which trading took place (n= 185) while some were stall assistants (n=10) and a few were farmers (n=1). This is depicted in Table 4.4 below.

Table 4.4 Occupations of informal traders

Occupation	Frequency	Percent
Farmer	1	0.5
Stall assistant	10	5.1
Stall owner	185	94.4

Figure 4.4 below depicts the number of years that the informal traders have been in this occupation. Most traders responded to being within this occupation between six to seven years (n= 77). This was followed by traders being in this occupation for eight to nine years (n=45, 23.3%) and more than nine years (n=36). Some responded to being in the occupation for four to five years (n=24) and a few responded from one to three years (n=10) and less than a year (n=1). Those that responded to more than nine years, had stated their years of occupation between the ranges of ten to thirty years. It was established by Cohen (2010:280) that the average years within the informal trading occupation was six to ten years which is in proportion to the data below.

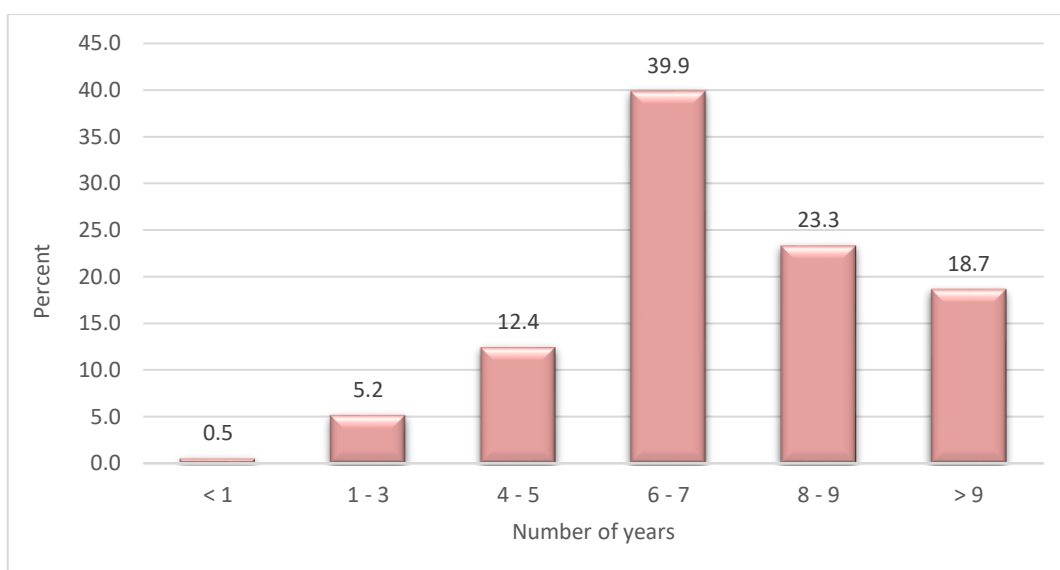


Figure 4.4 Number of years in the occupation

Table 4.5 depicts the trading market of the respondents in relation to their gender. It was ascertained that there were significantly more female (n = 160) traders at the Early Morning Market than males (n = 15). This indicated a significant relationship between the gender and the place of trade. This was also the case at the Verulam Morning Market with more of the respondents being female than male.

Table 4.5 Place of trade of the informal traders

Place of trade			Gender		Total
			Female	Male	
Where do you trade from?	Early morning	Count	160	15	175
		% within Gender	92.5%	71.4%	90.2%
		% of Total	82.5%	7.7%	90.2%
	Verulam market	Count	13	6	19
		% within Gender	7.5%	28.6%	9.8%
		% of Total	6.7%	3.1%	9.8%

4.3 WASTE MANAGEMENT

Figure 4.5 illustrates the methods of obtaining information regarding waste management undertaken by the informal traders. The feedback depicts that the source of information for most informal traders is the radio (n=166, 84.3%) which is followed by word of mouth from family and/or friends (n=148,75.1) and the city or government (n=78,39.6%).

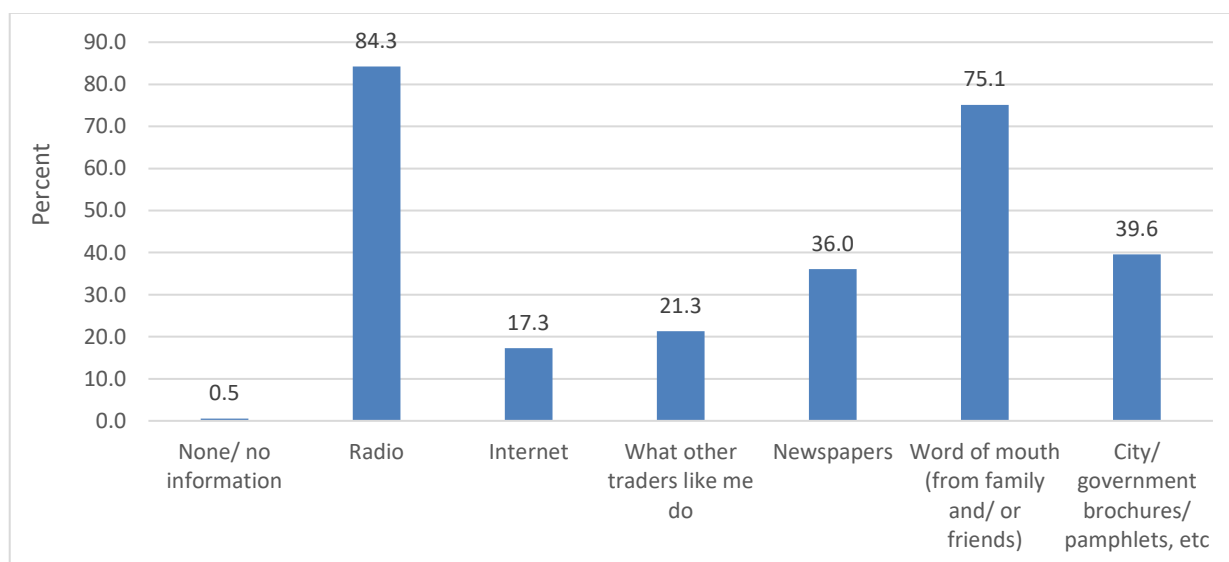


Figure 4.5 Sources of waste management information

Table 4.6 illustrates the informal trader’s awareness of the waste management facilities that were provided by the market management. Most traders were aware of the market management providing bin bags for waste to be stored in (n=177) while only some were aware of the wheely bins that were provided by the market management (n=122).

Table 4.6 Awareness of traders on waste management services provided by the market management

Waste management facilities	Frequency	Percent
Wheely bins	107	54.3
Bin bags	177	89.8
Waste storage area	122	61.9

Figure 4.6 illustrates the main aspects of waste management that the informal traders were aware of. Most of the informal traders were aware that the proper disposal of waste was an important aspect to waste management (n= 175) as well as having clear guidelines (n=164) and taking responsibility for one’s waste (n=158) while a few reported as not knowing what the main aspects were (n=12).

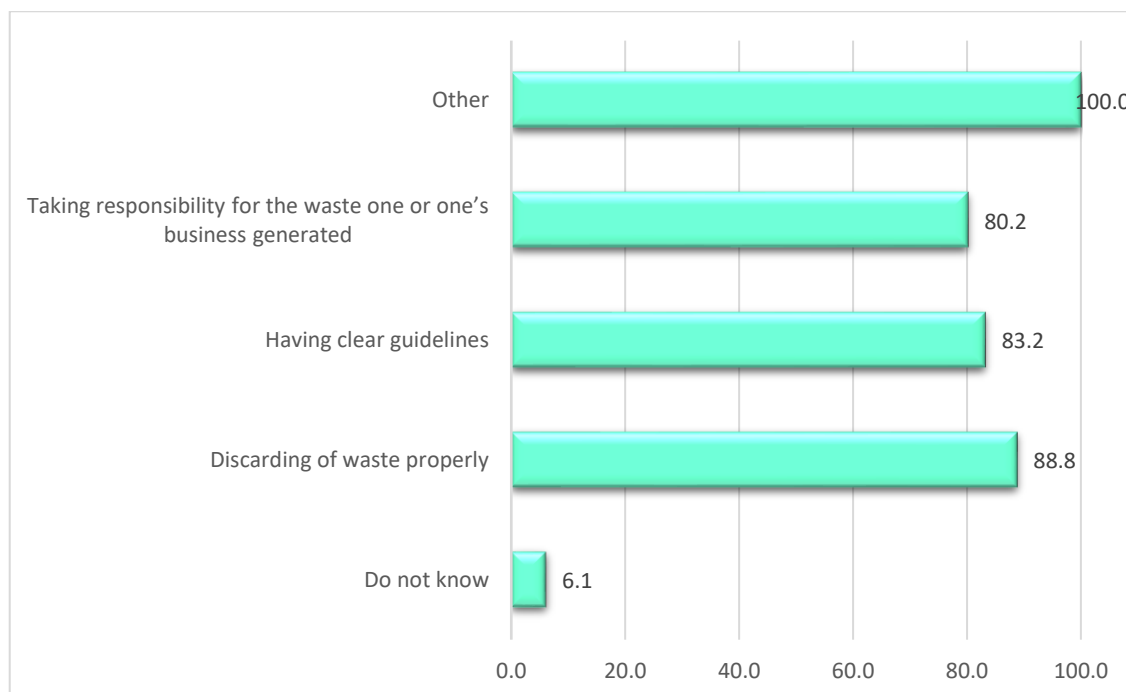


Figure 4.6 Informal traders’ awareness on the main aspects of waste management

Table 4.7 describes the methods of improving waste management identified by the informal traders within their business and within the municipality. Most of the respondents felt that more improvements were required by the Municipality (n=196) rather than in their business (n= 192) although the difference is marginal.

Table 4.7 Methods of improving waste management in business and municipality

Methods of improving waste management	Business		Municipality	
	Frequency	Percent	Frequency	Percent
Making in compulsory to separate at source	192	97.5	196	99.5
More laws to promote recycling	192	97.5	196	99.5
Put in place composting programs	192	97.5	196	99.5
Specific training and education programs for specific trades	192	97.5	196	99.5
Have more waste collection depots	192	97.5	195	99.0
Have a payment fund for waste diversion and separation programs - Incentives	192	97.5	196	99.5
Other	0	0.0	3	1.5

Table 4.8 illustrates the level of concern of the informal traders regarding the environment that they work in. Most of the participants expressed concern regarding the environment they work in due to the outlook their workspace gave to potential customers as this impacted their income, a healthy working environment that is free of disease, workspace constraints and heat while a few were not concerned as they found the space to be worth it and fine

Table 4.8 Level of concern of the working environment of informal traders

				Total
Are you concerned about the environment you work in?	Yes	Count		176
		% of Total		90.7%
	No	Count		18
		% of Total		9.3%

Figure 4.7 exemplifies the thoughts of the informal traders in regard to the waste management facilities that were provided by the municipality and the market management. The majority of the informal traders felt that the service provided were fair (n=170) followed by good (n=30), poor (n = 16) and lastly very good (n = 10).



Figure 4.7 Level of service provided by the municipality

Figure 4.8 depicts the level of satisfaction experienced by the informal traders with regards to the waste management services provided by the municipality. The majority of the informal traders felt neither satisfied nor dissatisfied with the services provided by the municipality (n = 129). Some informal traders were satisfied by the services provided (n = 43) followed by dissatisfied (n = 14). A few responded as being very satisfied (N = 9) with the least common answer being very dissatisfied (n = 1).

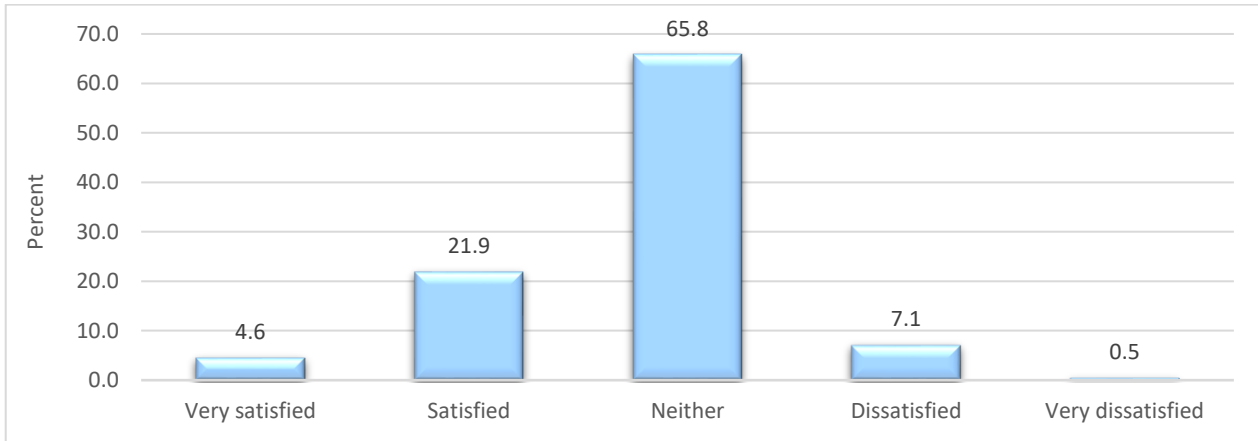


Figure 4.8 Level of satisfaction of informal traders towards waste management services provided by municipality

Figure 4.9 below depicts the environmentally sustainable, conscious practices that the informal traders undertook. Majority of the informal traders sometimes undertook practices such as recycling (n = 176, 89.8%), proper waste disposal (n = 142) and the reuse of water (n = 139). The following patterns are observed:

- All the statements show higher levels of sometimes.
- There are no statements with higher levels of agreement or disagreement.

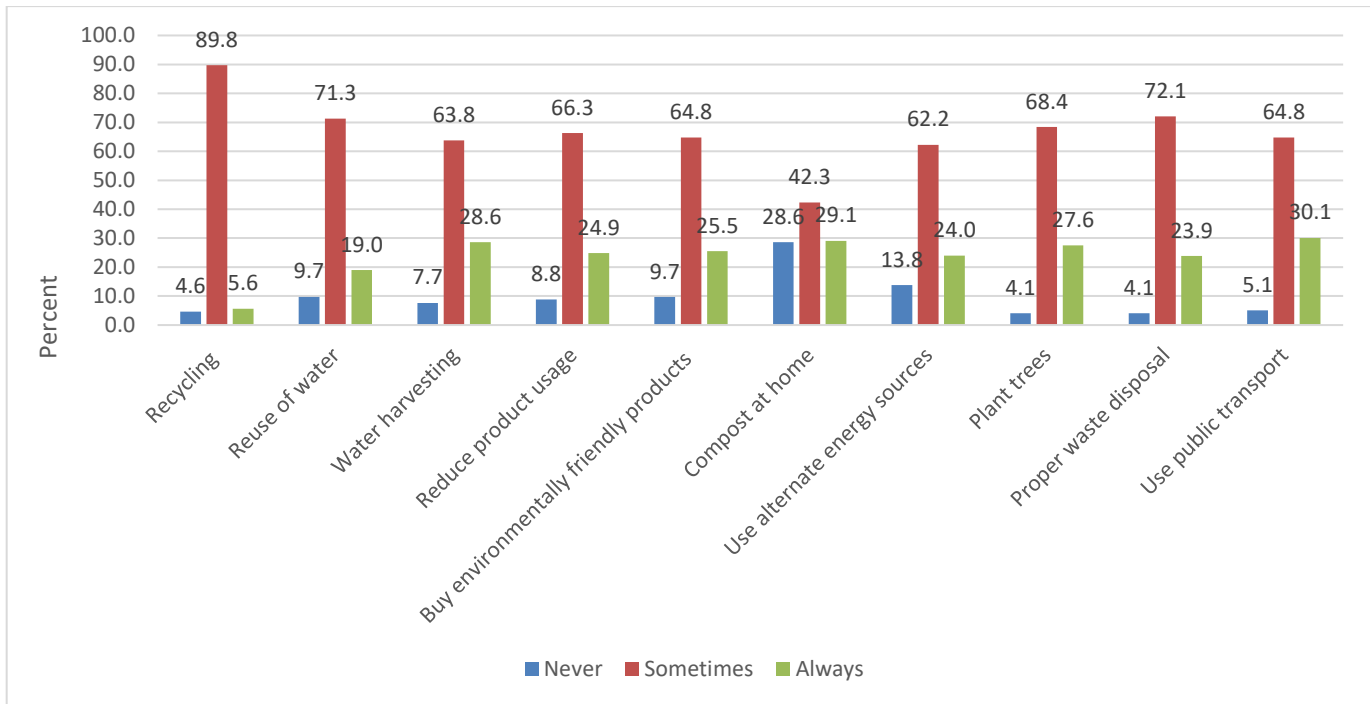


Figure 4.9 Environmentally friendly practices by informal traders

4.4 WASTE GENERATION

Figure 4.10 depicts the most prevalent waste streams emanating from the fresh produce stalls. The most predominant waste stream was found to be food waste (n = 196) followed by paper (n = 180), cardboard (n = 176), plastic packaging (n = 171) with glass (n = 24) and polystyrene (n = 22) featuring as the least generated waste stream.

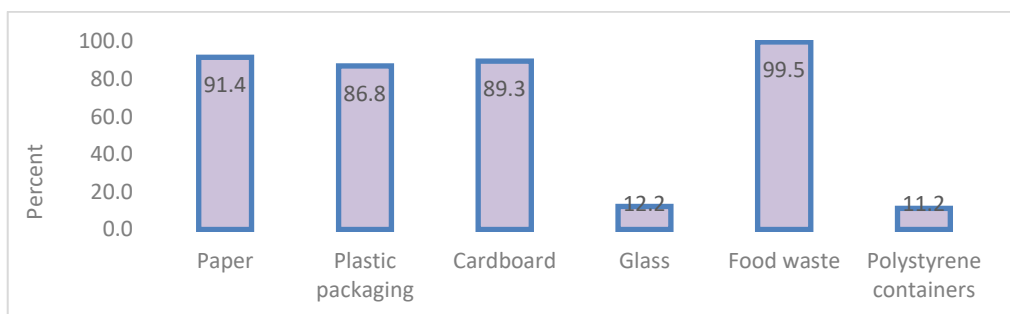


Figure 4.10 Most prevalent waste streams emanating from fresh produce stalls

Table 4.9 below shows the most prevalent waste stream generated by the fresh produce informal traders. The most common waste types mentioned by the informal traders were food waste, plastics, papers and cardboard. The majority stated that food waste was the main waste stream generated from their stall (n = 169).

Table 4.9 Waste streams generated at stalls of the informal traders

Waste generated	Frequency	Percent
Food	169.0	85.8
Mixed	7.0	3.6
Plastic	7.0	3.6
Cardboard	6.0	3.0
Paper	4.0	2.0
No response	4.0	2.0

Table 4.10 below depicts the estimated total amount of waste generated by the informal traders on an average trading day. Most of the informal traders disposed of between 1kg and 5kg of waste per day (n = 151).

Table 4.10 Estimated total amount of waste generated on an average trading day

	Frequency	Valid Percent
No Response	40	20.3
< 1 kg	3	1.5
1 – 5kg	151	76.7
> 5kg	3	1.5

Table 4.11 reveals the number of bin bags of waste that is disposed of at the waste area per week. The most frequent response was the disposal of two to five bags per week (n = 83, 43%) followed by less than one bag per week (n = 5).

Table 4.11 Number of bin bags used per week

Number of bags used	Frequency	Percent %
<1 Bag	5	2.6
2 - 5 Bags	187	94.9
> 5 bags	1	0.5
No response	4	2

Table 4.12 below shows how waste is dealt with daily by the informal traders. The difference between the two most common answers were marginal. The most common responses were to leave the waste at the storage area for collection (n = 66) and cleaning the stall and placing the waste in a plastic bag (n= 65) while the least common response was to throw out in the garbage (n = 27).

Table 4.12 Methods of dealing with waste by the informal traders

Method of dealing with waste	Frequency	Percent (%)
Method of dealing with waste	65	33.0
Clean the stall and put the waste in plastic bin bag	39	19.8
Leave at collection area for municipality to remove	66	33.5
Throw in the garbage	27	13.7

4.5 SEGREGATION OF WASTES

The responses from the participants revealed practices of separating wastes by informal traders. Only a few informal traders responded affirmative to separating their wastes (n = 13, 6.6%) while most of the informal traders did not practice separation of waste (n = 183, 93.4%).

4.6 STORAGE AND COLLECTION

The informal traders were questioned on their awareness of the waste storage area. Of the total respondents to the survey, only one hundred and thirty-eight answered this question. Of those that responded to this question, the majority were aware of the waste storage area (n = 137, 99.3%) with a single respondent not being aware of the area (n = 1, 0.7%). In terms of accessibility, 70.6% of the respondents found the waste storage area to be accessible.

Figure 4.11 reveals the responsibility of removal of waste from the stalls to the waste area. Majority of the informal traders took the responsibility upon themselves for the removal of waste from the stall (n = 73,) which was followed by other (n = 24) which consisted of the cleaners of the market. This was followed by the informal traders whom felt the removal of the waste from their stall was the responsibility of the market management (n = 17) which essentially meant it was the responsibility of the cleaners to remove the waste.

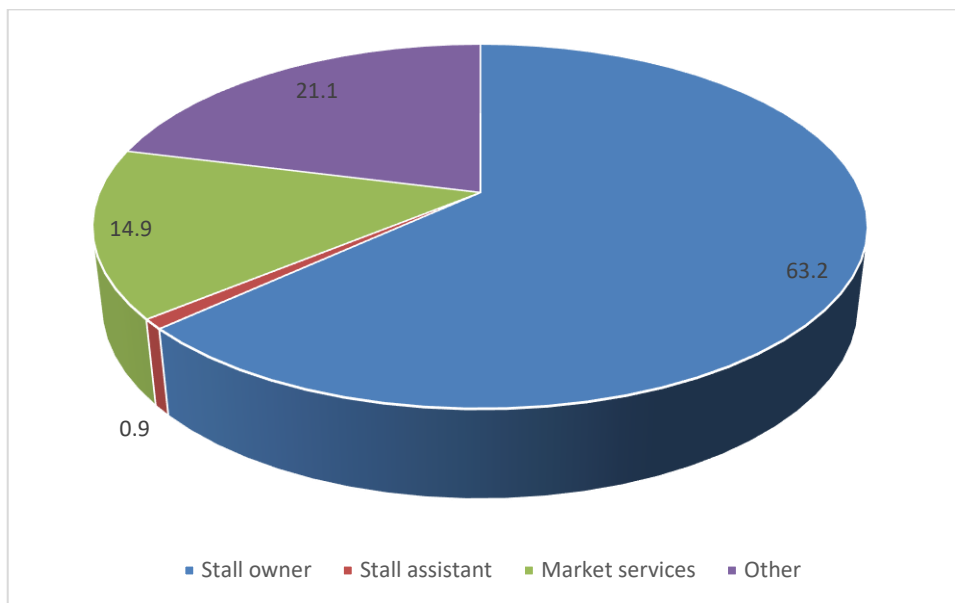


Figure 4.11 Responsibility of the removal of wastes from the stall

Figure 4.12 depicts the level of awareness of the informal traders in terms of the frequency of collection of waste from the storage area. Majority of the informal traders were aware that waste was removed daily (n = 84) while some responded as waste being collected on every trading day (n = 47) and a few stating every second day (n = 4). Majority of the informal traders were aware that municipality removed waste from the waste storage area (n = 132) while some did not respond to the question (n = 65).

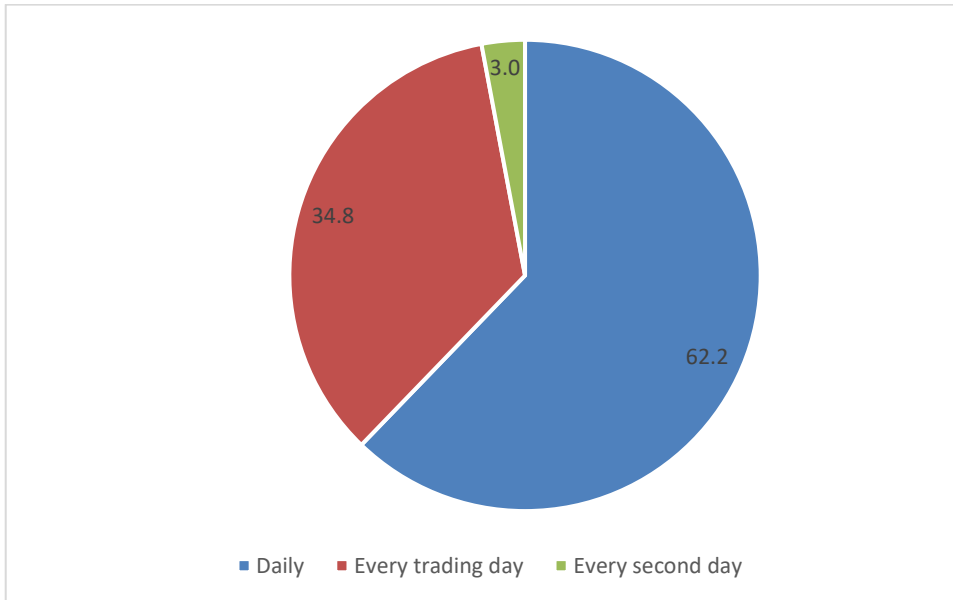


Figure 4.12 Level of awareness of the informal traders on the frequency of waste removal by municipality

4.7 DISPOSAL PRACTICES

Table 4.13 below depicts the level of importance of the correct disposal of waste as deemed by the informal traders. Most informal traders rated correct waste disposal as being very important (n = 91, 46.7) followed by average importance (n = 74, 37.9), absolutely important (n = 27, 13.8%) and little importance (n = 3, 1.5%).

Table 4.13 Importance of the correct disposal of waste

	Frequency	Valid Percent
Little importance	3	1.5
Average importance	74	37.9
Very important	91	46.7
Absolutely important	27	13.8

Table 4.14 depicts the cost of incorrect disposal rated by the informal traders. Most of the informal traders felt that the cost of incorrect disposal was moderate (n = 101, 51.5%) followed by mild (n = 85, 43.4%) and lastly severe (n = 10, 5.1%).

Table 4.14 Cost of incorrect disposal

	Frequency	Valid Percent
Mild	85	43.4
Moderate	101	51.5
Severe	10	5.1

Table 4.15 depicts the impact of incorrect disposal to health and the environment as rated by the informal traders. Most of the informal traders felt that the cost of incorrect disposal to health was moderate (n = 112) while majority felt that incorrect disposal had severe impacts to the environment (n = 123).

Table 4.15 Impacts of incorrect disposal to health and environment

	Health		Environment	
	Frequency	Percent (%)	Frequency	Percent (%)
Mild	15	7.7	3	1.5
Moderate	112	57.1	70	35.7
Severe	69	35.2	123	62.8

Figure 4.13 shows the methods of managing the waste that is generated at the stalls of the informal traders. Most of the traders stated that they would sometimes throw out their wastes with other general wastes (n = 127) while some said that they always did this (n = 48). Some traders said that they would sometimes discard their waste in an open dump (n = 40). The Majority of the informal traders did not burn their wastes (n = 152) while some stated that they sometimes undertook this practice (n = 37) and a few stating this was always done (n = 6).

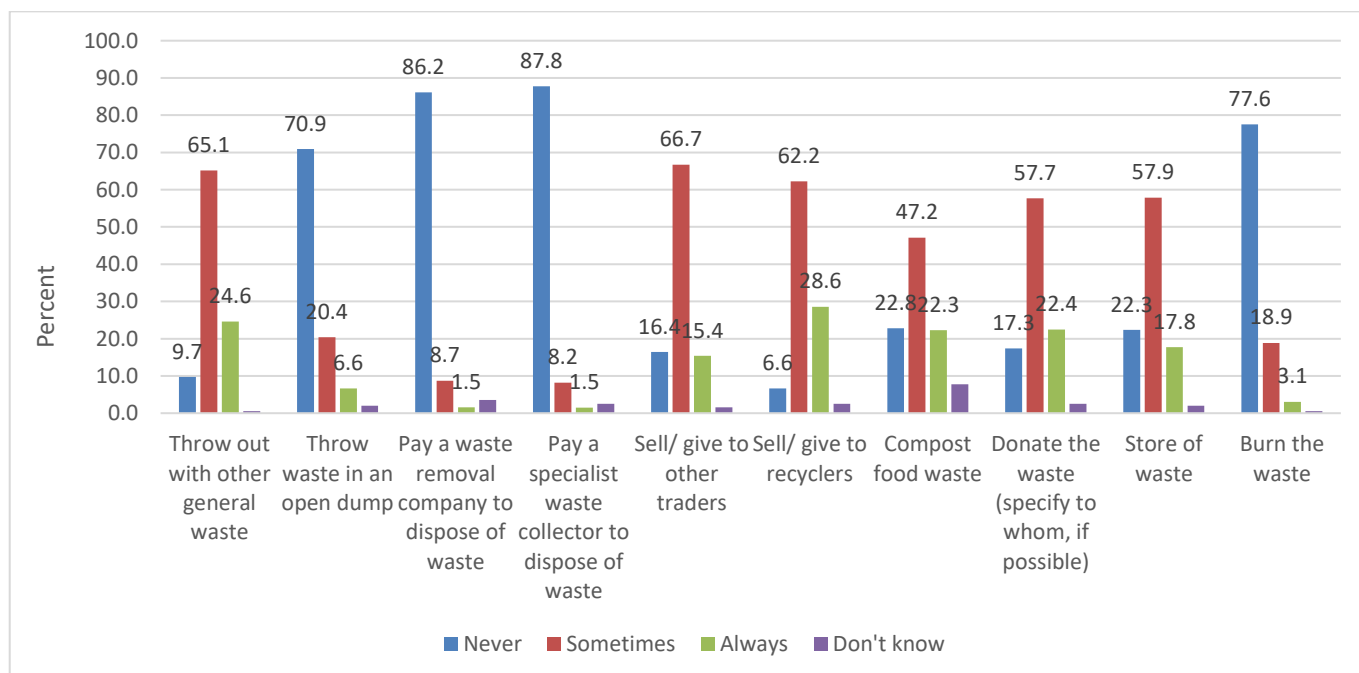


Figure 4.13 Waste management practices of the informal traders

Table 4.16 illustrates the method of disposal that the informal traders undertake. Most of the informal traders disposed of their wastes into bins (n = 295).

Table 4.16 Method of disposal of waste

	Frequency	Percent
Bin	195	99.0
Landfill	5	2.5
Open dump	8	4.1

Table 4.17 represents the practices of throwing waste in an open dump by informal traders. Most of the informal traders never practiced this (n = 139) however some (n = 40) participants did participate in this practice.

Table 4.17 Practices of open dumping

	Frequency	Valid Percent
Never	139	70.9
Sometimes	40	20.4
Always	13	6.6
Don't know	4	2.0

Table 4.18 reveals the practices of burning their waste by informal traders. A large proportion reported as never burning their waste (n = 152). This was followed by some participants (n = 37) stating that they sometimes burnt their waste.

Table 4.18 Burning of wastes

	Frequency	Valid Percent
Never	152	77.6
Sometimes	37	18.9
Always	6	3.1
Don't know	1	0.5

4.8 RECYCLE, REDUCE AND REUSE OF WASTE

Table 4.19 determines the sentence that best describes recycling of waste by the informal traders. The most common answer was the use of the item as a new product or in a new way than it is meant for (n = 187). This showed a good understanding of the concept of recycling by the informal traders.

Table 4.19 Best description for the recycling of waste

	Frequency	Percent
Use the item as much as possible before throwing it out	8	4.1
Use the item as a new product or in a new way than it is meant for	187	95.9

Table 4.20 determines the sentence that best describes the reuse of waste by the informal traders. The most common answer was the use of the item as much as possible before throwing it out (n = 174).

Table 4.20 Best description for the reuse of waste

	Frequency	Percent
Use the item as much as possible before throwing it out	174	90.2
Use the item as a new product or in a new way than it is meant for	19	9.8

The informal traders were asked if they would consider recycling and most responded affirmative (n = 189). This is depicted in Table 4.21 below.

Table 4.21 Willingness of the informal traders to participate in recycling programs

	Frequency	Percent
Yes	189	95.9
No	8	4.1

Table 4.22 demonstrates the frequency of recycling practices undertaken by the informal traders. Most of the informal traders responded as undertaking recycling initiatives at home sometimes (n = 176) while some responded as always recycling (n = 11). This indicates that if provided with the facilities, the informal traders will participate in waste recycling programs.

Table 4.22 Recycling undertaken by informal traders

Recycling	Frequency	Percent
Never	9	4.6
Sometimes	176	89.8
Always	11	5.6

The participants were asked if they recycled paper, cardboard, plastics and food waste. Most of the participants responded as never recycling those items which was followed by sometimes and always. Table 4.23 depicts the responses of the participants.

Table 4.23 Recycling practices of paper, cardboard, plastics and food wastes

	Paper		Cardboard		Plastics		Food waste	
	Frequency	Percent (%)	Frequency	Percent (%)	Frequency	Percent (%)	Frequency	Percent (%)
Always	58	29.7	63	32.1	39	21.1	4	2.1
Sometimes	64	32.8	60	30.6	73	39.5	13	6.8
Never	73	37.4	73	37.2	73	39.5	175	91.1

Table 4.24 illustrates the willingness of informal traders to participate in a composting program. Most of the respondents were willing to participate in the program (n = 179) with a few declining to partake in the program (n = 16).

Table 4.24 Willingness of informal traders to participate in a composting program

	Frequency	Percent
Yes	179	91.8
No	16	8.2

Table 4.25 depicts the current practices of composting food waste by the informal traders. Most of the informal traders stated that they sometimes compost their waste (n = 91). While there was a marginal difference between those that reported never (n= 44) and always (n=43) with a few that reported don't know (n = 15).

Table 4.25 Composting practices of informal traders

	Frequency	Valid Percent
Never	44	22.8
Sometimes	91	47.2
Always	43	22.3
Don't know	15	7.8

Table 4.26 depicts the practices undertaken by the informal traders in terms of disposal of waste at home by proper disposal and not burning. The most popular response was sometimes (n = 142) while some stated always (n = 47) and a few responding with never (n = 8).

Table 4.26 Proper waste disposal methods undertaken by informal traders

	Frequency	Valid Percent
Never	8	4.1
Sometimes	142	72.1
Always	47	23.9

Table 4.27 reveals the motives behind informal traders not separating their waste streams. Most of the informal traders did not know how to separate their waste (n = 70) while the other most prevalent responses were due to the informal traders not seeing a reason to do it (n = 58) and due to the process being time consuming (n = 24). A few traders did not provide a reason for not separating their waste (n = 21).

Table 4.27 Reasons for not separating wastes by informal traders

	Frequency	Valid Percent
No response	21	10.7
Can make more money	1	0.5
Different packets for different waste	4	2.0

Don't know how to	70	35.5
Don't see a need for it	6	3.0
It is time consuming	24	12.2
Municipality should do it	1	0.5
Never thought about it	7	3.6
No reason to do it	58	29.4
Separate plastic bags	5	2.5

Table 4.28 depicts responses of informal traders to having methods of reducing waste at their stalls. Most traders stated that they did not have any alternative methods (n = 180, 91.4%) while a few stated that they do have methods of reducing their waste (n = 17, 8.6%). Some of the methods that were provided by the informal traders were of peeling their vegetables before they got to their stall, taking their wastes home and dumping or planting rotten vegetables.

Table 4.28 Alternate methods of reducing waste at stalls

	Frequency	Percent
Yes	17	8.6
No	180	91.4

Table 4.29 Impact of incorrect waste management

Impact of incorrect waste management	p-value						
	Occupation	Gender	Race	Age	Household Income	Highest school grade completed	Number of years in occupation
Cost	0.00	0.396	0.595	0.606	0.004	0.002	0.41
Health	0.517	0.282	0.215	0.755	0.689	0.288	0.014
Environment	0.914	0.711	0.580	0.199	0.406	0.305	0.636

Table 4.30 Method of dealing of waste on a typical day

How is waste dealt with on a typical day	p-value					
	Average household income	Number of years in occupation	Gender	Race	Age	Occupation
Disposed storage area	0.00	0.00	0.079	0.014	0.933	0.097

Table 4.31 Awareness of recycling and reuse concepts

Demographic	p-value				
	Recycled waste Definition of recycling	Definition of reuse	Definition of recycling	Definition of reuse	Consider recycling
Gender	0.159		0.014	0.362	0.000
Race	0.716		0.825	0.825	0.828
Age	0.499		0.584	0.584	0.007
Average household income	0.002		0.919	0.919	0.047
Level of education	0.002		0.847	0.847	0.341
Occupation	0.016		0.788	0.778	0.613
No. of years in occupation	0.008		0.000	0.000	0.265

4.9 CONCLUSION

The results have shown that the most prevalent waste stream that is generated by the fresh produce market informal traders is food waste which is high in organic value and may be composted. The current disposal method is landfilling via the municipality. In general, most of the informal traders exhibited awareness on the waste management facilities provided by municipality and waste management concepts. The informal traders were willing to participate in recycling or reuse programs which would have to be initiated and driven by the municipality and the management of the markets. This was evident from their practices of recycling undertaken in a private capacity. Certain waste management practices such as open dumping and burning of wastes were found to be carried out by a few of the informal traders. This can be curbed by education and awareness programs by the municipality and the market managements. This would encourage responsible behaviors by the informal traders.

The informal traders depicted an understanding of the concept of recycling and reuse of wastes however, they were not aware of the benefits or methods of these practices. This was evident in their responses of not seeing a need for this practice or not knowing how to do it. The informal traders also associated their working environment with cost and least associated with health and environmental impacts.

CHAPTER 5

DISCUSSION

5.1 INTRODUCTION

This chapter is used to discuss the findings listed in the previous chapter and utilizes literature to compare those results to previous studies conducted.

5.2 DEMOGRAPHICS

Informal traders seldom have any other sources of income and rely mainly on income from their trading to run their households. Skinner (2008: 227) stated that data suggested a close correlation between being poor and informal trading. Further to this, it was revealed in a street survey, that most of the traders were women. This was found to be consistent with the findings of this study as 89.2% of the respondents were female.

Skinner (2008:227) attributed fluctuations in the number of informal traders within the informal sector due to the fluctuations of employment within the formal sector. This was confirmed by a study conducted by Cohen (2010:280). The average trading years was found to be between six to ten years (Cohen 2010:280; Ngiba, Dickinson and Whittaker 2009:463 and Fundie and Chisoro 2015:56). This study confirmed this phenomenon as most of the informal traders were within this trade for between six to nine and more than years. The informal sector, though informal, was found to provide a sense of stability to the informal traders. In this sector, they were self-employed and were able to manage their business. This sector was able to ensure that they were always employed and able to grow their business in the way they wanted to. This sector also allowed an individual with any level of education to trade within this sector as opposed to the educational requirements within the formal sector. This was supported by the findings on the level of education within this survey where the majority of the participants had completed grades two, nine and twelve. However, an influx of informal traders providing similar services could potentially affect their trade as the sector becomes saturated.

5.3. WASTE GENERATION

Waste is any item for which the generator does not have any use for. These items are generally discarded of into a bin and is landfilled. Rushton (2010: 183) defined waste as being anything that is discarded by an individual. Hence, the waste from the informal traders, whether they are recyclable or not, are classified as waste. In Indonesia, a study conducted among traditional markets found that the markets were the second largest contributor of MSW which contained a high portion of organic waste mainly due to food and garden waste. This was further established by Troschinetz and Mihelcic (2009: 920) which found that organic waste was the most prevalent waste generated in the USA, EU and other developing countries. Within this study, it was

ascertained that majority of the participants stated food waste as being the most prevalent waste stream being generated on a daily basis. This indicates a high organic fraction of the waste that is disposed via landfill. These wastes were generated due to produce going bad due to the lack of demand, the saturation of the produce on the market or due to poor conservation practices such as refrigeration and cold rooms.

Among the waste prevalent daily waste streams, the informal traders also mentioned that papers, cardboards and plastics were generated. These were noted to be the waste streams generated in Iloilo City in the Philippines. The study in the Philippines found that 60% of the waste included paper, cardboards and packaging material (Paul *et al* 2012: 2021).

Hazardous waste was not found to be generated by the informal traders. Their waste streams were noted to be homogenous and easily separable thus a higher potential for waste management and alternatives. In Portugal, only 4% of waste was separated at source which allowed for the diversion of waste from landfill (Minghua *et al* 2009: 1228). A similar scenario was evident in the of Yauondé where only 5% of waste was estimated to be recycled (Parrot, Sotamenou and Dia 2009: 989). At the informal markets, most of food items are unpackaged. The customers purchasing fresh produce are either provided a plastic bag as part of the sale or they bring their own plastic or material bags to be used. Most of the produce arrive in cardboards and are then laid out for sale on the trading counters. The waste streams that were identified by the informal traders currently have alternative and recycling options. This is with the exception of plastic which is based upon the type of plastic. However, alternatives still do exist hence they must be investigated and utilized.

5.4 WASTE COLLECTION AND STORAGE

Vergara and Tchobanoglous (2012: 291) stated that the importance of the waste collection system was to reduce the accumulation of waste at the generator. Therefore, waste collection must be done on a regular basis. Waste collection is the point of the waste management cycle at which there is an interface between the waste generator and the waste management system.

Most of the informal traders were aware that collection of the waste took place on a regular basis by the local municipality in the form of DSW as per the responses received from the questionnaire. The waste is either taken to the landfill site directly or is it taken to a transfer station where it is compacted and placed into containers which are then transported to an appropriate landfill site. Based on the number of traders at the markets and the volumes of waste generated within a day, daily waste collections are of utmost importance to prevent the accumulation of waste. The accumulation of waste can result in health hazards as the waste provides a good breeding ground for vectors and the situation can encourage environmentally

irresponsible behaviors on the part of the informal traders. Some of the traders currently do open dump and burn their wastes, the accumulation of waste could result in many more informal traders becoming fed up of the situation and disposing of wastes by themselves. Oteng-Ababio, Arguella and Gabbay 2013: 98) found that within low income and highly dense areas in Accra, Ghana, waste was dumped into gutters, drains and streams due to irregular collections of waste from the communal collection areas.

Waste segregation receptacles can be placed at the waste collection point which will reduce the amount of waste being landfilled. This could potentially decrease the transport costs for DSW as well. Vergara and Tchobanoglous (2012: 2911) found that the average cost of waste collection was between 50 – 60% of the budget in middle income countries. In low income countries, that allocation can increase to as much as 80%.

5.5 WASTE DISPOSAL METHODS

Landfilling is the traditionally most utilized waste disposal methods in developing countries. It is thought to be most economical however, in recent years, it has been established that this is not correct as environmental and spatial constraints were not effectively assessed (Taiwo 2011: 98 and Narayana 2009:1164).

In Indonesia, the traditional markets were found to be the second largest contributors of MSW despite alternatives for certain waste streams. The waste was also open dumped which posed a significant negative impact to the environment and to human health (Aye and Widjaya 2006: 1189).

This study indicated a strong correlation between the cost of improper waste management with the highest grade completed in school, occupation, and household income of the informal trader. This indicated that the higher the grade completed and the higher the household income, the better the understanding of the financial implications of improper waste disposal techniques. This can be attributed to a significantly improved understanding of finances and the domino effect thereof. By understanding the financial implications of improper waste disposal, the informal traders are able to make informed and the correct decisions for the disposal of their waste and are more likely to ensure their waste is disposed of in the correct manner. This finding was substantiated by Aye and Widjaya (2006: 1182) which stated that the level of education was found to directly impact the waste management practices undertaken.

In Kenya, the dumping of waste in open grounds was attributed to the lack of waste management services (Henry, Yongsheng and Jun 2006: 98). This was consistent with the findings relating to the reactions of the waste management services provided to them by municipality as most of the respondents were neutral and positive in terms of their outlook and

perspective on the level of services provided for the management of waste. They were more likely to comply with the proper waste management techniques.

5.6. RECYCLING

Recycling is defined as the reclaiming of rejected resources into a new product (Vergara and Tchobanoglous 2012: 282). The recycling rates within developing countries were found to be between 20 and 50% as stated by Wilson *et al* (2009: 630). This study did not measure the amount of waste that is recycled, if any, by the informal traders however, the waste streams identified by the respondents are recyclable material. The participants depicted a good understanding of the definition of recycling although they did not understand the reasons and benefits of recycling.

A study conducted by Almasi *et al* (2014: 67) found that approximately 11% of respondents recycled their wastes while 50% stated that they would be willing to participate in a recycling program. This conclusion was consistent with the findings of this study as it was ascertained that only 6.6% stated that they recycled their waste while over 95% were willing to participate in recycling program.

The practices of recycling paper, cardboard, plastics and food waste was found to be mostly not done. A large portion of the participants indicated that they never recycling their food waste which could be used as fertilizer for their produce. The informal traders are focused on the sale of their produce. They spend majority of their day at the market trying to sell their goods as this their main source of income. They do not have the means to separate and ensure the recycling of their waste streams. It is also perceived that this is the responsibility of the municipality and they do not see the benefit of them separating their wastes. The process of segregation of wastes needs to be simple. A complicated system would tire out the traders and create an oblivious attitude towards the program. This was further established by Abadi, Mahdavian and Fattahi (2020: 9).

The traders indicated that a method of reducing the waste at their stall was to peel or clean their vegetables prior bringing them to the market. This is seen as the reduction of waste at the market, but it is not, in definition, reducing their waste. It is merely shifting it from one area to another. Hence, awareness programs aimed at improving the concepts of waste and waste management would aid in them finding alternate methods of reducing their waste.

The correlation between recycling and reuse concepts was found to be strong amongst the average household income, number of years in the occupation and the level of education like Almasi *et al* (2019: 333) which found a significant correlation between knowledge and attitudes

even though the practices were poor. This relationship was further concluded by Desa, Kadir and Yusooff (2011: 646) as well as Adeolu, Enesi and Adeolu (2014: 70). Although, their findings established a link between education, sex age and environmental practices, this study was only able to prove a correlation between education, household income and number of years in the occupation.

5.7 COMPOSTING

The composting of waste can be defined as the biological processes during which air is introduced by means of mechanical turning which stimulates aerobic microorganisms to reduce the amount of organic materials into a more stable environmentally friendly manner. The end product can provide a fertilizer which can then be utilized by the informal traders for the growth of the fresh produce and further reduce the use of chemical fertilizer (Taiwo 2011: 96 and Couth and Trois 2010: 2339). The main waste stream that is generated by the informal traders are high in organic content. These wastes are ideal for composting and reduces the amount of organic matter at landfill sites. These wastes are generally classified as MSW which are mixed waste which can be problematic to deal with at composting plants. Hence, separation at source is imperative to ensure a sustainable process.

Babaei et al (2015: 97) found that only 0.3% of the respondents in the study participated in backyard composting while the majority felt that it was an ineffective method for the treatment of wastes. A large portion of the informal traders indicated that they would be willing to participate in a composting program. While some traders also indicated that they sometimes composted their wastes. This contradicted the findings of Babaei et al (2015: 97) as the participants perceived composting as an ideal treatment method.

5.8 ATTITUDE AND AWARENESS

The knowledge, attitudes and practices of a community is imperative to ensure the sustainability of the implementation of waste management interventions, especially of the waste generator. Abadi, Mahdavian and Fattahi (2020: 9) found during a cross-sectional study in Iran that the attitudes of the participants effectively shaped the decisions surrounding the supply and storage methods of produce in an effort to reduce wastage.

The informal traders exhibited a good understanding of the waste management services that were provided by the municipality in terms of receptacles for waste storage, waste collection and storage facilities. Most of the respondents understood that waste management encompassed taking responsibility for one's waste, having clear guidelines and discarding of waste properly. In Iran, Babaei *et al* (2015: 97) found that the respondents did not participate in recycling programs due to the inaccessibility of recycling bins, lack of awareness towards

recycling programs, lack of municipal services and the lack of financial incentives to encourage participation.

Level of education was directly proportional to the knowledge and attitudes in regard to waste management. This relationship was established by a significant correlation between knowledge and attitudes although the practices were poor. It can be inferred that the higher the level of education of the trader, the higher the possibility of proper waste management techniques. This can be attributed to the emphasis placed on recycling and reuse within the educational curriculum. This was substantiated by Adeolu, Enesi and Adeolu (2014: 70) which found that amongst secondary school learners' environmental practices were affected by sex, age and education.

During the hours of trading, traders often listened to the radio as a method of entertainment hence this may have attributed to the high response on radios however, this must be investigated further. The informal traders also depended on the local municipality and word of mouth to obtain information regarding waste management. This indicated that they were keen to obtain more information and educate themselves more on various matters.

5.10 CONCLUSION

Knowledge and awareness surrounding waste management issues must be improved within the local government to informal traders and the promotion of waste segregation to promote recycling and enable the diversion of waste to landfill. This would save the municipality landfill space as well as a reduction of greenhouse gas emissions.

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

6.1 INTRODUCTION

This study is assumed to be the first to assess the KAP of informal traders regarding waste management and to assess the waste management cycle utilized by the informal traders within the Durban area. The findings of the study were utilized to draw conclusions on the waste management process followed by the informal traders at the Early Morning and Verulam Morning Markets. These findings may be extrapolated to the other markets that are situated throughout Durban.

The findings in this study demonstrated that the main waste stream of the informal traders is that of food waste which is predominantly discarded and landfilled. While the significant contributing factors that influenced waste management decisions were ascertained to be level of education of the informal traders, the number of years that the informal trader was within their occupation and the level of service provided by the municipality in conjunction with the market management.

6.2 KEY FINDINGS

The level of education was found to result in the method of treatment and disposal of waste generated by the informal traders. Those with a higher level of education

The study also found that the number of years within this occupation affected the perception towards recycling, reuse and environmentally friendly practices of the informal traders which was also affected by the level of income. The informal traders with a higher income were more likely to engage in environmentally friendly activities as they had the finances to do so. Those within a lower income range needed to allocate their income to necessities.

Storage of waste was found to be directly impacted by the level of services that were rendered by the local municipality. This indicated that the informal traders were more likely to ensure proper storage of waste until collection on the condition that they were provided the necessary means to do so. This indicates that the informal traders are open and willing to participate in proper waste management should they have the knowledge and means to do so.

6.3 RECOMMENDATIONS

Based on the data analysis of this study, it is recommended that the following be addressed at local government level:

- A better connectivity needs to be established within the municipal sectors to enable efficient waste management procedures within the municipal sectoral jurisdiction.
- The municipality needs to invest in infrastructure such as waste separation stations and receptacles to enable a large-scale diversion of wastes emanating from markets.
- The municipality needs to investigate and invest in the infrastructure for composting programs which will enable for a large portion of waste to be diverted from landfills.
- Develop an awareness program aimed at the informal traders to create a better understanding and awareness of waste management, the impacts of improper waste management and the benefits of recycling or reuse programs. The municipality should consider the communication methods stated in this study when developing awareness programs. Utilizing their current sources of information would have a greater impact.
- Develop an onboarding program inclusive of waste management which can be done when issuing of permits that allow informal traders to trade at the markets.

Based on the data analysis of this study, it is recommended that the following be addressed at market management level:

- Encourage and enforce the separation of waste.
- Maintain waste management processes and receptacles.
- Provide training and ongoing awareness on waste management to the informal traders.
- Engage with the informal traders to understand their needs and for better suited interventions.
- Proceeds from composting and recycling programs should be reallocated to the informal traders as an incentive for them to ensure that their wastes are separated. Trading is their main source of income hence the incentive will motivate them to reduce their waste.

6.4 LIMITATIONS

The researcher relied on self-reporting by the respondents who were willing to participate regarding waste management practices. The questionnaires could only be conducted during the trading hours of the informal traders which was challenging as not all the traders were willing to take time away from trading to answer a questionnaire.

Selection bias

Due to financial constraints, all the informal traders were not able to participate in the study and a sample population was chosen to carry out the study. Selection bias may have originated at the time of selecting the informal traders to participate in the study which may have resulted in loss of information. A follow up study was also not part of this study hence it was not possible to survey those that were not sampled in the initial phase.

6.5 STRENGTHS

This is the first study done in South Africa that assessed the waste management cycle utilised by market inform traders.

The strengths of this study include:

- This is the first study in South Africa to assess the waste management cycle utilised by market informal traders.
- This is the first study in South Africa to assess the waste streams generated by market informal traders.

6.6 AREA FOR FURTHER RESEARCH

Although this study assessed the waste generation within informal markets in Durban, it must be noted that only two markets were included in this study. A holistic review of the amount of waste generated and the impact to landfill must be done to fully understand the impact that these wastes pose to the environment. In addition to this, a detailed cost analysis on the financial benefits of waste diversion and reduction at source strategies should be conducted.

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APPENDICES

APPENDIX A - QUESTIONNAIRE

Study No.: _____

TOPIC:

An evaluation of the waste management cycle utilized by fresh produce market informal traders in Durban, KwaZulu-Natal.

Aim:

The overall aim of the study is to undertake an evaluation of the waste management cycle utilised by fresh produce market informal traders in Durban, KwaZulu-Natal.

Objectives:

1. To determine the generation of the waste streams of fresh produce by market informal traders.
2. To determine knowledge of waste management cycle among fresh produce market informal traders.
3. To evaluate the feasibility of reducing, reusing and recycling waste on site.

NOTE

THANK YOU FOR TAKING PART IN MY STUDY!! 😊 YOUR HELP IS MUCH APPRECIATED!

Please tick the appropriate box/boxes below.

Please answer questions honestly.

Answers will be kept confidential.

SECTION A – DEMOGRAPHICS

Gender

Female ₁		Male ₂	
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Historical race group

African ₁		Colored ₃		White ₄	
Indian ₂		Other, please specify ₅			

Age group

Younger than 21 ₁		21 – 30 years ₂		31 – 40 years ₃	
41 – 50 years ₄		51 – 60 years ₅		Older than 61 years ₆	

Average household income

Less than R500 ₁		R3001 – R4000 ₅		No response ₉	
R501 – R1000 ₂		R4001 – R5000 ₆			
R1001 – R2000 ₃		More than R5000, please specify ₇			
R2001 – R3000 ₄		Confidential ₈			

Level of education

No formal education ₁		Primary completed (7years of schooling) ₂	
Partial secondary completion ₃		Completed matric ₄	
Certificate/ diploma ₅		Undergraduate degree ₆	
Other, please specify ₇			

Please state the highest grade you have completed in school.

Grade 1 ₁		Grade 2 ₂		Grade 3 ₃		Grade 4 ₄	
Grade 5 ₅		Grade 6 ₆		Grade 7 ₇		Grade 8 ₈	
Grade 9 ₉		Grade 10 ₁₀		Grade 11 ₁₁		Grade 12 ₁₂	

Please state your occupation.

Farmer ₁		Stall assistant ₂	
Stall owner ₃		Other, please specify ₄	

State the number of years in your occupation.

Less than a year ₁		<u>6 – 7 years</u> ₄	
<u>1 – 3 years</u> ₂		<u>8 – 9 years</u> ₅	
<u>4– 5 years</u> ₃		More than 9 years, please specify ₆	

SECTION B – WASTE MANAGEMENT

Where do you trade from?

Early morning ₁	Verulam market ₂	Other, please specify ₃

Do you have any other business or occupation?

Yes, please specify ₁	No ₂

Please state your trading hours

Do you have any employees? If so, how many?

Yes, please state how many ₁	
No ₂	

Where do you get information on how to manage or deal with waste generated by your business?

None/ no information ₁		Radio ₂	
Internet ₃		What other traders like me do ₄	
Newspapers ₅		Word of mouth (from family and/ or friends) ₆	
City/ government brochures/ pamphlets, etc ₇		Other, please specify ₈	

Which waste management facilities that you know of are provided by the market management?

Wheely bins ₁	
Bin bags ₂	
Waste storage area ₃	
Other, please specify ₄	

What in your opinion are the main aspects of waste management? Multiple responses permitted, please do not prompt. (What is waste management made up off)

Do not know ₁	
Discarding of waste properly ₂	
Having clear guidelines ₃	
Taking responsibility for the waste one or one's business generated ₄	
Other, please specify ₅	

How can waste management be improved in your type of business and in eThekwini Municipality more generally?

	In business	eThekwini Municipality
Making it compulsory to separate at source ₁		
More laws to promote recycling ₂		
Put in place composting programmes ₃		
Specific training and education programmes for specific trades ₄		
Have more waste collection depots ₅		
Have a payment fund for waste diversion and separation programmes (incentive) ₆		
Other (specify) ₇		

Are you concerned about the environment you work in?

Yes ₁		No ₂	
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If yes, why?

If no, why?

What do you think about the waste management facilities provided by the market? Please rate.

Very good ₁	Good ₂	Fair ₃	Poor ₄	Very poor ₅

How do you feel about the waste management facilities provided by the market?

Very satisfied ₁	Satisfied ₂	Neither ₃	Dissatisfied ₄	Very dissatisfied ₅

Which of the following environmentally-friendly practices do you personally undertake/partake in while at home?

	Never ₁	Sometimes ₂	Always ₃
Recycling			
Reuse of water			
Water harvesting e.g. JoJo tanks			
Reduce usage of products			
Buy environmentally-friendly products			
Composting at home			
Using sources of energy other than electricity			
Planting trees/ vegetation			
Proper disposal of waste (not burning)			
Use of public transport			

SECTION C - GENERATION

Tick the different types of waste from your stall.

Paper ₁		Plastic packaging ₂	
Cardboard ₃		Glass ₄	
Food waste ₅		Polystyrene containers ₆	
Other, please specify ₇			

Which waste type do you generate the most on a typical trading day?

What is your largest amount of waste you have generated on a trading day? Estimate in kg.

On average, how many bags of waste do you generate and place at the storage area for collection each week?

None ₁		3 -4 bags ₅	
Less than 1 ₂		4 – 5 bags ₆	
1 – 2 bags ₃		More than 5 bags, please specify ₇	
2 – 3 bags ₄			

Please state how you deal with waste generated in your business on a typical day:

Approximately how much of waste is generated per week? Note: type of waste might have different quantity criteria e.g. kilograms and numbers.

Waste type	Quantity	Waste type	Quantity
Paper ₁		Aluminium foil containers ₆	
Cardboard ₂		Metal cans ₇	
Glass bottles and jars ₃		Other plastic ₈	
Plastic bottles and jars ₄		Food waste ₉	
Food waste ₅		Other, please specify ₁₀	

SECTION D - SEGREGATION

Do you separate your different types of waste? If yes go to question 1.1. If no, go to question 1.2.

Yes ₁		No ₂	
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If yes, how:

Type of waste	Method of separation

If no, why?

SECTION E - STORAGE

STORAGE

Is there a storage area for waste? (central point of pick up/ disposal point)

Yes ₁		No ₂	
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Is it accessible?

Yes ₁		No ₂	
------------------	--	-----------------	--

Where is the waste storage area located?

-

COLLECTION

Who picks up the waste from the storage area?

How often is waste picked up?

Daily ₁	Every trading day ₂	Every second day ₃	Weekly ₄	Other ₅

Who removes waste from your stall?

Stall owner ₁		Market services ₃	
Stall assistant ₂		Other, please specify ₄	

How is waste removed from your stall?

SECTION F - DISPOSAL

How would you rate the importance of correct disposal of waste?

Not important at all ₁	Little importance ₂	Average importance ₃	Very important ₄	Absolutely important ₅

Please rate, as per rating below, the following negative impacts due to incorrect waste disposal:

1= Mild

2= Moderate

3= Severe

Cost ₁		Environmental ₃	
Health ₂		Other, please specify and rate ₄	

What do you do with waste generated at your stall?

	Never ₁	Sometimes ₂	Always ₃	Don't know ₄
Throw out with other general waste ₁				
Throw waste in an open dump ₂				
Pay a waste removal company to dispose of waste ₃				
Pay a specialist waste collector to dispose of waste ₄				
Sell/ give to other traders ₅				
Sell/ give to recyclers ₆				
Compost food waste ₇				
Donate the waste (specify to whom, if possible) ₈				
Store of waste ₉				
Burn the waste ₁₀				
Other (specify) ₁₁				

If you dispose of your waste on your own (not at market), please state where:

Bin ₁		Open dump ₃	
Landfill ₂		Other, please specify ₄	

SECTION G - RECYCLING

Would you consider recycling your waste?

Yes ₁		No ₂	
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Do you recycle (explain) any of the following waste products from your business?

	Always ₁	Sometimes ₂	Never ₃		Always ₁	Sometimes ₂	Never ₃
Paper				Metal cans			
Cardboard				Aluminium foil containers			
Glass bottles and jars				Polystyrene containers			
Plastic bottles and jars				Food waste			
Other plastic				Other, please specify			

Would you participate in a composting program?

Yes ₁		No ₂	
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Please tick which sentence you think describes recycling of waste:

Use the item as much as possible before throwing it out ₁	
Use the item as a new product or in a new way than it is meant for ₂	

SECTION H - REUSING

Do you reuse any of the following waste products from your business?

	Always ₁	Sometimes ₂	Never ₃		Always ₁	Sometimes ₂	Never ₃
Paper ₁				Metal cans ₆			
Cardboard ₂				Aluminium foil containers ₇			

Glass bottles and jars ³				Polystyrene containers ⁸			
Plastic bottles and jars ⁴				Food waste ⁹			
Other plastics ⁵				Other, please specify ¹⁰			

Please tick which sentence you think describes reuse of waste:

Use the item as much as possible before throwing it out ¹	
Use the item as a new product or in a new way than it is meant for ²	

SECTION I - REDUCING

Do you have any ways of reducing your waste?

<u>Yes</u> ¹		<u>No</u> ²	
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How do you reduce waste generated at your stall?

THANK YOU FOR YOUR TIME 😊

APPENDIX B – QUESTIONNAIRE (IsiZulu)

Inamba Yocwaningo.: _____

IMIBUZO

ISIHLOKO:

Ukuhlolwa komjikelezo wokuphathwa kwemfucumfucu osetshenziswa abahwebi bemakethe bezilimo abangekho emthethweni eThekwini, KwaZulu-Natal.

Umgomo:

Umgomo wonke wocwaningo ukwenza ukuhlola komjikelezo wokuphathwa kwemfucumfucu osetshenziswa abahwebi bemakethe bezilimo abangekho emthethweni eThekwini, KwaZulu-Natal.

Izisusa:

1. Ukuthola imbangela yemfucumfucu ngabahwebi bezilimo bemakethe abangekho emthethweni.
2. Ukuthola ulwazi lomjikelezo wokuphathwa kwemfucumfucu kubahwebi bezilimo bemakethe abangekho emthethweni.
3. Ukuphakamisa izindlela zokunciphisa, ukusebenzisa futhi kanye nokuvuselela kabusha imfucumfucu esizindeni.

PHAWULA

NGIYABONGA NGOKUTHATHA INGXENYE KULOLUCWANINGO LWAMI!! ☺ LUYAZISWA KAKHULU USIZO LWAKHO!

Siza uphawule ibhokisi/amabhokisi afanele ngezansi

Siza uphendule imibuzo ngokwethembeka.

Izimpendulo zizogcinwa ziyimfihlo.

INGXENYE A – AMANANI ABANTU

Ubulili

Owesifazane ₁		Owesilisa ₂	
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Iqembu lohlanga olungokomlando

umAfrika ₁		iKhaladi ₃		umLungu ₄	
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umNdiya ₂		Okunye, siza uchaze ₅	
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Ubudala

Ngaphansi kuka-21 ₁		21 – 30 iminyaka ₂		31 – 40 iminyaka ₃	
41 – 50 iminyaka ₄		51 – 60 iminyaka ₅		Ngaphezu kweminyaka engu-61 ₆	

Umholo womndeni ongokwesilinganiso

Ngaphansi kuka-R500 ₁		R3001 – R4000 ₅		Ayikho impendulo ₉	
R501 – R1000 ₂		R4001 – R5000 ₆			
R1001 – R2000 ₃		Ngaphezu kuka-R5000, siza uchaze ₇			
R2001 – R3000 ₄		Yimfihlo ₈			

Izinga lemfundo

Angifundile ₁		Ngiqede amabanga aphansi (iminyaka engu-7 yokufunda) ₂	
Ngiqede amabanga aphakeme ngokwengxenye ₃		Ngiqede umatikuletsheni ₄	
Isitifiketi/ idiploma ₅		Iziqu zabangakaphothuli ₆	
Okunye, siza uchaze ₇			

Siza usho ibanga eliphakeme kunawo wonke oliphothulile esikoleni.

Izinga 1 ₁		Izinga 2 ₂		Izinga 3 ₃		Izinga 4 ₄	
Izinga 5 ₅		Izinga 6 ₆		Izinga 7 ₇		Izinga 8 ₈	
Izinga 9 ₉		Izinga 10 ₁₀		Izinga 11 ₁₁		Izinga 12 ₁₂	

Siza usho umsebenzi wakho.

Umlimi ₁		Isekelaendaweni yokuthengisela ₂	
Umnikazi wendawo yokuthengisela ₃		Okunye, siza uchaze ₄	

Yisho inani leminyaka emsebenzini wakho.

Ngaphansi konyaka ₁		6 – 7 iminyaka ₄	
1 – 3 iminyaka ₂		8 – 9 iminyaka ₅	
4– 5 iminyaka ₃		Ngaphezu kweminyaka engu-9, siza uchaze ₆	

INGXENYE B – UKUPHATHWA KWEMFUCUMFUCU

Uthengisela kuphi?

e-Early morning ₁	EMakethe yase-Verulam ₂	Okunye, siza uchaze ₃

Unalo elinye ibhizinisi, noma umsebenzi?

Yebo, siza uchaze ₁	Cha ₂

Siza usho amahora akho entengiso

Unabo yini abasebenzi? Uma kunjalo, bangaki?

Yebo, siza usho inani ₁	
Cha ₂	

Ukuthola kuphi ukwaziswa kokuthi ungayiphatha noma uyisingathe kanjani imfucumfucu ebangelwa yibhizinisi lakho?

Angikutholi/ Akukho ukwaziswa ₁		Umsakazo ₂	
I-inthanethi ₃		Lokhu abanye abahwebi abangitshela khona ₄	
Iphephandaba ₅		Kubasiki bebunda (emndenini wami kanye/ noma abangane) ₆	
Idolobha/ izincwajana zikahulumeni/ amaphamfulethe, njalonjalo ₇		Okunye, siza uchaze ₈	

Yiziphi izinto zokuphatha imfucumfucu ozaziyo ezilungiselelwe abaphathi bemakethe?

Imigqomo enamasondo ₁	
Oplastiki bemigqomo ₂	
Indawo yokugcina imfucumfucu ₃	
Okunye, siza uchaze ₄	

Ngokombono wakho, yiziphi izici eziyinhloko zokuphatha imfucumfucu? Izimpendulo ezingana zivumelekile, siza ungafunzeleli. (Ukuphatha imfucumfucu kwenziwe ngani)

Angazi ₁	
Ukulahla imfucumfucu ngendlela efanele ₂	
Ukuba neziqondiso ezicacile ₃	
Ukuthatha umthwalo wemfanelo ngemfucumfucu ebangelwe ngumuntu siqu noma ibhizinisi lakhe ₄	
Okunye, siza uchaze ₅	

Ukuphathwa kwemfucumfucu kungathuthukiswa kanjani ohlotsheni lwebhizinisi lakho nakuMasipala waseThekwini ngokwengeziwe?

	Ebhizinisini	kuMasipala waseThekwini
Ukwenza kube yimpoqo ukuhlukanisa lapho ivela khona ₁		
Imithetho eyengeziwe ethuthukisa ukukhuculula ₂		
Kube nezinhlelo zokwenza umquba ₃		
Ukuqeqeshwa okuthize nezinhlelo zemfundo zemisebenzi yezandla ethize ₄		
Makube namadepho engeziwe okuqongelela imfucumfucu ₅		
Makube nesikhwama senkokhelo yokuhlukanisa imfucumfucu nezinhlelo zokuhlukanisa (indlela yokukhuthaza) ₆		
Okunye (chaza) ₇		

Ingabe ukhathazekile ngendawo osebenzela kuyo?

Yebo ₁		Cha ₂	
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Uma kungu-yebo, kungani?

Uma kungu-cha, kungani?

Ucabangani ngezinsizazokuphatha imfucumfucu ezinikezwa yimakethe? Siza ulinganise.

Zinhle kakhulu ₁	Zinhle ₂	Zisesimweni esikahle ₃	Zimbi ₄	Zimbi kakhulu ₅

Uzizwa kanjani ngezisetshenziswa zokuphatha imfucumfucu ezinikezwa yimakethe?

Nganelisekile kakhulu ₁	Nganelisekile ₂	Akukho engingakusho ₃	Anganelisekile ₄	Anganelisekile kakhulu ₅

Yimiphi kulemikhuba elandelay engalimazi imvelo oyenzayo/ohlanganyela kuyo wena ngokwakho uma usekhaya?

	Nakancane ₁	Ngezinye izikhathi ₂	Njalo ₃
Ukukhuculula			
Ukusetshenziswa futhi kwamanzi			
Ukugcinwa kwamanzi, njengokuthi ithangi likaJoJo			
Ukunciphisa ukusetshenziswa kwemikhiqizo			
Thenga imikhiqizo eyiphatha kahle imvelo			
Ukuzenzela umquba ekhaya			
Ukusebenzisa imithombo yamandla ngaphandle kukagesi			
Ukutshala imithi/ izimila			
Ukulahla imfucumfucu ngedlela efanele (hhayi ukuyishisa)			
Ukusebenzisa izinto zokuhamba zomphakathi			

INGXENYE C – UKUBANGELA

Phawula izinhlobo ezahlukahlukene zemfucumfucu endaweni yakho yokuthengisela.

Amaphepha ₁		Amapulasitiki okuphatha ₂	
Ikhadibhodi ₃		Ingilazi ₄	
Imfucumfucu yokudla ₅		Okopokopo ₆	
Okunye, siza uchaze ₇			

Yiluphi uhlobo lwemfucumfucu olubangela kakhulu ngosuku lokuhweba oluvamile?

Yiliphi inani lemfucumfucu elikhulu kunawo wonke oke walibangela ngosuku lokuhweba?
Linganisa ngamakhilogremu

Ngokwesilinganiso, zingaki izikhwama zemfucumfucu ozibangelayo nozibeka endaweni yokugcina imfucumfucu ukuze zithathwe isonto ngalinye?

Lutho ₁		3 -4 izikhwama ₅	
Ngaphansi kuka-1 ₂		4 – 5 izikhwama ₆	
1 – 2 izikhwama ₃		Ngaphezu kwezikhwama ezingu-5, siza uchaze ₇	
2 – 3 izikhwama ₄			

Siza usho ukuthi ubhekana kanjani nemfucumfucu ebangelwayo ebhizinisini lakho ngosuku oluvamile:

Kubangelwa imfucumfucu engaba ngakanani isonto ngalinye? Phawula: Uhlobo lwemfucumfucu lungaba nezinhlalo ezahlukene zokubalwa, ngokwesibonelo, amakhilogremu namanani.

Uhlobo lwemfucumfucu	Inani	Uhlobo lwemfucumfucu	Inani
Amaphepha ₁		Izitsha ezenziwe ngofoyela we-aluminiyamu ₆	
Ikhadibhodi ₂		Amathini ensimbi ₇	
Amabhodlela nezitsha zengilazi ₃		Omunye upulasitiki ₈	
Amabhodlela nezitsha epulasitiki ₄		Imfucumfucu engukudla ₉	
Imfucumfucu yokudla ₅		Okunye, siza uchaze ₁₀	

INGXENYE D - UKWEHLUKANISWA

Ingabe uyazehlukanisa izinhlobo zakho zemfucumfucu ezahlukahlukene? Uma kunjalo, iya embuzweni 1.1. Uma kungenjalo, iya embuzweni 1.2.

Yebo ₁		Cha ₂	
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Umakunjalo, kanjani:

Uhlobo lwemfucumfucu	Indlela yokwehlukanisa

Uma kungenjalo, kungani?

INGXENYE E - UKUGCINA

Ingabe ikhona indawo yokugcina imfucumfucu? (indawo emaphakathi yokuyilanda/ yokuyilahla)

Yebo ₁		Cha ₂	
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Ingabe iyafinyeleleka?

Yebo ₁		Cha ₂	
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Ikuphi indawo yokugcina imfucumfucu?

UKUQOQA

Ubani obutha imfucumfucu endaweni yokuyigcina?

Ibuthwa kaningi kangakanani imfucumfucu?

Usuku ngalunye ¹	Njalo ngosuku lokuhweba ²	Njalo ngosuku lwesibili ³	Isondo ngalinye ⁴	Okunye ⁵

Ubani osusa imfucumfucu endaweni yakho yokuthengisela?

Umnikazi wendawo yokuthengisela ¹		Izinkonzo zemakethe ³	
Isekela endaweni yokuthengisela ²		Okunye, siza uchaze ⁴	

Isuswa kanjani imfucumfucu endaweni yakho yokuthengisela?

INGXENYE F - UKULAHLA

Ukulinganisa njengokubaluleke kangakanani ukubalulela kokulahla imfucumfucu ngendlela efanele?

Akubalulekile nhlobo ¹	Kubaluleke kancane ²	Kubaluleke ngokuvamile ³	Kubaluleke kakhulu ⁴	Kubaluleke ngempela ⁵

Siza ulinganise, njengoba kulinganisiwe ngezansi, imiphumela emibi engabakhona ngenxa yokungalahli imfucumfucu ngendlela engafanele.

1= Ikahle

2= Ayeqile

3= Mibi kakhulu

Izindleko ¹		Eyemvelo ³	
Impilo ²		Okunye, siza uchazefuthi ulinganise ⁴	

Wenzani ngemfucumfucu ebangelwe endaweni yakho yokuthengisela?

	Phinde ₁	Ngezinye izikhathi ₂	Njalo ₃	Angazi ₄
Lahla nenye imfucumfucu evamile ₁				
Lahlela udoti endaweni evulekile yokulahla udoti ₂				
Khokhela inkampani yokubutha imfucumfucu ukuze ilahle imfucumfucu ₃				
Khokhela ochwepheshe bemfucumfucu ukulahla imfucumfucu ₄				
Thengisa/ nika abanye abahwebi ₅				
Thengisa/ nika abakhukululi ₆				
Yenza umquba ngokudla okulahliwe ₇				
Nikela ngemfucumfucu (yisho ukuthi kubani, uma kwenzeka) ₈				
Gcina imfucumfucu ₉				
Shisa imfucumfucu ₁₀				
Okunye (chaza) ₁₁				

Uma uzilahlela imfucumfucu yakho ngokwakho (hhayi ngemakethe), siza usho lapha:

Umgqomo ₁		Indawo yokulahla evulekile ₃	
Izigodi ₂		Okunye, siza uchaze ₄	

INGXENYE G - UKUKHUCULULA

Ingabe ungakucabangela ukukhuculula imfucumfucu yakho?

Yebo ₁		Cha ₂	
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Ingabe uyayikhuculula (chaza) imfucumfucu elandelayo ebuya ebhizinisini lakho?

	Njalo ₁	Ngezinye izikhathi ₂	Phinde ₃		Njalo ₁	Ngezinye izikhathi ₂	Phinde ₃
Amaphepha				Amathini ensimbi			
Amakhadibhodi				Izitsha ezenziwe ngofoyela we-aluminiyamu			

Amabhodlela nezitsha zengilazi				Okopokopo			
Amabhodlela nezitsha zepulasitiki				Imfucumfucu engukudla			
Omunye upulasitiki				Okunye, siza uchaze			

Ingabe ungalanganyela ohlelweni lokwenza umquba?

Yebo ₁		Cha ₂	
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Siza uphawule ukuthi yimuphi umusho ocabanga ukuthi uchaza ukukhucululwa kwemfucumfucu:

Sebenzisa izinto kaningi ngokunokwenzeka ngaphambi kokuzilahla ₁	
Sebenzisa izinto njengezinto ezintsha noma ngendlela entsha engahloselwe zona ₂	

INGXENYE H – UKUSEBENZISA FUTHI

Ingabe ikhona imfucumfucu kwelandelayo oyisebenzisayo futhi ebhizinisini lakho?

	Njalo ₁	Ngezinye izikhathi ₂	Phinde ₃		Njalo ₁	Ngezinye izikhathi ₂	Phinde ₃
Amaphepha ₁				Amathini ensimbi ₆			
Amakhadibhodi ₂				Izitsha ezenziwe ngofoyela we-aluminiyamu ₇			
Amabhodlela nezitsha zengilazi ₃				Okopokopo ₈			
Amabhodlela nezitsha zikapulasitiki ₄				Imfucumfucu yokudla ₉			
Omunye upulasitiki ₅				Okunye, siza uchaze ₁₀			

Siza uphawule ukuthi yimuphi umusho ocabanga ukuthi uchaza ukusetshenziswa futhi kwemfucumfucu:

Sebenzisa izinto kaningi ngokunokwenzeka ngaphambi kokuzilahla ¹	
Sebenzisa izinto njengezinto ezintsha noma ngendlela entsha engahloselwe zona ²	

INGXENYE I - REDUCING

Ingabe unayo indlela ongaciphisa ngayo imfucumfucu yakho?

<u>Yebo</u> ¹		<u>Cha</u> ²	
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Uyinciphisa kanjani imfucumfucu edaleke etafuleni lakho?

SIYAKUBONGA NGESIKHATHI SAKHO 😊

APPENDIX C – LETTER TO MUNICIPALITY

15 March 2017

RE: REQUEST TO CARRY OUT RESEARCH STUDY WITHIN THE MARKETS IN THE DURBAN AREA

To: eThekweni Municipal Academy

My name is Renisha Sahathu. I am a MHS Sc Environmental Health student at the Durban University of Technology. I am in the process of preparing my research protocol to conduct a study on “A lifecycle evaluation of the waste management practices utilized by informal traders within Durban”.

The views and opinions of the market traders will be needed as it will play a pivotal role in this study. Therefore, I would appreciate if permission could be granted for me to access this population from which I can obtain a sample to interview.

This study will assist the concerned area in determining the knowledge, attitudes and practices regarding waste management of the informal market traders. It will also aim to assist in reviewing methods of reusing or recycling waste emanating from the markets. This will also help provide in depth knowledge of proper waste management techniques to those involved with waste management of the markets.

I will also ensure that the information provided will be confidential and participants remain anonymous. The information will be used for research purposes by myself and my supervisor concerned. If you require further information please contact my research supervisor Ms Joy Kistnasamy on email: joyk@dut.ac.za or 031 373 2249.

Thanking you,

Ms R Sahathu

Email: renisha.sahathu@gmail.com

Contact No.: 072 605 6341

APPENDIX D – LETTER OF INFORMATION



LETTER OF INFORMATION

Title of the Research Study: An evaluation of the waste management cycle utilized by fresh produce market informal traders in Durban, KwaZulu-Natal.

Principal Investigator/s/researcher: Renisha Sahathu, Bachelor of Technology: Environmental Health

Co-Investigator/s/supervisor/s: Emilie Joy Kistnasamy, MTech, BCom

Brief Introduction and Purpose of the Study: The study aims to determine the waste streams of fresh produce market traders as well as their understanding with regards to the waste management cycle.

Outline of the Procedures: The letter of information will be given and explained to you after which an informed consent form will be signed if you are willing to take part in the research. A questionnaire will be given to you. You are also expected to be truthful when answering the questionnaire. You are allowed to refuse to answer a question if you feel uncomfortable. The questionnaires will be conducted on site at the respective markets. Questionnaires will be administered to you i.e. stall owners, stall assistants and personnel responsible for waste management at the facility. Groups that will be excluded from the study are market management and stall assistants under the age of 18 years.

Risks or Discomforts to the Participant: There will be no risks or discomforts to you linked with the study.

Benefits: You will be educated on good waste management practices as well as the outcome of this study.

Publication of at least one article.

Reason/s why the Participant May Be Withdrawn from the Study: You may pull out from the study at any time. There will be no bad effect to you should you want to pull out.

Remuneration: You will not receive any kind of payment.

Costs of the Study: You will not cover any costs towards the study.

Confidentiality: You will remain anonymous. No person other than the researcher and the supervisor will have access to the questionnaires to prevent a break of privacy. Records will be kept in a lockable safe at the Durban University of Technology for a period of five years after which it will be destroyed and discarded.

Research-related Injury: No research-related injury is expected due to the nature of the study. This study only requires a questionnaire which will be used to obtain information.

Persons to Contact in the Event of Any Problems or Queries:

In the case of any problems or queries please contact the researcher, supervisor or the Institutional Research Ethics Administrator on 031 373 2375. Complaints can be reported to the Acting Director: Research and Postgraduate Support, Prof C E Napier on 031 373 2577 or carinn@dut.ac.za.

APPENDIX E – LETTER OF INFORMATION (IsiZulu)



INCWADI YOKWAZISWA

Isihloko soCwaningo: Ukuhlola komjikelezo wokukhuculula imfucumfucu osetshenziswa abahwebi bemakethe bezilimoabangekho emthethweni eThekwini, KwaZulu-Natal.

Um/abaphenyi oyinhloko/ umcwaningi: Renisha Sahathu, i-Bachelor yezobuchwepheshe: Ezempilo Zomphakathi

Aba-/Umphenyi kanye/ aba/umphathi: Emilie Joy Kistnasamy, MTech, BCom

Isingeniso Esifushane Nenjongo Yocwaningo: Ucwaningo luhlose ukuthola ukuqhubeka kwemfucumfucu yabahwebi bezilimo kanye nokuqonda kwabo umjikelezo wokuphatha imfucumfucu.

Ukuhlelwa Kwezinqubo: Incwadi yokwaziswa izoyinikwa futhi uchazelwe okuyothi ngemva kwalokho ifomu lokuvuma ngemva kokwaziswa uzolisayinwa uma ufuna ukuthatha ingxenye ocwaningweni. Iphepha lemibuzo uzonikwa. Kulindelwe ukuba ukhulume iqinisouma uphendula iphephalemibuzo. Uvumelekile ukwenqaba ukuphendula umbuzo uma uzizwa ungakhululekile. Imibuzo izobuzelwa endaweni leyo izimakethe zikuyo. Amaphepha emibuzo nizowanikwa. Isibonelo, abahwebi, okungukuthi, abanikazi bezindawo zokuthengisela, amasekela abo kanye nabantu abanomthwalo wemfanelo wokuphatha imfucumfucu endaweni. Imfucumfucu yezindawo zokuthengisela ezithile izokalwa futhi irekhodwe ukuze kuqondwe inani lemfucumfucu ebangelwayo ngosuku oluvamile lokuhweba. Amaqembu angena kubamba iqhaza kulolucwaningo abaphathi bemakethe namasekela ezindaweni zokuthengisela angaphansi kweminyaka engu-18.

Izingozi Nokungaphatheki Kahle Komhlanganyeli: Akuyikuba nazingozi noma ukungaphatheki kahle kuweokuhlobene nocwaningo.

Izinzuzo: Uzofundiswa ngezindlela ezikahle zokuphatha imfucumfucu kanye nemiphumela yocwaningo.

Uyothola okungenani iphepha bhukwana eliloldwa elishicilelwe.

Isi-/Izizathu Ezingenza ukuba Othatha Ingxenye Asuswe Ocwaningweni: Ungakhishwa nganoma yisiphi isikhathi ocwaningweni. Akuna kwenzeka lutho olubi kuwe uma ufusa ukuhoxa.

Iholo: Awuzokwamukeliswa nanoma yiluphi uhlobo lweholo.

Izindleko Zocwaningo: Uwonakuhlangabezana nanoma yiziphi izindleko zocwaningo.

Ukugcina Imfihlo: Imininingwaneyakho ayiyikudalulwa. Akekho omunye umuntu ngaphandle komcwaningi nomphathi ozokwazi ukuthola amaphepha emibuzo ukuze kugwenywe ukudalulwa kwezimfihlo. Amarekhodi azogcinwa esisevweni esikhiywayo eDurban University of Technology iminyaka emihlanu okuyothi ngemva kwalokho ashabalaliswe futhi alahlwe.

Izingozi ezihlobene nocwaningo: Akukho kulimala okungabangelwa wucwaningo okulindelekile ngenxa yohlobo locwaningo. Lolucwaningo ludinga kuphela iphepha lemibuzo elizosetshenziselwa ukuzuzaimininingwane.

Umntu okumelwe athintwe uma kwenzeka kuba nanoma yiziphi izinkinga noma imibuzo:

Uma kuvela noma yiziphi izinkinga noma imibuzo siza uthinte umcwaningi, umphathi noma i-Institutional Research Ethics Administrator ku-031 3732900. Izikhalazo kumelwe zibikwe Esiphathimandleni: Research and Postgraduate Support, Prof S Moyo on 0313732577 nom moyos@dut.ac.za

Umcwaningi: Renisha Sahathu – 072 605 6341 noma renisha.sahathu@gmail.com

Umphathi: Emilie Joy Kistnasamy – 082 953 3465 noma joyk@dut.ac.za

Okuvamile: Labo abazothatha ingxenye kumelwe baqinisekise ukuthi ukuthatha ingxenye kwenziwa ngokuzithandela futhi batshelwe nenani elilinganiselwayo labazothatha ingxenye. Ikhophi yencwadi yokwaziswa kumelwe inikwe abathatha ingxenye. Incwadi yokwaziswa nefomu lokuvuma kumelwe kuhunyushwe futhi banikwe khona ngolumi oluyinhloko olusetshenziswa abantu abazobuzwa imibuzo, ngokwesibonelo, isiZulu.

Full Name of Researcher Date Signature _____

Full Name of Witness (If applicable) Date Signature _____

Full Name of Legal Guardian (If applicable) Date Signature _____

APPENDIX G – CONSENT FORM (IsiZulu)



IMVUME

Isitatimende Sokuvuma ukuhlanganyela ocwaningweni:

Ngiyavuma ukuthi ngifundisiwe ngumcwaningi, uRenisha Sahathu, ngohlobo, ukuziphatha, izinzuzo nezingozi zalolucwaningo – i-Research Ethics Clearance Number:

Ngibuye ngamukela, ngafunda futhi ngazwisisa lokhu kwaziswa okubhalwe ngenhla (Incwadi Yokwazisa Yothatha Ingxenye) mayelana nocwaningo.

Ngiyazi ukuthi imiphumela yocwaningo, kuhlanganise imininingwane yomuntu siqu emayelana nobulili bami, iminyaka, usuku lokuzalwa, amanishela nokutholiweyo kuzofakwa ngasese embikweni wocwaningo.

Ngenxa yezidingo zocwaningo, ngiyavuma ukuthi ukwaziswa okuqongelelwe kulolucwaningo kungafakwa ekhompuyutheni ngumcwaningi.

Ngingazikhipha ocwaningweni, ngaphandle kokwenza okungalungile, kunoma yisiphi isigaba.

Ngibe nethuba elanele lokubuza imibuzo futhi (ngokuzikhethela) ngisho ukuthi ngikulungeleukuthatha ingxenye ocwaningweni.

Ngियाqonda ukuthi ngizonikwa izinto ezintsha ezibalulekileezitholwangesikhathi salolucwaningo ezingathinta ukuhlanganyela kwami.

Igama Eliphelele Lomhlanganyeli Usuku Isikhathi Isignesha / Isithupha sokudla

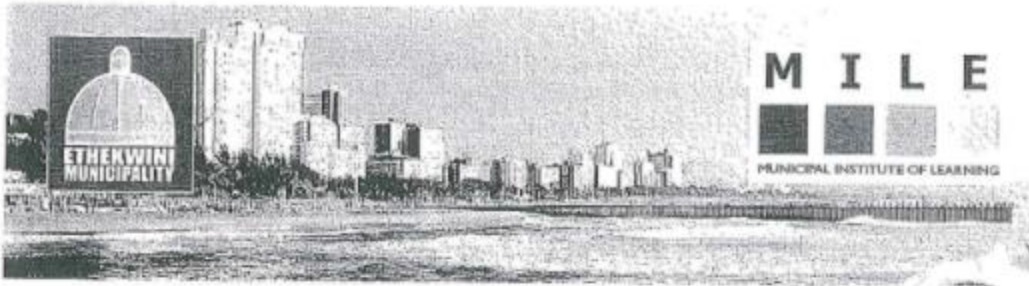
Mina, Renisha Sahathu, ngiyaqinisekisa ukuthi lomhlanganyeli ongaphezulu wazisiwe ngokugcwele ngemvelo, ukuziphatha kanye nezingozi zalolucwaningo olungenhla.

Igama Eliphelele Lomcwaningi Usuku Isignesha

Igama Eliphelele Lofakazi (uma ekhona) Usuku Isignesha

Igama eliphelele lomqaphi ongokomthetho (uma ekhona) Usuku Isignesha

APPENDIX H – MUNICIPALITY APPROVAL



Pod 1, Second Floor, Intuthuko Junction, 750 Mary Thelpe Street, Umkhumbane, Cato Manor, Durban 4001.
Tel: 031 322 4513, Fax: 031 261 3405, Fax to email: 086 265 7160, Email: mile@durban.gov.za, Website:
www.mile.org.za

For attention:
Chair of Ethics Committee
Institutional Research Ethics Committee
Durban University of Technology
Steve Biko Campus
Durban
4001

16 May 2017

RE: LETTER OF SUPPORT TO MS R. SAHATHU, STUDENT NUMBER 21219744 - GRANTING PERMISSION TO USE
ETHEKWINI MUNICIPALITY AS A CASE STUDY

Durban Cleansing and Solid Waste (DSW) Unit and eThekweni Municipal Academy (EMA), have considered a request from Ms *Renisha Sahathu* to use eThekweni Municipality as a research study site leading to the awarding of a Master of Health Sciences in Environmental Health (MHS: Environmental Health) entitled: *"An evaluation of waste management cycle utilized by food preparers and fresh produce market informal traders in Durban, KwaZulu-Natal."*

We wish to inform you of the acceptance of her request and hereby assure her of our utmost cooperation towards achieving her academic goals; the outcome which we believe will help our municipality improve its service delivery. In return, we stipulate as conditional that she presents the results and recommendations of this study to the related unit/s on completion of her research study.

Wishing Ms R. Sahathu all the best in her studies.

Nir K. Rampersad
Head: Durban Cleansing and Solid Waste (DSW) Unit
eThekweni Municipality

Dr M. Ngubane
Head: eThekweni Municipal Academy
eThekweni Municipality

APPENDIX I – IREC APPROVAL



Institutional Research Ethics Committee
Research and Postgraduate Support Directorate
2nd floor, Serwyn Court
Gate 1, Steve Biko Campus
Durban University of Technology
P O Box 1334, Durban, South Africa, 4001
Tel: 031 373 2375
Email: irethead@dut.ac.za
http://www.dut.ac.za/research/institutional_research_ethics
www.dut.ac.za

22 November 2018

IREC Reference Number: **REC 10/18**

Ms R. Sahathu
57 Hydepark Circle
Sastri Park
Phoenix

Dear Ms Sahathu

An evaluation of the waste management cycle utilized by fresh produce market informal traders in Durban, KwaZulu-Natal

The Institutional Research Ethics Committee acknowledges receipt of your final data collections tool for review.

We are pleased to inform you that the data collection tools have been approved. Kindly ensure that participants used for the pilot study are not part of the main study.

In addition, the IREC acknowledges receipt of your gatekeeper permission letter.

Please note that **FULL APPROVAL** is granted to your research proposal. You may proceed with data collection.

Any adverse events [serious or minor] which occur in connection with this study and/or which may alter its ethical consideration must be reported to the IREC according to the IREC Standard Operating Procedures (SOP's).

Please note that any deviations from the approved proposal require the approval of the IREC as outlined in the IREC SOP's.

Yours Sincerely,

Professor J K Adam
Chairperson: IREC



Stamp: DUT DURBAN, 2018-11-22, INSTITUTIONAL RESEARCH ETHICS COMMITTEE, P O BOX 1334 DURBAN 4001