KNOWLEDGE, ATTITUDES AND PRACTICES OF MARKET USERS ON SOLID WASTE MANAGEMENT AT DZALEKA IN DOWA

MSc. THESIS (SANITATION)

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MZUZU UNIVERSITY

JULY 2024

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MSc. Thesis (SANITATION)

MALANI GEOFFREY CHANGAYA

A THESIS SUBMITTED TO THE FACULTY OF ENVIRONMENTAL SCIENCES, DEPARTMENT OF WATER AND SANITATION IN FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF SCIENCE DEGREE (MSc) IN SANITATION

MZUZU UNIVERSITY.

JULY 2024

DECLARATION

I hereby declare that this thesis titled, "*Knowledge Attitudes and Practices of Market Users on Solid Waste Management at Dzaleka in Dowa"* has been written by me and is a record of my research work. All citations, references, and borrowed ideas have been duly acknowledged. It is being submitted in fulfilment of the requirements for the award of the degree of Masters of Science in Sanitation in the Department of Water and Sanitation of Mzuzu University. None of the present work has been submitted previously for any degree or examination in any other University**.**

Parts of the materials presented in this thesis have been submitted for publication.

Malani Geoffrey Changaya **JULY 2024**

_____ _____

Students name Date

CERTIFICATE OF COMPLETION

The undersigned, certify that this thesis is a result of the author's work and that to the best of my knowledge, it has not been submitted for any other academic qualification within the Mzuzu University or elsewhere. The thesis is acceptable in form and content, and satisfactory knowledge of the field covered by the thesis was demonstrated by the candidate through an oral examination held on 30th April 2024.

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ABSTRACT

Globally solid waste management is a challenge due to rapid population growth and urbanization. Markets highly generate solid waste, its management has been a problem in Malawi. A cross-sectional study was conducted, aimed at assessing market users' knowledge, attitudes, and practices on solid waste management at Dzaleka in Dowa. Using mixed methods data was collected from respondents (n = 138), using questionnaires, key informant interviews (n = 12), focus group discussions (n = 16) and observations of solid waste management practices. Quantitative data was analyzed using Statistical Package for Social Sciences (SPSS) version 26 and qualitative data was analyzed through thematic analysis. Majority (77.54%) showed good knowledge, (77.46%) had positive attitudes and (69.80%) showed poor practices of solid waste management. Majority (94.20%, n=130) of respondents reported not doing solid waste separation and (52.17%, n=72) practised open dumping. Majority (78.99%, n=109) of respondents reported disposing of solid waste in drains and gutters, as a risk to the environment and public health. Observational results showed solid waste accumulation within the Dzaleka market. The study found that (47.62%, n =66) of respondents reported composting and (42.86%, n = 59) reported metal recycling. Chi-squared test of independence at ≤ 0.05, showed the statistical significance of knowledge, practices and solid waste as a resource, against the level of education and age of respondents. Thematic analysis highlighted issues of awareness, lack of sanitation infrastructure, accumulation of solid waste, and commercialization of solid waste. Financial constraints and poor stakeholder coordination affected solid management. In conclusion, market users reported good knowledge, positive attitudes and poor practices of solid waste management. It is recommended to promote hygiene behavioural change educational programs, at Dzaleka market and strengthen institutional capacity, for sustainable solid waste management.

Keywords: Knowledge; Attitudes; Practices; Hygiene Behaviour change; Environment; Public Health; Sustainable Solid Waste Management.

DEDICATION

This thesis is dedicated to my family members, Mother Grace Kanyinji, my wife Regnat Chitheka, and my children Shadreck Changaya, Angella Changaya and Caleb Changaya, Special thanks for their tireless support during the entire period of my study.

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ACRONYMS AND ABBREVIATIONS

FGD	Focus Group Discussion.
GDP	Gross Domestic Product
HSAs	Health Surveillance Assistants.
ISWA	International Solid Waste Association.
KAP	Knowledge Attitudes and Practices
KII	Key Informant Interview.
MZUNIREC	Mzuzu University Research Committee.
NEP	National Environmental Policy.
NGO	Non-Governmental Organization
NSO	National Statistical Office.
NSP	National Sanitation Policy.
NWMS	National Waste Management Strategy.
UN	United Nations
UNICEF	United Nations Children's Fund
UNHCR	United Nations High Commissioner for Refugees.
SDGs	Sustainable Development Goals.
SPSS	Statistical Package for Social Sciences.

WASH	Water Sanitation and Hygiene.
WHO	World Health Organization

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CHAPTER ONE: INTRODUCTION

1.1 Background

Globally provision of suitable solid waste management has been a challenge as a result of rapid population growth and increased urbanization that have led to an increase in the generation of solid waste (Akbar *et al.* 2015). The world generates 2.01 billion tonnes of municipal solid waste annually and 33 % of it, is unsafely managed, in Sub-Saharan Africa with a fast rate of generation (Kaza *et al.* 2018). Significant hindrances to the implementation of good practices in solid waste management have been reported in the literature that have included limited knowledge, negative attitudes, negative public perception, and limited technical and financial resources (Hummer, 2017). The United Nations Sustainable Development Goal Number 6, ensures the availability and sustainable management of water and sanitation for all (Opoku 2016).

Solid waste management encompasses generation, on-site storage, collection, transfer, transportation, treatment, and disposal (McAllister 2015). Sustainable solid waste management involves processes of waste reduction and waste separation (Pitchtel 2014). The solid waste generated is hazardous to humans and the environment if not properly managed (Vinti *et al.* 2023). Poorly managed waste has created unsanitary conditions that have led to pollution of the environment and outbreaks of vector-borne diseases spread by rodents and insects (Nathanson 2020).

Global waste management goals for improving sustainability at the global level have advocated for improved access for all, to adequate, safe, and bearable solid waste collection services. The motive is to control open dumping and open burning to accomplish sustainable and environmentally friendly management of all hazardous wastes by 2030 (Wilson and Velis 2015).

It was therefore significant to address some of the factors which contribute to poor solid waste management in public places such as markets. Waste services are featured in the targets and indicators of both SDG 11 and SDG 12, which are aimed at waste prevention, reduction, recycling, and reusing. In addition, an emphasis has been placed on the proper collection and discharge of urban solid waste, and halving global food waste by 2030 has been highlighted (Cibrario 2018).

Kaseva and Mbuligwe (2005) in Manyazewal and Waleign (2019); indicated that solid waste generation in Africa is high from agricultural, and domestic activities, institutions, public areas and commercial centres such as markets. The management of solid wastes in developing countries is difficult because of unsustainable practices such as open dumping in uncontrolled sites which have resulted in leachate production in the disposal sites. Furthermore, poor solid waste management has resulted in surface water and groundwater pollution (Modak,*et. al.* 2015). Reyes, *et al*. (2013), described ineffective waste collection strategies and lack of disposal sites as major setbacks affecting waste management in developing countries. Moreover, the burning of waste causes air pollution which has led to respiratory diseases (Asefa. *et al*. 2015, Abubakar *et.al* 2022).

Some developing countries have made progress in recent times, however, solid waste collection coverage and controlled disposal rates in the poorest countries have remained at low levels (Wilson and Velis, 2015). Vinti *et al.*(2023); conducted a study in northern and northeast Ghana and looked at how poor solid waste management poses risks to the people's health and the environment. The findings showed that inadequate solid waste management led to a high risk of infectious and vector-borne diseases. This was attributed to an inadequate knowledge of good solid waste management practices among the people in the study area. This called for action to identify knowledge attitudes and practices of solid waste management among the people in the study area. This would address the gaps in the behaviour of people towards solid waste management.

Unsustainable solid waste management has been exacerbated by rapid urbanisation and financial and institutional limitations that, have impacted negatively on environmental and public health (Abubakar *et al.*, 2022). The development of knowledge on solid waste management among the people is significant as it has contributed to effective solid waste management services that could mitigate adverse health and environmental impacts. Victoire *et al.*(2020) assessed solid waste management challenges and impacts on people's livelihoods in Kinyinya, in Kigali city. The study evaluated methods and techniques used for waste collection, transportation and deposits to landfills by households and companies. The findings showed a poor deposit of waste that, was attributed to low levels of education and lack of skills. One of the recommendations from these studies has been improving knowledge and skills among the people.

The challenges with solid waste management have been reported in several areas in Malawi. Kasinja and Tilley (2018) in the study of the formalisation of informal waste picker's cooperatives reported that in Blantyre waste was disposed of in pits, along the roadside, or in the river. The poorly managed waste blocked drains that posed a risk of flooding with further impacts on infrastructure. M'bawa (2018) reported urbanisation as a factor contributing to the high generation and accumulation of waste in the cities of Lilongwe, Blantyre, Zomba, and Mzuzu. Maganga (2013) described an increase in population due to urbanization as leading to pressure on resources and an increase in quantities of waste generated contributing to environmental problems as the urban solid waste decomposed. All the impacts of poor solid waste management on the environment have been related to a knowledge gap in good solid waste management practices among people in public places such as markets. This necessitated the significance of carrying out the study on the market users at Dzaleka market, to identify factors that contributed to the current status of solid waste management practices.

Malawi faces problems with solid waste management due to low awareness, financial resources, inadequate and poor infrastructure, and lack of coordination among stakeholders (Malawi Government 2019). Waste generation is estimated at 0.5 kilograms per capita per day and 30% of the generated waste is collected (Malawi Government 2019). Blantyre generated 450 metric tonnes of waste per day, Lilongwe generated 500 metric tonnes of waste per day in 2013, and out of this 40% was generated from commercial (Barré 2014). Alternative options like recycling and composting of solid waste were not taken into account.

Solid waste is also a good breeding ground for vectors such as mosquitoes that transmit malaria, dengue fever, and the Zika virus. Open dumpsites also emit methane which contributes to global and regional climate changes (USEP Agency and Conservation 2020). Dzaleka, like other markets in the Dowa district, has had challenges with solid waste collection, posing a health hazard to the residents and the environment. The study was hence done to close a knowledge gap on solid waste management, dealing with behavioural change aspects.

The assessment of the level of knowledge and attitudes of the market users had its significance to understand the factors leading to the current practices of solid waste management if at all there could be others. This is a critical step toward establishing and implementing plans that lead to a change in practices for market users on solid waste management at the Dzaleka market. This necessitated carrying out the study to assess the knowledge attitudes and practices of market users on solid waste management at Dzaleka. This would aid in the development of interventions for sustainable solid waste management which is significant for the prevention of environmental pollution and the promotion of public health.

1.2 Problem Statement

Dowa is one of the districts in Malawi which has seen an increase in the number of businesses, which has contributed to an increase in the generation of solid waste. The impact has been huge as 70% of the markets are reported to have no reliable means of storing their waste before disposal (Dowa District Council 2020). According to the fifth integrated household survey, public heaping of solid waste in the Central Region was at (10.7%), and the Northern and Southern regions were at 2.1% and 8.2%, respectively (NSO 2020). Dzaleka is one of the markets with a huge amount of solid waste being generated as observed on the field tour, with challenges in its collection systems. The indiscriminately disposed solid waste poses a risk to the spread of infectious pathogenic microorganisms and environmental contamination (Dowa District Council 2020).

Barré (2014) in the study of the waste market in urban Malawi, observed the rapid accumulation of solid waste in cities and other locations and attributed the challenge of poor solid waste collection to inadequate resources. Malawi Government (2014) noted the problem of waste collection in cities and district councils and attributed it to limited funds and resources. Solid waste management problems are cross-cutting in both cities and districts such as markets as observed at Dzaleka during situation analysis on the field tour. There was open dumping and an accumulation of solid waste which was observed at the Dzaleka market signifying challenges with the waste management systems.

Dowa District has advocated for the use of open landfills to dump its waste and this has promoted scavenging bringing back the waste into the markets, which is a risk to public health (Dowa District Council 2020). The waste left in open spaces blocks the drainage system and results in the breeding of vectors. Poor sanitation and hygiene in most areas have contributed greatly to the disease burden and child survival rates in Malawi (Malawi Government and UNICEF 2019).

Dzaleka market has a problem with the open dumping of its waste being a risk to the environment and public health. Accumulation of solid waste leads to poor sanitation in communities, impacting public health due to the spread of diarrheal diseases, cholera and typhoid (ISWA, 2015). UNICEF (2016), describes that 60 % of deaths worldwide are due to diarrheal diseases which are a result of poor hygiene and sanitation. According to the district health information systems, there has been a rise in diarrhoea cases in the Dowa District in the previous 5 years (Malawi Government 2022).

An upsurge of Cholera cases was reported in Malawi in 2022, due to unsafe drinking water, poor sanitation and inadequate hygiene such as open defecation and dumping of human wastes into water bodies (WHO 2022). Dzaleka was also once hit by Cholera in March 2023, due to its congestion, poor sanitation and hygiene standards, including factors of poor solid waste disposal and limited water and sanitation facilities (Shelter 2023). Community participation has contributed to improvements in solid waste management practices (Hanh 2016). Poor solid waste management has been attributed to a lack of knowledge and skills in previous studies (Victoire *et al.* 2020; Vinti *et al.*2023). The study assessed knowledge attitudes and practices on solid waste management if at all were among the factors which contributed to poor practices.

1.3 Aim of the study

1.3.1 Main objective

The study aimed to determine the level of knowledge, attitudes and practices of market users on solid waste management at Dzaleka in Dowa.

1.3.2 Specific objectives

a) To determine the level of knowledge of market users on solid waste management at Dzaleka in Dowa.

b) To assess the attitudes of market users on solid waste management at Dzaleka in Dowa.

c) To determine practices of market users on solid waste management at Dzaleka in Dowa.

d) To evaluate institutional capacity on solid waste management at Dzaleka Market in Dowa.

1.4 Research Questions

a) What is the level of knowledge of market users on solid waste management at Dzaleka in Dowa?

b) What are the attitudes of market users towards solid waste management at Dzaleka in Dowa?

c) What are the practices of market users on solid waste management at Dzaleka in Dowa?

d) Does the Dzaleka Market have the Capacity to implement effective solid waste management in Dowa?

1.5 Justification of the study

The study findings improve academician's competencies, teaching and learning processes, as it added to the body of knowledge in academia in the area of sanitation. The research findings have been documented in a thesis which will be used as reference material in the library at Mzuzu University. The findings from the study would aid in institutional capacity building, inform stakeholders in the water sanitation and hygiene sector and aid in designing and planning behavioural change interventions.

This would facilitate the promotion of investments in the sanitation sector toward effective solid waste management based on study findings, as they would inform and guide program planners. The findings from the study would help in the provision of knowledge which would change the attitudes of market users through behavioural change modification programs designed to change practices on solid waste management. This would further provide guiding principles that would be followed for effective solid waste management. The evidence from the study would help market users promote sustainable solid waste management activities such as solid waste reuse, recycling, and composting which are good practices for the circular economy. The process of promoting the initiatives of reuse and recycling of solid waste would bring economic value as the solid waste is turned into a resource, which would help in the creation of waste businesses in the communities surrounding the market. Furthermore, this would lead to the creation of jobs for the youth and women as they would turn into waste entrepreneurs.

1.6 Summary of the Introduction Chapter

The first chapter of this thesis opens with the background of the study. The previous studies are described to highlight what has been done and the research problem that is investigated is described. The main objective of this research was to assess the knowledge, attitudes and practices of market users on solid waste management at Dzaleka Market. The significance of the study is that results are useful as they would help in change of practices on solid waste management and further aid in policy formulation. The main limitation of this study was the small sample size which may have affected the generalization of the study findings. The other limitations such as language problems did not affect the study findings as language translators assisted in the interpretation of the Kiswahili into the local language of Chichewa. The literature review is presented in the next chapter.

CHAPTER TWO: LITERATURE REVIEW

This chapter reviewed research concepts on key areas of the study broadly. It included concepts on waste management, levels of knowledge, attitudes, and practices on sustainable solid waste management. This section reviews the government's position on waste management. It provides the change and waste management theories and the linkage between a circular economy with sustainable solid waste management. In addition, it provides the previous work, and research conducted by others related to the study objectives in the present study.

2.1. Waste management

Waste management is significant to the community as improper waste management impinges on human health and the environment, impacting the economic development of a country (Yusop and Othman, 2021). National Sanitation Policy Malawi Government (2023) addresses areas of improved sanitation and hygiene promotion in markets. Waste management is significant for environmental quality and public health, but there is limited information as to how the Knowledge, attitudes, and practices (KAP) of market users have contributed to the current status of solid waste management in markets in Malawi. There have been limited studies on the knowledge, attitudes and practices related to solid waste management and assessment of the solid waste as a resource generated from the markets.

Globally, solid waste is reported to have been treated by the use of sophisticated machinery. Countries have lacked basic measurement tools such as scales to measure incoming waste (UNEP 2015). In developing countries such as Malawi, local councils have supported investments in solid waste management which have been hampered by the lack of resources and institutional capacity among others (Malawi Government 2014).

There have been no studies to assess how the availability or inadequate knowledge has influenced solid waste management (SWM) activities in markets in Malawi. Inadequate knowledge and awareness of proper solid waste management have contributed to poor practices which can lead to infectious and waterborne diseases. Poor solid waste management can lead to environmental contamination and human health risks (Vinti *et al.*, 2023). This brings the point of focus on assessment of the availability of knowledge to the people, as it has influenced effective management of solid waste which is generated from public places such as markets

Some of the available research studies done on solid waste management in Malawi have been reviewed. Maganga (2013), conducted a study in Lilongwe on the emerging waste market, he investigated the willingness to pay for the collection of solid waste, and the results showed that level of education, concern for environmental quality and satisfaction with waste collection were important predictors of willingness to pay for waste services. Barre (2014), explored urban waste management strategies and markets to understand the economic and social benefits of urban waste management in Lilongwe and Blantyre. The results identified 3 marketing activities as trade of compost from organic waste, the trade of plastic for industry and residential waste collection by small companies. The study done by Ndau and Tilley (2018), found that there was a willingness to pay for waste services. The focus was based on the willingness to pay people toward solid waste management services, institutional will and the capacity of the institutions to carry out proper solid waste management. These studies did not focus on the knowledge, attitudes and practices of effective solid waste management among people in public places such as markets.

Kasinja and Tilley (2018) conducted a study in Blantyre, to understand whether the formalisation of informal waste pickers into cooperatives could be accepted as a way of managing solid waste in unplanned settlements in urban settlements in Malawi.

The results found factors such as low price fluctuations, lack of transportation, a fear of decreased income, conflicts of proceeds sharing and negative public perception, which could lead to ineffective formation of cooperatives. Chirwa (2020) conducted an assessment of community participatory interventions in solid waste management in Chitete township-Kasungu municipality and found a discord between the two in terms of development. The study further found that 53 % of the respondents practised open dumping. The availability of knowledge among the people in communities on solid waste management would lead to better public participation to prevent environmental pollution and promote public health. Kalina *et al.* (2021), conducted a study on conceptualising reuse in African households: perspectives from Chembe that examined and contextualised waste practices of reuse and recycling. The study found that public participation in the reuse of solid waste practices was motivated by the availability of awareness and information on good practices. Njewa *et al.* (2022) conducted a study which was aimed at providing insight into stakeholders on the health implications and environmental outcomes of negligence in maintaining dumpsites in Lilongwe and Blantyre. The results showed that the residents in both cities had limited knowledge of environmental issues and lacked recycling initiatives, which suggested a gap in awareness.

2.1.1 Operational definitions in the study

Knowledge: The acquired basic understanding by the participants of solid waste management and its associated problems. According to Bano, Al-Shamari, and Fatima (2013), in Ahmad *et al. (*2020), knowledge refers to the capacity to acquire, retain and use information, a mixture of experience and skills. *Attitude:* Jaspert and Kroon (1988) in Molina (2014) define attitude as a mental construct explaining consistency in the behaviour of an individual.

In a recent study, attitudes are described as feelings, opinions, likes or dislikes, and interests of market users as shown by their practices. *Practice***:** It is described as the way knowledge and attitudes are shown by people's actions in implementing sustainable solid waste management. It is the application of rules and knowledge that leads to action. Moffat (2013) in Barré (2014) described a market as any place where the sellers of a particular good or service can meet with the buyers of that good or service and a transaction can potentially take place. Market users: in the present study, are those involved in buying and selling goods in established markets like that of Dzaleka.

Solid waste: all those wastes that are useless, unwanted, and cast-off materials arising from production and consumption or human and animal activities (Mondol *et al.* 2013). It is categorized as municipal waste, industrial waste, and hazardous waste, in the current study market waste is regarded as municipal waste. UNICEF (2009) in (Omar et al. 2019) describes waste as unwanted remains, residues discarded, and material or by-products which are no longer required by the initial user. Solid waste management strategies in the current study are defined as approaches used to manage waste generation, storage, collection, transportation, treatment, and disposal at the final dumping place (Paghasian 2017).

2.1.2 The Government's Position on waste management in Malawi

Waste management in Malawi is guided by several policies and legislation. It includes the National Environmental Policy (NEP) of 2004 and the Malawi National Environmental Management Act number 19 of 2017. People have the right to live in a clean and healthy environment and safeguarding the environment is essential for the promotion of public health (Malawi Government 2017).

National Waste Management Strategy (NWMS) 2019-2023, enacted legislation to reduce waste generation and promoted responsible behaviour in waste management. It advocated for waste treatment and the adoption of environmentally sound infrastructure and systems for waste management. It also promoted waste segregation at the source, reducing, reusing, recycling, and recovering energy from the waste, significant for sustainable solid waste management (Malawi Government 2019).

The Malawi Public Health Act section 75, mandates district councils to do sanitary control of their markets and market buildings. The National Sanitation and Hygiene Policy (NSHP) focuses on awareness and hygiene behaviour change, through the mindset, attitudinal and abandonment of unhealthy practices. It ensures the promotion of proper waste management at all levels, in towns, cities, and rural markets. The national Sanitation and Hygiene policy has the mandate of ensuring that awareness and behaviour change are effectively implemented (Malawi Government 2023). Waste management has encompassed solid waste management with little emphasis and this has faced serious challenges due to its poor management practices (Malawi Government 2017).

2.2 Sustainable waste management framework

Waste services are vital to the governance of cities, districts and refugee camps such as Dzaleka, as management of the waste is significant for humanity (Reno 2015). Waste when generated is supposed to be reused, recycled and recovered for sustainability. The avoidance of the accumulation of solid waste helps to prevent environmental pollution and helps in the promotion of public health. Well-designed waste plans are key to its management (Batista *et al.* 2021). Fuss *et al* (2018) described factors that make waste management ineffective, such as difficulties which are associated with public policies for instance economic and financial profitability services.

2.3 The waste management hierarchy

The EU Environmental Commission (2015) and Elsaid and Aghezzaf (2015) described the waste hierarchy as encompassing activities of reducing, reusing, recycling, composting, energy recovery and treatment and disposal. Solid waste reuse and recycling needed to be assessed for the generated waste at the Dzaleka market. The UN (2015) and Pires and Martinho (2019), described the significance of promotion of waste reduction practices through prevention, recycling and reuse. The promotion of waste separation at its source of generation has improved the recovery and recycling rates. Njewa *et al.* (2022) found that waste reduction was a preferred practice that promoted organic waste recycling into manure, apart from plastic, metal reuse and recycling. The assessment of the availability of knowledge and awareness of waste hierarchy practices such as reduction, prevention, reuse and recycling practices among the market users was significant to be conducted.

Figure 1, indicates the practices in the waste management hierarchy. Yu *et al.* (2015) described waste reduction and minimization as the most preferred priority in waste management. Wilts and Rademacher (2014) have described waste prevention as a key strategy for a rise in the efficiency of resource use. Permana *et al.* (2015) found that waste reduction and waste separation as preferred practices in sustainable solid waste management in Makassar, Indonesia, however, these practices were highly dependent on high awareness among the households. The knowledge of waste management hierarchy among the people plays a crucial role in how solid waste management is being carried out by the people. For people to follow what are the preferred solid waste management practices in the waste management hierarchy, awareness and availability of information are significant. The people with knowledge would follow sustainable solid waste management practices, which would lead to the reduction of solid waste that is being disposed off.

Fig.1: The Waste Management Hierarchy, EPA (United States Environment Agency 2022)

2.4. Waste management practices and approaches.

2.4.1 Open waste dumping

Waste dumping is a common practice in public places due to its low cost and its simple operation. In Malawi, open dumping is one of the methods that is usually done. Kumar *et al.*(2017) described open dumps as cost-intensive and hazardous to the environment and odour which causes a nuisance to the public. Ali *et al.* (2014) reported the effects of open dumping of solid waste such as excessive soil degradation that destroyed 72% of the natural vegetation in Islamabad, Pakistan. Modak *et al.*(2015) reported open dumping and the poor management of solid waste as being aggravated by unsustainable practices which have led to environmental contamination and the spread of diseases. Knowledge of proper management of solid waste among the market users would be cost-effective as it would help in preventing effects on the environment and public health.

2.4.2 Waste disposal

The National Waste Management Strategy (2019-2023) in Malawi promoted responsible behaviour in waste management, but there has been limited enforcement of existing environmental laws and general public awareness. This is shown by the poor public attitude toward individual responsibility for waste management, as 70 % of the waste produced in Malawi has been openly dumped (Chirwa 2020). It was significant to assess the knowledge of market users toward solid waste management at Dzaleka, as there have been no published studies on the same. Barré (2014) in a study of the waste market in urban Malawi, noted the dumping of waste in open spaces and streets in the cities of Lilongwe and Blantyre, of the generated waste; 30 % of the collected waste was not effectively disposed off. There has been limited data on the amount of solid waste that is collected from the markets and disposed off at the disposal sites. In previous studies, knowledge and attitudes of the people toward solid waste management have not been focused. It was significant to assess if the accumulated waste was a resource potential for business and how it contributed to the reduction of solid waste sent for disposal in the dumpsites. Turpie *et al.* (2019); reported that illegal dumping of solid waste in disposed sites in Malawian cities was a risk factor to the environment and public health. The solid waste being dumped illegally is reported to have been washed away by water leading to water pollution and other waste being blown by the wind leading to air pollution.

2.4.3 Landfills

Despite following measures of waste reuse, avoidance, and recycling, some solid waste is reported to be still disposed of in landfills due to its lowest costs. Landfills and open dumpsites are a common practice globally, Sun *et. al.* (2019), Costa *et.al*. (2019), and Havukainen *et.al* (2017) in Vaverková,(2019) reported that the U.S.A deposited 58 % of its municipal solid waste in landfills.

Landfills have remained a commonly used method for waste disposal despite being not environmentally friendly, causing groundwater pollution and air pollution (Vaverková 2019). Help Save (2015) as cited in Ozbay *et al.* (2021) described controlled landfills as on level above open dumps landfills with the presence of an authority figure on-site, with control of vehicular movement and access to the landfill. Joseph *et al.* (2013) in Ozbay *et al.*(2021) described sanitary landfills as having a high standard of waste disposal trash that is buried in layers and compressed as solid ensuring the safety of accumulated waste and ease of decomposition. Malawi's major cities of Lilongwe, Blantyre, Zomba, and Mzuzu do not have landfills except for a few dumpsites. A similar situation applies to Dowa District markets such as Dzaleka which do not have landfills but open dumps. Chirwa (2020) cites a lack of community engagement and participation in solid waste management as evidenced by the halting of the Nsiro Waste Management Facility at Dunduzu in Mzuzu which could be turning organic waste into compost manure. A waste management facility at Mchengautuwa which was near homes posed a health risk to the communities through the spread of houseflies. A landfill should be 3 km away from the community or village (Al-ansari 2013).

2.5 Sustainable solid waste management

Sustainable solid waste management focuses on reduction, reuse, recycling, energy recovery, final disposal, and treatment of waste. Oladapo *et al* (2014) described sustainable waste management as encompassing best practices to protect the environment and public health. Unsustainable waste management practices include open dumping, burning, and open incineration which contribute to environmental pollution and also promote the spread of diseases impacting public health. Apinhapath (2014) cited the significance of sustainable waste management as concerned with alleviating the negative impacts of waste and environmental preservation.

Studies that have been done in Malawi have not focused on how the knowledge would influence the people's attitude towards attaining sustainable solid waste management practices in public places such as markets. Hartono, *et al*. (2015) in a study of the potential reduction of solid waste from traditional and modern markets in Indonesia, found a potential reduction of solid waste generation by 40% through reducing, reusing, recycling and composting. The waste business was promoted, which could be an opportunity for accumulated solid waste at the Dzaleka Market.

The solid waste generated from the markets needs to be reduced through sustainable solid waste management options such as composting. IFAD, (2011) cited by Barré (2014) described compost as a key player in waste management in Sub-Saharan Africa, Malawi inclusive as agriculture is the main employer of a large workforce where compost is usually promoted due to the high cost of inorganic fertilizer. An assessment of whether solid waste at Dzaleka Market was being used as a resource was important to understand the current practices.

2.5.1 Recycling and reusing

Recycling is a process that involves collecting, reprocessing, or recovering certain waste materials for instance glass, metal, plastics, and paper to make new products (Karunathine 2015). Waste Directive Framework EU, 2008 in Barré (2014) described reusing as any operation by which products or components are not used again for the same purpose for which they were conceived. Items usually reused are bottles, glass, and clothes. Xuan, *et al*. (2011) as cited in Apinhapath (2014) describe recycling as an efficient measure to reduce the cost of collection, transportation, and treatment of waste. Boonrod *et al.* (2015) conducted a study of enhancing waste separation at the source behaviour, in Thailand, that found that a traditional mechanism yielded a 19 % organic waste separation efficiency, while a community business mechanism was better as it increased efficiency up to 58%.

The economic incentives promoted more waste separation, reuse and recycling. The non-economic incentives such as behavioural and education programs increased waste separation from 20 % to 35 %. Kalina et *al.* (2021), in the study of conceptualizing reuse in African households: perspectives from Chembe, Malawi, examined practices of reuse and recycling. The study found that reuse and recycling of solid waste was promoted for economic gains, but did not focus much on understanding knowledge that influences the attitudes of the people in a community to perform the practices.

2.5.2 Composting

Composting is considered the conversion of waste materials into soil additives. Hartino *et al*. (2015) in a study on the potential reduction of solid waste generated from traditional and modern markets, argued that solid waste generated from the markets could be reduced through sustainable solid waste management as in composting, this could help reduce waste deposited into dumpsites. Boonrod *et al.*(2015) have argued that the process of increasing recycling and composting may help tackle the increasing generation of organic matter.

Barré (2014) in a study of the waste market for urban Malawi argued that agriculture would benefit much due to the compost from the waste organic matter thereby promoting its market. Understanding the value of solid waste through the development of knowledge of the production of compost would change people's mindset on solid waste management thereby influencing the attitudes of the market operators to promote the use of compost as compared to the expensive inorganic fertilizers. This could promote the economic development of the country as forex would be saved which is used for the purchasing of expensive inorganic fertilizers.

2.5.3 Recovery / Incineration

This is the direct burning of solid waste with a sufficient oxygen supply that proceeds to the production of heat energy and ash residues. According to Abramov (2018) as cited in Das *et al.* (2019), incineration is done to reduce the volume of waste, as 60 – 80% of energy is derived from solid waste. Takomborerwa (2011) cited in Barré (2014) described that the activity of incineration did not seem to work well in low-income countries such as Malawi. The majority of the waste is organic and rich in water which could promote turning incinerators into energy consumers than producers.

2.5.4 Waste prevention

The process of reducing the percentage of waste produced is significant for solid waste management which is a challenge due to an increase in the population. According to the European Directive 2008/98/EC, as cited in Bartl (2014) waste prevention should be prioritised, if less waste is produced, less energy would be used to recycle or dispose of the waste. Previous studies in Malawi have not focused much on the knowledge of sustainable solid waste management such as the principle of prevention of waste. Hoog and Ballinger (2015), in Magrini *et al. (*2020) described waste prevention as a potential for savings for carbon dioxide emissions being greater when waste is prevented than when it is recycled. Wilts and Rademacher (2014) described waste prevention as contributing to a rise in resource efficiency as a goal for a circular economy. The current focus on waste management is reported to be centred on recycling as compared to waste prevention. Recycling has been reported to create markets for secondary materials which are key for the economic development of countries due to the value of waste.

2.5.5 Significant studies on solid waste management practices.

Omar *et al.* (2019) conducted a study aimed at assessing the knowledge attitudes and practices of communities on waste management and how actions affect the environment and health in Mogadishu Somalia. The findings showed good knowledge levels and positive attitudes. However, the practices were poor, though the respondents understood the value of waste that it would be directed to the community through reuse and recycling. Akbar *et al.* (2015) conducted a study to evaluate knowledge attitudes and practices toward solid waste reduction, source separation and recycling, collection and willingness to pay for solid waste services for the residents of Ibadan in Nigeria. The results showed positive attitudes toward solid waste source separation and low intimate knowledge. However, the study found that their practices were weak.

Laor, *et. al.* (2018) explored the knowledge attitudes and practices of highland residents in Northern Thailand, to provide a basis for the development of waste management in the study area. The results showed that 73% of respondents had a high level of knowledge, 85% showed a neutral attitude and 59% showed moderate practice. The age and educational level of respondents showed statistical significance in association with the knowledge attitudes and practices at ≤ 0.05. Giao (2021) conducted a study in Vinh Trung Commune, Vietnam, to evaluate the knowledge attitudes and practices of the communities on environmental quality and benefits of waste separation. The results indicated that 93.33% of the respondents had a good level of knowledge and, a good attitude, however, they showed poor practices. In this study, the respondents showed a good attitude with the willingness to sort waste, but the results of the practice survey did not relate with the knowledge and attitude, as there was lack of waste separation.

Kumar and Agrawal (2020), assessed the trends in solid waste management status, and challenges in Indian cities. The findings indicated problems with the segregation of solids in most of the cities in India, this was attributed to a lack of awareness of national sanitation policies and the decentralized methods of treatment of waste. Shelter (2023) reported limited access to safe sanitation and hygienic facilities, poor WASH situation and lack of food hygiene and hygienic practices as some of the factors which contributed to an outbreak of Cholera in Malawi. However, one of the suggested solutions was raising awareness of hygienic practices.

2.6 Levels of knowledge on sustainable solid waste management

The public willingness to take part in solid waste management relies on awareness. Oladapo (2014) examined the participatory environmental education program on traders' knowledge attitudes and practices in solid waste management in some selected markets in Oyo state Nigeria. The results showed that traders who were exposed to participatory environmental education performed better in knowledge, attitude, and practices than their counterparts with no education. Fredrick, Oonyu, and Sentongo (2018) study investigated the influence of education on the solid waste management practices of communities in Kampala City. The findings indicated that sensitisation had a significant bearing on the management of waste in the city. However, there was limited sensitisation on waste separation and organic waste management. Gunasin and Senadheeva (2019); investigated the relationship between knowledge and attitudes toward waste management practices followed by managerial officers in Srilanka. The findings showed a moderate level of knowledge, 75% had a moderate attitude and 55% with poor practices in waste segregation and recycling behaviours. Sallwey *et al* (2017), reported illiteracy and low education levels as a challenge for waste management services and awareness campaigns.

Owolabi *et al.* (2016) in a comparative analysis of solid waste management in developed, developing, and lesser-developed countries, cited limited public awareness of proper waste management as one of the challenges faced in less developed countries. The study focused on solid waste practices, legislation, waste management technologies and challenges in solid waste management. Quantities of waste are directly influenced by the knowledge attitudes and practices of the people (Gunasin and Senadheeva 2019).

Mochache *et al.* (2020) conducted a study to establish the status of household solid waste management in the market town of Embu in Kenya. The results indicated that the sustainability of household solid waste management depended on awareness of health and environmental benefits. Solid waste management practices were inadequate due to the low educational levels. Licy *et al* (2013) have argued that insufficient environmental knowledge in individuals leads to poor practices toward maintaining a good environment. The development of knowledge of waste management is key to the sustainable management of waste. Ndala and Ndala (2022) in a study assessing the role of community members in waste disposal in Lilongwe in Malawi, found that 63 % of respondents lacked waste management skills.

2.7 Attitudes towards sustainable solid waste management

An attitude people have toward solid waste management is key to embracing a culture of a clean and safe environment. The attitudes of people toward waste management can be affected by their level of knowledge and awareness of waste management. Brown *et al.* (2015) cited in Gani *et al.* (2020) have argued that the literature suggests that insufficient solid waste management in markets centres around the attitudes of the market users, lack of awareness, and involvement of the community.

Gusti (2016) examined the intention of sustainable waste management behaviour in an elementary school and the results showed that knowledge about sustainable waste management had a significant relationship with attitudes toward waste management. Knowledge of solid waste management among people would always change peoples' attitudes. The market users will follow proper disposal of solid waste if they are well informed about the environmental, social, and health implications that are brought by improper solid waste disposal.

A study by Ndau and Tilley (2018) focused on community financing which was considered a sustainable approach to solid waste management. Knowledge of proper solid waste management was not focused on, would help the people engaging in the behaviour of reducing, reusing, and recycling the waste in underserved areas. World Bank (2012), and Brown *et al*. (2015) as cited in Yoade, Olatunji, and Adelabu (2018) reported that the dependable evidence of inadequate solid waste management in markets has been related to attitudes, lack of awareness, and local community participation. Olaseha *et al*. (2005); Balugon (2012), in Abigo, *et al.* (2016) have reported unauthorized behaviours of indiscriminate dumping in drainages, on open spaces, and at dumpsites. The behaviour of dumping of solid waste was observed during a field tour at the Dzaleka Market, which motivated this study to assess the level of knowledge among market users.

Limited research has been done on the knowledge, attitude and practices of market users towards sustainable solid waste management in Malawi. Without a clear reference point, it cannot be assumed that the market users either have positive or negative attitudes that affect their practices. Barloa *et al.* (2016) conducted a cross-sectional study on KAP on undergraduate students in a Philippine state university, whose results indicated that the majority (74%) had satisfactory levels of knowledge and attitudes (71%), however (43%) showed satisfactory practice levels. The awareness of solid waste as a resource would also help to change the practices.

Knowledge of solid waste management is paramount as it has influenced attitudes and changed the practices of the people. Shubeler (1996), in Gani *et al.* (2020), reported knowledge of solid waste management in the public as being influenced by positive attitudes and significant behaviours that influence good practices. Rama, Wai Chow Lee, and Muhammad (2010) in Raghu and Rodrigues (2020) examined recycling behaviour among students and the results showed that attitude and social norms were positively associated with behaviour. Effective solid waste management depends on some behavioural control factors such as knowledge and awareness among the people. Christiam *et al.*(2023) explored the drivers motivating solid waste separation at home and applied 450 surveys in two municipalities in Lima. The study demonstrated that technical knowledge and physical space availability at home were barriers to carrying out the behaviour of solid waste separation at home in Lima. Attitude and knowledge were the best predictors of waste separation behaviours. People with inadequate knowledge would find difficulties in performing good solid waste management behaviours.

The previous studies on solid waste management have not focused on understanding the attitudes of the people as they influence their practices on solid waste management. Developing awareness of solid waste management influences the right attitudes and change in mindset when dealing with mental waste. Taking into account that it's everybody's responsibility to take part in waste management activities. Public participation in solid waste management relies on the behaviour of the people as they display their actions toward solid waste management. This study is significant as it assessed the knowledge and attitudes of the market users. The previous studies have not focused much on the assessment of behaviour of the people toward solid waste management in public places in Malawi.

2.8 Circular economy (waste as a resource)

Waste is regarded as a resource in the circular economy and not as a burden. Perey *et al.* (2018) described the focus of change on understanding waste as a resource with value for the business. Waste due to its value has reportedly been restored by focusing on relabeling material and energy flows to accomplish greater resource efficiency through the reuse, repair and recycling of the materials. Geissdoerfer *et al.* (2017) have described a circular economy as bringing benefits to the economy and the environment, benefiting society. The management of waste has now focused on how to find value and redirect it back to the community (Omar *et al.* 2019).

Waste reuse and recycling have led to better use of resources, as it has brought responsibilities to the private businesses, regulators and policy-makers for the economic system to benefit. EMF (2013) in Geissdoerfer *et al.* (2017) described the individual economic benefits that have been realised through the circular economy through input reduction, efficiency gains and waste avoidance. The circular economy has turned used goods into valuable resources for others, intending to maximize value, which has contributed to the creation of jobs in the reprocessing of these products (Stahel 2016).

Anggari, Sumarwan and Yuliati (2017) in a study of performance and strategies to develop a waste business, described how waste could be turned into a business and how municipal waste could be purchased and reutilised as a raw material. The waste could be cleared in highly populated areas and then transported to other areas for recycling as a business or composting for the organic matter. Drechsel *et al.* (2018) as cited in Bagire *et al.* (2021) described the importance of turning waste into business to protect populations from disease and prevent disaster to the ecosystem. The new product innovations and marketing of the products would create jobs in the process. Economic gains for the waste business would help governments achieve SDG targets (Iqbal *et al.*, 2023).

Entrepreneurial investment in solid waste management has enhanced employment generation. Brown (1997) in Ofobruku, Okafor and Agbaeze (2016) described opportunities that are brought by entrepreneurs, which include meeting the demand that is not currently met, promotion of a better product than the one on the market and solving a problem that consumers have. In Malawi solid waste has been a problem in need of being turned into compost. Barré (2014) in a study of the waste market in urban Malawi described waste as being processed in different ways that need the required skills and awareness for its sustainable implementation. Bocken *et al*. (2015) have described how circular economy strategies such as boosting recycling and preventing of loss of valuable materials would help in the creation of jobs and increase economic growth. Figure 2, is an illustration of how waste is being recycled and redesigned into useful products which are further used by the consumer after its production.

Fig.2: The circular economy (Waste and resources action program UK)

2.9 Theoretical and conceptual framework

2.9.1 Theoretical framework

The study is based on the theory of planned behaviour. The theory of planned behaviour explains that human actions are influenced by attitude in combination with subjective norms and perceived behavioural control (Ajzen 2015). It provides a framework for human actions, the more favourable the attitude, the greater the relationship between intention and behaviour. The individual's attitudes and subjective norms determine one's intention to perform a particular behaviour. The more positive a person's attitude toward changing their behaviour the more others are going to support their behaviour. Myhill (2021) describes a behavioural change as being about altering habits and behaviours for the long term. Ajzen, (2005) in Raghu and Rodrigues (2020), the control beliefs guide behavioural intention, the perceived difficulty of performing a behaviour depends on the perceived power of one's research, making somebody finish a particular task.

In Solid waste management, an activity of waste prevention and separation at the source of generation may be easy for someone, but becoming difficult for someone. The theory of planned behaviour aided the researcher in the provision of further insight into the relationship between market users' knowledge, attitudes, behaviour intention and actual behaviour as it influences waste management techniques. In this study, it was hypothesised that the market users' awareness of the negative consequences of poor solid waste management could favourably influence their attitudes leading to the performance of desirable behaviour on solid waste management practices. For interventions to be designed for good solid waste management practices among the market users, this study was significant to assess if the market users had knowledge, awareness and skills towards solid waste management. It was significant to understand the potential barriers that could lead the market users to display ineffective performance toward solid waste management at Dzaleka.

Figure 3, is an illustration of the theory of planned behaviour with attitude, perceived behavioural control and subjective norm of an individual, with a negative or positive intention that leads to a performance of a certain type of behaviour.

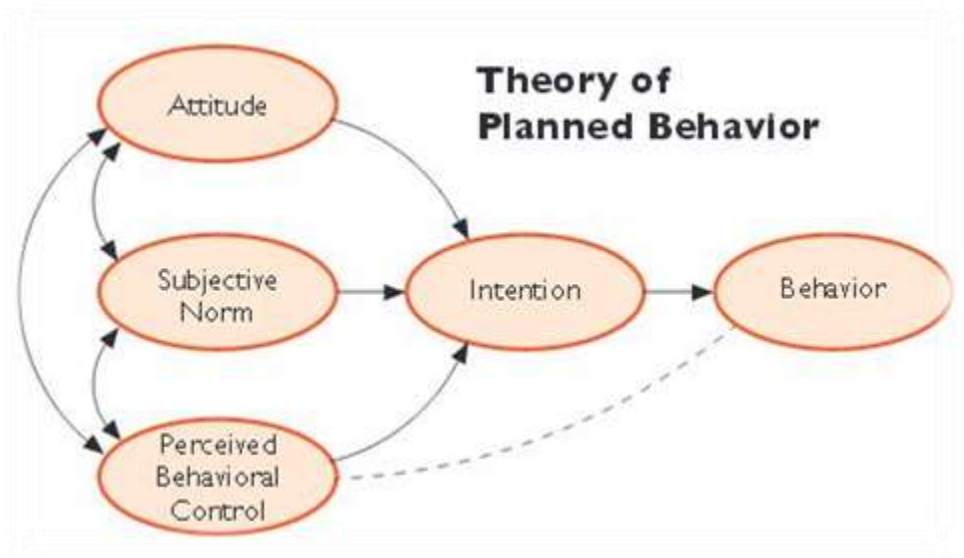

Fig. 3: The theory of planned behaviour (An HC3 research primer)

2.9.2 Waste management theory

The theory of waste management was introduced into environmental sciences, Pongrácz, Phillips and Keiski (2004) described waste management as being focused on knowing the significance of preventing harm to human health and the environment. Waste prevention is the key goal and reducing the volumes of already produced waste. The waste management theory has adopted the strategy of environmental and sanitation integration; valuing waste. Janmaimool (2017) in a study in Bangkok applied protection motivation theory to explore how individuals' solid waste management behaviours were influenced by the perceived threats caused by the environmental contamination from waste disposal and their perceived coping capability. This study examined the availability of knowledge among market users on waste prevention and waste as a resource.

2.9.3 The theory of change

Change occurs over some time after discovering what an individual can find out. Ratana and Chan (2020); argue that an effective change comes as a result of a successful strategy which is shown by an even interaction of various elements of change at a given time. Kahan *et al.*(2014), found that the theory of change framework could hold promise for improving planning, design and evaluation of complex interventions of development programs, increasing the likelihood of being effective, sustainable and scalable. Strategies offered have been used to sharpen interventions and used for the evaluation of designs (Taplin *et al.* 2013).

Behaviour change communication has been used in WASH, and other behaviours have led to ill health (Laverack 2017). Ramayah, Lee and Lim (2012) in (Raghu and Rodrigues, 2021), indicated that studies had shown that non-recyclers would experience inconvenience and would be less likely to be involved in the recycling behaviour. This meant that there was supposed to be an influence of knowledge that would influence the development of change that would lead to their involvement in recycling behaviour.

Figure 4, indicates the conceptual framework which has been formulated by the researcher. It indicates knowledge, attitudes and institutional capacity as independent variables, while solid waste management practices and solid waste as a resource are dependent variables. The sustainable solid waste management, reuse and recycling of solid waste depend on the availability of good knowledge which could influence the attitudes of the people to perform good behaviours towards solid waste management. The main goal is to attain a sustainable solid waste management that would reduce environmental contamination and promote public health.

2.9.4 Conceptual Framework

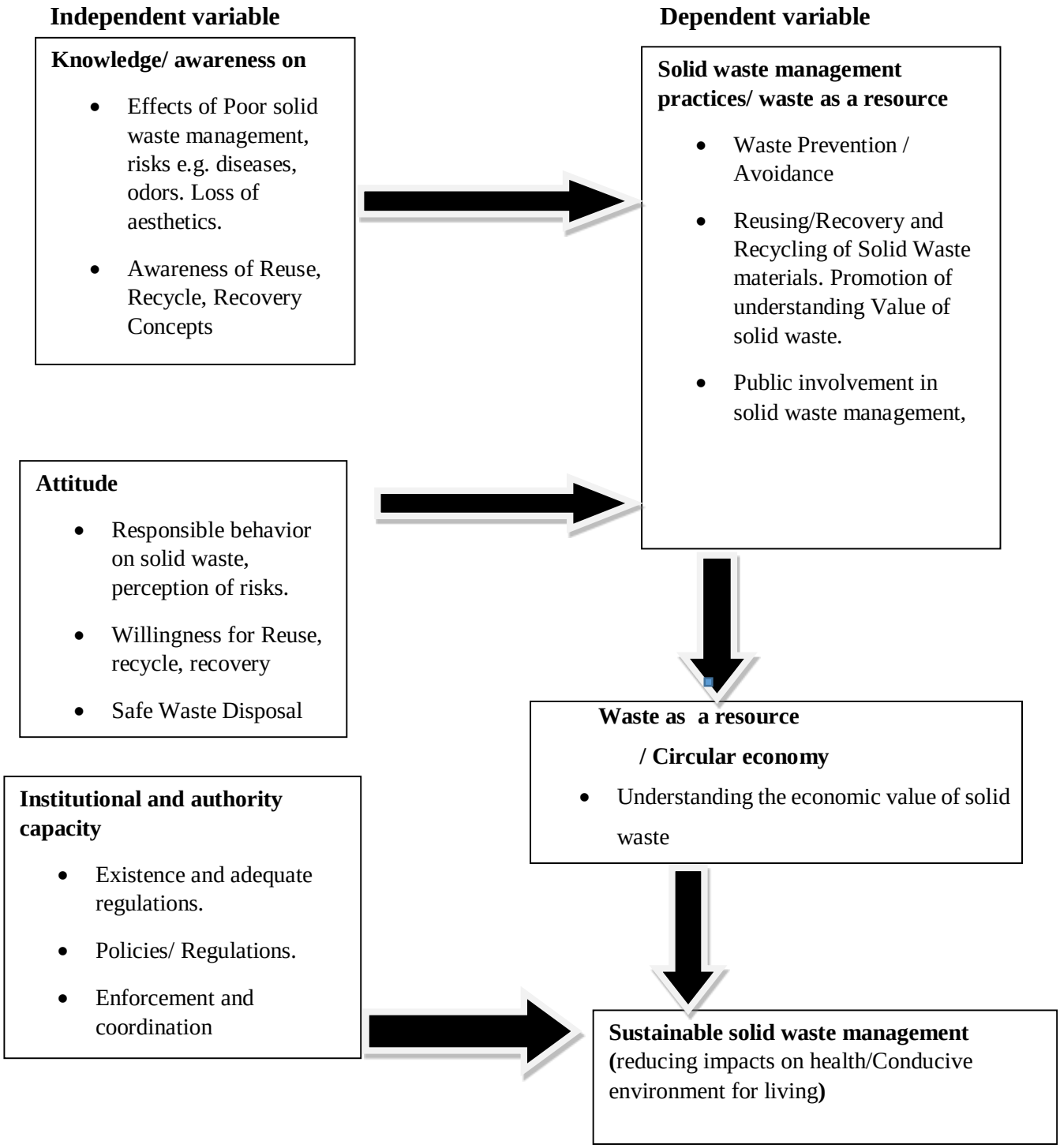

Fig. 4: Conceptual framework formulated by the researcher.

In this study, the conceptual framework (fig.4) is based on the market users' understanding of the effects of poor solid waste management on the environment and public health. The knowledge of the impacts of poor solid waste management would help market users understand the need to reduce waste generation at sources and follow proper solid waste management practices. Awareness of concepts of reuse, recycling, and recovery would lead to sustainable solid waste management. Geissdoerfer *et al.* (2017) describe the significance of the circular economy, as market users' awareness of recycling practices would make them engaged in the activities of the waste business. Understanding the value of solid waste would promote entrepreneurship for communities surrounding the markets, promoting economic gains. Organic solid waste would be turned into compost and sold to farmers, creating value for solid waste (Stahel, 2016).

The change in the attitude of the market users would make them become influenced and start following sustainable solid waste management practices of reuse, recycling, and recovery. This would in turn lead to environmental protection and prevent risks to public health. People should consider changing their behaviours to successfully reduce environmental impacts such as air pollution and water pollution. Sustainable solid waste management is also dependent on institutional capacity, good governance and financial capability of institutions (Barré, 2014). These facilitate effective and efficient solid waste management activities. The district council is mandated to coordinate sanitation services in markets (Malawi Government 2008). The enforcement of legislation and policies plays a significant role in achieving sustainable solid waste management by institutions. Romero-Hernández and Romero (2018) describe improvement of solid waste management practices, in a circular economy to transform waste products into value and revenue. This reduces adverse effects on the health of communities.

2.9.5 Summary of Literature Review

In summary, in this chapter of the literature review, concepts on knowledge, attitudes, and practices of solid waste management and the circular economy, provided information on the study objectives. The theories on waste management, change and planned behaviour are described as they are related to the study. A review of sustainable waste management, theoretical and conceptual frameworks and other previous studies is conducted. The variables which were used to answer research questions and the methodology have been adopted from the literature review. Details of the methodology section are presented in the next chapter three.

CHAPTER THREE: METHODOLOGY

3.1 Description of the study area.

3.1.1 Geographical location of the study area.

Dowa district is located in the Central Region of Malawi, bordering Kasungu to the North, Ntchisi to the North-East, Salima to the East, and Lilongwe to the South. The district with a catchment area of 3,041 km^2, has a population density of 210 people per km^2 (Dowa District Council 2020). According to Malawi National Statistical Office (2021), Dowa has a population of 212, 720 people. Dzaleka Market is situated 10 kilometres from the Dowa District administrative offices. Dzaleka has a catchment area of 78, 948 people (UNHCR 2022).

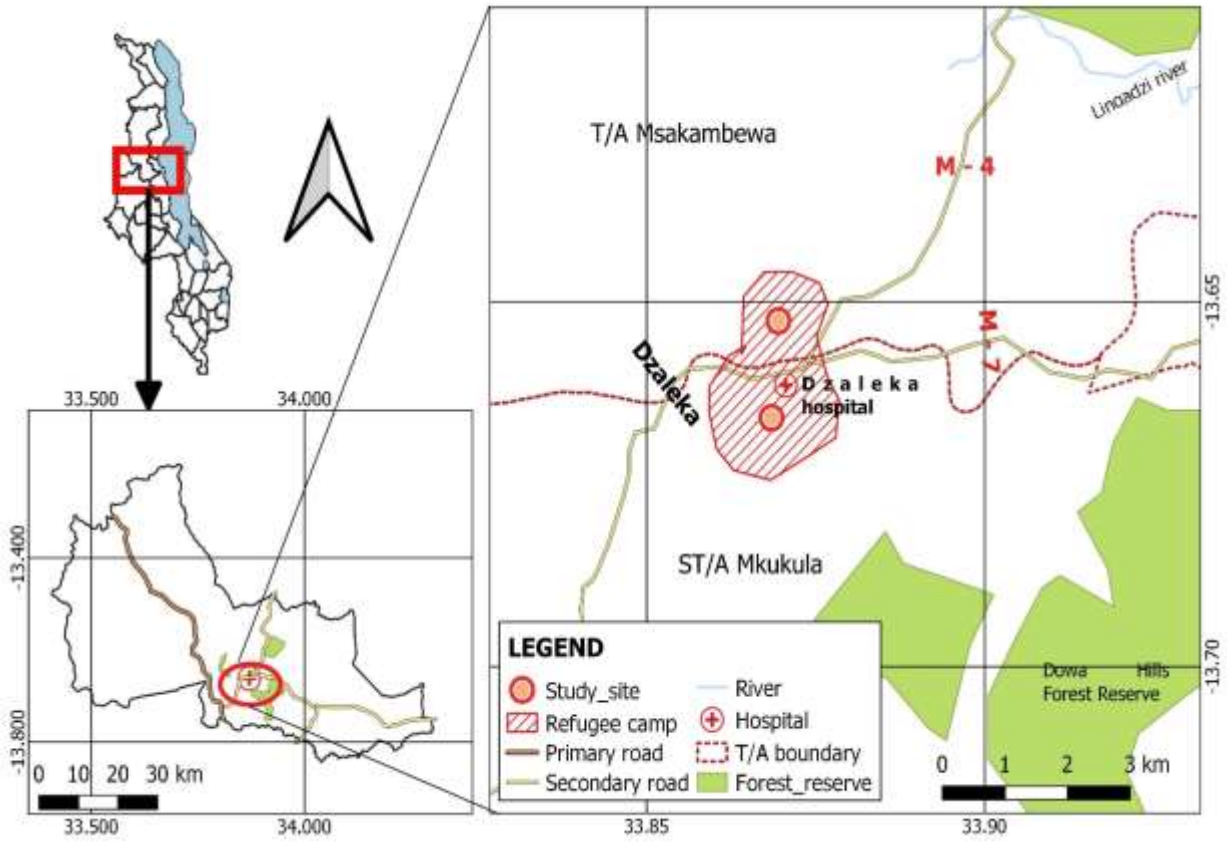

Fig. 5: Map of Dzaleka Market in Dowa District.

3.1.2 Social-economic context

Farming is the main activity that brings money to the communities in Dowa District, as the yield from the farming business is sold in the markets. The crops grown are fruits such as bananas, vegetables, and citrus fruits. Maize, tobacco, and groundnuts are also grown in the district apart from animal farming which brings in monetary resources to the communities (Dowa District Council 2020). At Dzaleka Market, assorted items are sold in the market including plastics, metals, and manufactured foods. This adds to the solid waste generated at the market apart from the agricultural waste which is in abundance.

3.2 Research design and methods

The study adopted a cross-sectional, design, Kesmodel (2018) describes this design as most relevant when conducting descriptive knowledge, attitude and practice surveys. It is also based on a representative sample population, to provide estimates of the prevalence of the problem in the population under study. The study further used a mixed methods approach, where qualitative and quantitative data were collected to allow the researcher to triangulate data to have valid results. Quantitative and qualitative approaches were used in the process of data collection, which was administered in the form of key informant interviews, questionnaires, field observations, and focus group discussions.

3.2.1 Sampling frame

The study population was the traders and buyers (n = 138) who were randomly selected from the market of Dzaleka. The key informants *(* n = 12) were purposively selected and they included health surveillance assistants, the District Environmental Health Officer and the Dowa District Hospital Health Promotion Officer, the Environmental Officer at Dowa District Council.

Furthermore, key informant interviews were conducted with the market committee members on waste management, and the Water Sanitation and Hygiene Engineer for Welt Hunger. The two focus group discussions (FGDs) each comprising 8 people (*n* = 16), were conducted with the traders and buyers. The market had been purposively sampled because of the variety of goods that are sold and the frequency of operation of the market at least 6 days a week. Furthermore, the occurrence of the problem of poor solid waste management was observed during the field tour in the market on situation analysis.

3.2.2 Sample size

The respondents (*n* = 138*)* were randomly sampled from a group of buyers and traders, and key informants (*n = 12*) were purposively selected from the different sectors such as health, council and partners working on sanitation at the Dzaleka refugee camp. The target population for the traders and the buyers were those 18 years and above up to 64 years. Questionnaires were administered to a total of 138 respondents and 12 key informant interviews were conducted. The two focus group discussions were conducted with 8 people in each group (*n* = 16) of men and women buyers and traders found during the time of the interview.

The sample size of the respondents was calculated using Fischer's formula, for the determination of the frequency of proportions or prevalence, according to Glenn (2003) as cited by Owojori, Mulaudzi and Edokpayi (2022).

$$\mathbf{n} = \frac{Z^2 P(1-p)}{d^2}$$, **where** n **= sample size.**

Z = Statistic for a level of confidence **Z** value (**1.96**) for 95 % confidence level,

P = percentage picking a choice expressed as a decimal, in this case, it was estimated at 90 % (**0.9** as a decimal).

q = **1- P**.

d = margin of error valued at **0.05**

$$\mathbf{n=}\frac{Z^2P(1-p)}{d^2}$$

$$= \mathbf{1.96 \times 1.96 \times 0.9\,(1-0.9) \div (0.05 \times 0.05)}$$

$$=\mathbf{3.8416 \times 0.09 \div 0.0025 = 138\ respondents.}$$

It was estimated that about 90 % of the respondents were going to respond with a satisfactory level of knowledge, a positive attitude, and good practices of sustainable solid waste management, as seen from previous studies (Barloa *et al.* 2016).

3.2.3 Validity of data collection tools and reliability

The validation of the questionnaire was done by 3 experts who reviewed and rated it, the validation form was rated satisfactory with reasons offered for the judgement. The questionnaire was also validated by selecting 5 volunteers who identified problems faced in completing the questionnaire. The suggestions were received and the questionnaire was refined according to the identified problems.

The data collection tool was dependable, it had well-phrased questions to avoid ambiguity and lead respondents to a particular answer. The use of Cronbach's Alpha testing for reliability for the questionnaire was done as we measured a construct of Attitude in the study.

Cronbach's Alpha is a statistic that shows that tests and scales that have been made are fit for purpose (Taber 2018). The Cronbach's Alpha test analysis was done and was found to be 0.911. The Cronbach's Alpha based on standardised items was 0.905 (Table 1). The reliability test was rated as excellent. According to George and Mallery (2003) in Schrepp (2020) reliability of a score of ≥ 0.7 is rated as acceptable.

Table 1: Cronbach's Alpha Analysis

Cronbach's Alpha	***Cronbach's Alpha based on standardized Items***	***Number of items***
0.911	0.905	15

TABLE 2 (A): METHODOLOGY MATRIX

Specific objective	Variables	Data Collection Method	Type of Data	Data analysis Method	Data Analysis Tool
To determine the level of knowledge of market users on solid waste management at Dzaleka in Dowa	Effects of poor solid waste disposal. Solid waste collection methods. Knowledge of waste reduction, reuse and recycling. Benefits of solid waste segregation	Using a structured questionnaire. In-depth interviews	Quantitative Qualitative	Descriptive statistics, means, percentages, frequencies. Chi-square Thematic analysis	SPSS Version 26 Manually coding Using Microsoft (2013)
To assess the attitudes of market users on solid waste management at Dzaleka in Dowa	Individual role in waste management. Public participation in solid waste management. Waste collection service satisfaction. Behaviours towards solid waste management by market users	Using a structured questionnaire In-depth interviews	Quantitative Qualitative	Descriptive statistics(means, frequencies, percentages) Thematic analysis	SPSS Version 26 Manually coding using Microsoft (2013)

TABLE 2(B): METHODOLOGY MATRIX (CONT…/ /).

Specific objective	Variables	Data Collection Method	Type of Data	Data analysis Method	Data Analysis Tool
To determine the practices of market users on solid waste management at Dzaleka in Dowa	Solid waste recycling. Waste reuse, Waste reduction methods. Waste disposal methods. Waste treatment options. Waste collection systems.	Use of a questionnaire. Observation- use of a checklist. In-depth interviews	Quantitative Qualitative	Descriptive statistics, means, percentages, frequencies. Chi-square Thematic analysis	SPSS Version 26 Manually coding using Microsoft (2013)
To evaluate institutional capacity on solid waste management at Dzaleka Market in Dowa.	Frequency of solid waste collection. Availability of sanitation equipment. Availability of sanitation facilities, disposal infrastructure (Landfill), recycling infrastructure	Using a structured questionnaire In-depth interviews	Quantitative Qualitative	Descriptive statistics(means, frequencies, percentages) Thematic analysis	SPSS Version 26 Manually coding using Microsoft (2013)

3.2 Inclusion and exclusion criteria

The respondents included in the study were those who were 18 years or older and those who consented. The traders who had been at the markets for a period greater than 6 months, were deemed to be in a better place to understand waste management practices at the markets. The buyers who were available at the time of the data collection were included in the study. The vendors or buyers greater than 65 years and respondents who did not give consent were excluded from the study.

3.3 Data Collection

The study used four methods of data collection, which included surveys using questionnaires, key informant interviews (KII), focus group discussion (FGD), and direct observation to record practices. The photographs indicating solid waste management practices and disposal sites in the market were taken by the researcher during the time of data collection.

3.3.1 Questionnaire

The data from the market respondents was collected using a questionnaire that was prepared in English and translated into the local language of Chichewa. The instrument was uploaded in the ODK /Kobo collect software version, 2022.4.3. Kobo Collect is a mobile data software that has the significance of collecting quality data for research, increasing speed and accuracy (Lakshminarasimhappa 2021). The use of Kobo Collect software facilitated the collection and aided its analysis into frequencies and median, similar to previous studies (Nampa *et al.* 2020). Questionnaires that had open and closed-ended questions were used to obtain data on respondents. The collected data was reviewed and examined for consistency, reliability, and completeness.

3.3.2 Key Informant Interviews

The key informants were purposively sampled, and interviews were conducted through a face-to-face approach at the offices where the individual key informants work. Key informant interviews (*n* = 12*)* included (6) participants for the health surveillance assistants, the assistant environmental health officer from the Dzaleka health facility and (2) participants were the market committee members on waste management.

The other key informants included (1) participant the District environmental officer from the Dowa district council, and (2) participants from the Dowa District hospital who included, the district Environmental health officer and the health education promotion officer. One participant was the Water Sanitation and Hygiene (WASH) Engineer for Welt Hunger, a UNHCR organization working on Sanitation at the Dzaleka Refugee Camp.

3.3.3 Focus group discussions

A group of 8 participants were purposively sampled for focus group discussions (FDGs) among the traders and buyers at the Dzaleka Market. A total of 2 focus group discussions (*n* = 16) were conducted, the first group was for men which had 8 participants and the second group was for women which had 8 participants as well. Each participant was identified by a number which was assigned. This was done to make sure each participant took part in the discussion. The research assistants facilitated the discussion following a guide of questions in each group and the researcher took some notes as the discussion was going on. The responses were summarized, the tallying was done and themes were developed with the use of Microsoft Word (2013).

3.4 Data analysis

Quantitative data obtained through questionnaires were coded, using Statistical Package for Social Sciences (SPSS) version 26, while qualitative data was thematically analysed. Frequencies and percentages were generated from the responses of the study participants. The chi-square of independence was used to assess the statistical significance level at (0.05, 95 % confidence level). The qualitative data sourced from the FGDs and KIIs were audio-recorded, transcribed and translated from Chichewa into English. The written transcripts were reviewed by the researcher, in conjunction with the research assistants to ensure the reliability of the results.

The analysis of transcripts and notes obtained from the key informants' interviews and the focus group discussions were manually coded using Microsoft Word (2013). The coding categories (sub-themes) were developed from codes and were further grouped into main themes, whereas; quotes were selected to illustrate the main themes. The marking score was developed for knowledge, attitude and practice questions. The questions were divided into correct and incorrect response rates. The respondents' attitude was measured by a 5-point Likert scale, strongly agree, agree, not sure, disagree and strongly disagree.

The respondents who agreed and strongly agreed were put in the correct response rate of agree to that particular question. The respondents who were not sure, disagreed and strongly disagreed with the attitude questions were put in the incorrect response rate. The respondent's responses were summed up which were divided by the total expected responses to come up with a mean percentage for knowledge, attitude and practice variables. The knowledge scores were classified into poor and good, while attitude variables were scaled into positive and negative. The practice variables and total responses were measured and rated into incorrect and correct response rates.

The scoring of the variables was adapted from a study by Aluko *et al.*(2016), where the median percentages were used in the classification of the knowledge, attitudes and practices of various questions.

3.5 Ethical consideration

Ethical considerations were considered. An application was sent for approval by the Mzuzu University Research Ethics Committee (MZUNIREC) and a permit was given for protocol reference number MZUNIREC / DOR/23/11 (*Appendix A*). Furthermore, permission was sought from the Dowa District Council. The purpose of the study was explained to the respondents and informed consent was sought from the respondents before data collection (*Appendix B*). Participants were informed that participation in the study was voluntary, and the data collected would be treated with confidentiality.

3.6 Research dissemination

The study report (thesis) has been submitted to the Faculty of Environmental Science, Department of Water and Sanitation, in fulfilment of the degree (MSc in Sanitation). Presentations at national and international conferences, manuscript publications and newspaper articles would be used to disseminate the study findings.

3.7 Study limitations

Communication was a major problem due to the language barrier and it was resolved by the use of interpreters who helped in translation from English to the local language of Kiswahili which was understood by most of the people who are refugee residents conducting their business at the Dzaleka Market.

The other limitation of the study was the long period that it took to get clearance from the Ministry of Homeland Security to conduct key informant interviews with the UNHCR non-organization (NGO) called Welt Hunger which works on water sanitation and hygiene. The Ministry of Homeland Security cited the problem of security at Dzaleka Refugee Camp due to conflicts between refugees, as some individuals could take videos of some scenes without authorisation. This was resolved by engaging authorities at Dzaleka Refugee Camp. The Camp administrator only authorised interviews with officials from Welt Hunger. Furthermore, the study being of cross-sectional type; was prone to response bias since it was conducted among respondents who represented randomly selected market users from the study area. However, all the limitations cited did not have an impact on the results of this study.

3.8 Summary of the Methodology Chapter

This chapter describes the research methods that were followed in the study. The study was conducted at Dzaleka Market in Dowa District. The study adopted a mixed research design. Simple random and purposive sampling were used for selecting study participants. Data was collected using focus group discussions, key informant interviews, observations and from survey using a questionnaire. Quantitative data was analysed using descriptive analysis using SPSS version 26 and the qualitative was analysed using thematic analysis. The section of chapter four describes the study findings according to the research objectives.

CHAPTER FOUR: RESULTS

The chapter presents the results based on the study objectives, which included; a) to determine the level of knowledge of market users on solid waste management at Dzaleka in Dowa, b) to assess the attitudes of market users on solid waste management at Dzaleka in Dowa, c) to determine practices of market users on solid waste management at Dzaleka in Dowa and d) to evaluate institutional capacity on solid waste management at Dzaleka Market in Dowa.

4.1 Socio-demographic characteristics of respondents

Demographics of the respondents of the study are shown (Table 3), gender, male (52.17%, *n* = 72) females, (47.83%, *n* = 66) and the majority (73.91%, *n* = 102) were married. Another majority (75.36%, *n* = 104) were not employed, and (39.13%, *n* = 44), their ages ranged from 30-39, (44.93%, *n* =62), had a primary education level and (10.14%, *n* = 14*),* were respondents with no formal education (Table 3).

The socio-demographic characteristics indicated that the majority of the study respondents were literate. The majority of study participants were in the age range of 18- 39, this showed that more were exposed to information on waste management in different media platforms. The gender of individuals did not show significance to the knowledge, attitudes and practices of the market users towards solid waste management. This brought attention to ascertain whether the availability of knowledge only in individuals could contribute to good solid waste management practices. The observational results indicated poor solid waste management practices.

Table 3: Demographics of the participants (n = 138)

Variable	*Category*	*Frequency (n)*	*Percentage (%)*
Age	18-29	44	31.88
	30-39	54	39.13
	40-49	22	15.94
	50-59	14	10.14
	60-64	4	2.90
Gender	Female	66	47.83
	Male	72	52.17
Marital status	Married	102	73.91
	Single	33	23.91
	Divorced	0	0.00
	Widowed	3	2.17
Level of Education	Primary	62	44.93
	Secondary	46	33.33
	Tertiary	16	11.59
	No formal education	14	10.14
Employment Status			
	No	104	75.36
	Yes	34	24.64

Table 4, indicates the percentages and the frequencies of the study participants and how they responded to the knowledge questions. It also indicates the correct response rate to the knowledge questions. The majority (77.54 %, *n* = 107) of the respondents had satisfactory knowledge of solid waste management at the Dzaleka Market, this was displayed through the face-to-face interviews. The observational results indicated some poor solid waste management practices. The lack of knowledge of the benefits of solid waste segregation and lack of knowledge of good solid waste management methods contributed to the poor observed practices.

Table 4: The study participants' responses summary to the knowledge Questionnaire **(***n* = 138)

Frequency (%)

	No	Yes
Do you know waste?	2 (1.45)	136 (98.55)
Do you have any knowledge of the effects of solid waste on public health and the environment?	13 (9.42)	125 (90.58)
Do you agree that the quantity of waste sent for disposal to landfills should be minimized?	28 (20.29)	110 (79.71)
Are you aware of any waste collection methods?	17 (12.32)	121 (87.68)
Do you know any benefits of waste segregation?	76 (55.07)	62 (44.93)
Are you aware of effective solid waste methods of disposal?	70 (50.72)	68 (49.28)
Can waste be sorted or recycled?	32 (23.19)	106 (76.81)
Do you have any knowledge of composting of solid waste?	32 (23.19)	106 (76.81)
Do you know any methods of waste reduction?	31 (22.46)	107 (77.54)
Are you aware that participation in solid waste management is the responsibility of everyone?	7 (5.07)	131 (94.93)

4.2 Knowledge of solid waste management among market users

This section presents the results of the study respondents on the knowledge questionnaire on the effects of solid waste on the environment and public health, knowledge of effective solid waste methods disposal, benefits of solid waste segregation and solid waste collection methods.

The Chi-square test of independence of knowledge questions against social-demographic characteristics of respondents' results is also presented in this section.

4.2.1 Knowledge of the effects of poor solid waste management

The majority (90.58%, *n* = 125) of the respondents knew the effects of poor solid waste on the environment and public health (Table 4) mentioned air pollution, soil pollution, the environment polluted by disease-causing organisms transmitting typhoid, diarrhoea diseases and Cholera. A majority (98.55%, *n* = 136) knew what waste is.

4.2.2 Knowledge of effective solid waste disposal methods

The respondents showed knowledge of the effective solid waste disposal methods, slightly above half (50.72%, *n* = 70), indicated less knowledge, mostly of solid waste reuse and recycling, and landfilling, while (49.28%, *n* = 68), were knowledgeable of solid waste composting and the cabbage waste used as animal feeds (Table 4).

4.2.3 Knowledge of benefits of solid waste segregation.

Of respondents' knowledge of waste segregation/ separation benefits, slightly above half (55.07%, *n* = 76) did not know, they indicated they did not separate the solid waste that was being generated. Slightly less than 50% (44.93%, *n* = 62) of respondents, knew the benefits of solid waste segregation, they indicated the generation of manure from solid waste which was used in farms for crop production and economic gains as the segregated solid waste was being sold as manure to the general public. (Table 4). The majority of respondents indicated that they do the separation of solid waste for easy collection and disposal by the cleaners of the market. Few respondents described doing separation of solid waste as preventing the transmission of diseases.

Some respondents reported doing the separation for economic gains. They would sell the manure and some solid waste such as glass bottles and metals.

4.2.4 Knowledge of solid waste collection methods

The majority (87.68%, *n* = 121) of respondents knew waste collection methods at the Dzaleka market (Table 4). The market users described reuse and recycling as being done on a small scale as compared to the open burning, collection and disposal at dumpsites. The other majority (79.71%, *n* = 110) knew and agreed that the quantity of Solid waste that is sent to landfills from the Dzaleka market was supposed to be minimized (Table 4). They described the minimization of solid waste sent to the landfill could help in the reduction of pollution and preventing damage to the environment. Another majority (76.81%, *n* = 106) of respondents knew that solid waste could be sorted, recycled and composted respectively at the Dzaleka market (Table 4). Most of the respondents indicated composting as one of the solid waste practices performed by the market users. The collected solid waste such as bottles, metals and manure could be sold within Dzaleka.

Table 5, is indicating the study participant's responses to a knowledge question about the effects of poor solid waste management on the environment and public health. The majority described the effects of solid waste accumulation that could lead to the contamination and growth of microorganisms for diseases such as diarrhoea, typhoid and cholera. Others described it as causing pollution to the environment as solid waste decays producing emissions of greenhouse gases. The clogging of drains could lead to the breeding of vectors for Malaria. The other market users described the clogging of drains as leading to flooding of the areas where the people live. Few respondents described it as causing contamination of the soil and water. Table 6 provides the results for Chi-square for the knowledge questions, it was statistically significant at 0.05.

Table 5: Effects of solid waste on the environment and public health

What are the effects of solid waste on the environment and public health	**frequency (%), *n* = 138**
Disease	91 (65.94)
Air pollution	31 (22.46)
Floods	10 (7.25)
None	6 (4.35)

4.2.5 Chi-square test of independence on knowledge questions.

Table 6: Pearson Chi-square tests of independence of knowledge and demographic factors.

	Age	*Gender*	*Marital status*	*Education level*	*Employment*
Do you know waste?	.654	.137	.678	.251	.415
Do you have any knowledge of the effects of solid waste on public health and the environment?	.059	0.196	.358	.447	.136
Do you agree that the quantity of waste sent for disposal to landfills should be minimized?	.072	0.126	.417	.429	0.960
Are you aware of any waste collection methods?	.012*	0.946	.004*	.087	.012*
Do you know any benefits of waste segregation?	.938	0.251	.646	.037*	0.493
Are you aware of effective solid waste methods of disposal?	.837	0.236	.343	0.625	0.375
Can waste be sorted or recycled?	.035*	0.779	.194	.062	0.177
Do you have any knowledge of composting of solid waste?	.405	0.136	.202	.389	0.601
Do you know any methods of waste reduction?	.121	0.632	.397	.103	0.438
Are there laws governing solid waste management in the market of Dzaleka	.700	.049*	.507	0.429	0.282

**. The Chi-square statistic is significant at the .05 level.*

4.3 Attitudes of respondents towards solid waste management.

This section presents the results of the study respondents' responses to the attitude questionnaire. The market user's attitudes toward solid waste collection, solid waste disposal and sustainable solid waste management practices are presented. Results are also presented for the study respondents' attitudes toward their participation in solid waste management at Dzaleka Market. This section further presents results for the Pearson Chi-square of independence of attitude questions against respondents' socio-demographic characteristics, which did not show any statistical significance.

4.3.1 Attitude of Respondents towards Solid Waste Disposal

The majority disagreed as (48.55%, n = 67) of respondents strongly disagreed and (26.81%, n = 37) disagreed that dumping solid waste in open spaces, drains and gutters is not bad (Table 7). Another majority (65.94%, n = 91) of the respondents strongly agreed and (24.64%, n = 34) agreed that improper refuse disposal can cause the occurrence of pollution (Table 7). Most of the study respondents reported that the practice of open disposal of solid waste would contaminate the environment, leading to the growth of microorganisms for transmission of diseases such as cholera. Solid waste disposal in drains would lead to the breeding of vectors for the transmission of malaria. The market users knew how solid waste could be disposed of, though some had negative attitudes as they could practice open disposal of solid waste.

4.3.2 Public participation in solid waste management

The majority (63.04%, n = 87), of respondents, strongly agreed and (21.01%, n = 29), agreed that participating in solid waste management activities is everybody's responsibility (Table 7). Observational results showed that some market users could pile the solid waste in sources where waste was being generated.

In the other group, almost half (48.55%, *n* = 67) of respondents were not satisfied with solid waste management services at the Dzaleka market, while a minority (8.7 %, *n* = 12) were satisfied with solid waste management services. The participation of the market users in solid waste management at Dzaleka market was dependent on the availability of adequate knowledge of the benefits of collecting solid waste for ease of disposal or the prevention of sanitation-related diseases such as diarrhoea and Cholera. A few respondents described being involved in solid waste management activities at Dzaleka Market for economic gains as they could sell some bottles for reuse and manure to others.

4.3.3 Attitudes of the respondents towards solid waste collection

The majority (54.35%, *n* =75) of respondents strongly agreed and (30.43%, *n* = 42), agreed that regular collection of solid waste at the Dzaleka Market could be the only solution to solid waste management (Table 7). The market respondents had a positive attitude and described that the regular collection of solid waste would reduce the heaping and accumulation in the market, reducing the risk factors for the spread of diseases such as diarrhoea and deadly Cholera. Some respondents reported that they are motivated to do the frequent collection of solid waste for economic gains. Another majority (73.19%, *n* =101) of respondents strongly agreed that putting waste in bins is the responsibility of everybody (Table 7).

4.3.4 Attitude of respondents towards waste management practices

The majority of respondents agreed that they cared about waste management reduction, reuse, and recycling, as (47.1%, *n* = 65), they strongly agreed and (30.43%, *n* = 42) agreed (Table 7). The market respondents described that they would reduce solid waste generation to prevent its accumulation. The study participants reported that they would reuse and recycle solid waste though on a small scale, due to inadequate knowledge.

Another majority disagreed that open burning is a good method, as (45.65%, *n* = 63) of respondents strongly disagreed and (38.41%, *n* = 53), disagreed. The other majority disagreed that open burning of solid waste did not affect the health of the human being, as (36.23%, *n* = 50), of respondents, strongly disagreed and (23.19%, *n* = 32), (Table 7). The study respondents knew the open burning effects of solid waste as respiratory problems in human health as a factor that would prevent them from the practice.

Table 7, presents the study participant's responses summary to the attitude questionnaire and the responses that could be regarded as correct according to the guiding principles for the literature in sanitation. The results found as seen in Table 7, showed positive attitudes toward solid waste management through face-to-face interviews, but the actual behaviour displayed by some individuals towards solid waste management was poor. It was observed that there were poor practices, there was no separation of solid waste, indiscriminate disposal and open dumping of solid waste at the Dzaleka Market.

Above half of the study participants disagreed that individuals had to play a role in solid waste management as 27.54% (*n*=38) disagreed and (19.57%, *n* = 27) strongly agreed. The majority of study participants agreed that regular collection of solid waste would bring a solution to the accumulating waste in the different areas of the market. The majority of study participants agreed that open dumping of refuse in open spaces is bad, but observational results indicated the same. The Chi-square results in Table 8 of attitude questions did not show any statistical significance against the socio-demographic characteristics of the study participants.

Table 7: The study participant's responses to attitude questionnaire. (n=138)

	Frequency (%)				
	Strongly disagree	*Disagree*	Not sure	*Agree*	*Strongly agree*
Waste management is important?	1 (0.72)	0 (0)	0 (0)	42 (30.43)	95 (68.84)
Dumping solid waste in open spaces, drains and gutters is not bad?	67 (48.55)	37 (26.81)	3 (2.17)	7 (5.07)	24 (17.39)
Open burning of refuse is a good method	63 (45.65)	53 (38.41)	2 (1.45)	7 (5.07)	13 (9.42)
Open burning of solid waste has no negative effect on the health of human beings	50 (36.23)	32 (23.19)	2 (1.45)	13 (9.42)	41 (29.71)
Improper refuse disposal can cause the occurrence of environmental pollution	7 (5.07)	2 (1.45)	4 (2.9)	34 (24.64)	91 (65.94)
Individuals play key roles in solid waste management in the market of Dzaleka	27 (19.57)	38 (27.54)	16(11.59)	26 (18.84)	31 (22.46)
I feel comfortable with the way solid waste is managed in the market of Dzaleka.	38 (27.54)	34 (24.64)	11 (7.97)	27 (19.57)	28 (20.29)
Putting waste in bins is the responsibility of everybody	1 (0.72)	4 (2.9)	3 (2.17)	29 (21.01)	101(73.19)
Participating in solid waste management activities is everybody's responsibility	6 (4.35)	16 (11.59)	0 (0)	29 (21.01)	87 (63.04)
I care about waste management reducing, reusing and recycling	7 (5.07)	31 (22.46)	15(10.87)	20 (14.49)	65 (47.1)
Regular collection of solid waste is the only solution to solid waste management	6 (4.35)	11 (7.97)	4 (2.9)	42 (30.43)	75 (54.35)

4.3.5 Chi-square tests of independence on attitude questionnaire.

This section presents chi-square results of attitude questions, showed no statistical significance.

Table 8: Pearson Chi-square tests of independence of attitude and demographic factors

	Age	*Gender*	*Marital status*	*Level of Education*	*Employment*
Waste management is important?	*.360*	*.628*	*.098*	*.000**	*.001**
Dumping solid waste in open spaces, drains and gutters is not bad?	.570	.088	.065	.000*	.000*
Open burning of refuse is a good method	.185	.087	.031*	.005*	.012*
Open burning of solid waste has no negative effect on the health of human beings	.816	.648	.095	.005*	.001*
Improper refuse disposal can cause the occurrence of environmental pollution	.000*	.917	.090	.000*	.035*
Individuals play key roles in solid waste management in the market of Dzaleka	.622	0.492	.789	.062	.016*
I feel comfortable with the way solid waste is managed in the market of Dzaleka.	.237	0.641	.679	.068	.005*
Putting waste in bins is the responsibility of everybody	.365	.670	.063	.091	.037*
Participating in solid waste management activities is everybody's responsibility	.783	.314	.125	.000*	.002*
There is satisfaction with waste service collection in the market of Dzaleka.	.584	.128	.852	.197	.073
Reusing plastic bags for shopping is good for reducing waste	.868	.441	.174	.000*	.062
I care about waste management reducing, reusing and recycling	.675	.386	.110	.126	.399
Public education could be good for fixing the challenge of poor solid waste management	.133	.567	.038*	.699	.790
It is important that local government put recycling laws and programs in place	.425	.555	.251	.001*	.083

**. The Chi-square statistic is significant at the .05 level.*

4.4.0 Market users' practices on solid waste management

This section presents the results of the study respondents at the Dzaleka market on practices. The Pearson Chi-square of independence of practices questionnaire against socio-demographic characteristics of the study respondents is presented. The majority of respondents reported good knowledge and, a positive attitude through face-to-face interviews and reported poor practices, this was also revealed in observation results which showed open dumping, and indiscriminate disposal of solid waste.

4.4.1 Solid waste disposal practices at Dzaleka Market

Slightly above half (52.17%, *n* = 72) of respondents reported dumping solid waste in undesignated places, (Table 9). Another majority (78.99%, *n* = 109) of respondents reported the practice of disposing of solid waste in drains and gutters (Table 9). The other majority (83.3 %, *n* = 119) of respondents reported that the final disposal of solid waste is an open dump (Table 9). The majority of respondents (71.01%, *n* = 98) reported that there is no proper use of refuse bins at the Dzaleka Market. The reasons for improper solid waste use of bins were related to negative attitudes, whilst some individuals described the lack of adequate bins in the market could lead to poor solid waste disposal (Table 9).

The majority (94.2%, *n* = 130) reported that there was no practice of separation or segregation of solid waste at Dzaleka Market (Table 9). Slightly above half (53.62%, *n* = 74) of the respondents reported the burning of solid waste as being practised at Dzaleka Market (Table 9). Another majority (66.67%, *n* = 92), of respondents, reported that there was no application of reducing, reusing and recycling of waste at Dzaleka Market (Table 9). Slightly above half (56.52%, *n* = 78) of respondents reported that they did not practice solid waste prevention, (43.48%, *n* = 60), and responded that they practised waste prevention (Table 9).

Table 9, shows the study participants' responses to a practice questionnaire 69.57% poor practices.

Table 9: The study participant's responses summary to the practice questionnaire (n = 138)

	Frequency (%)	
	No	*Yes*
Does dumping of solid waste occur in designated dumpsites?	72 (52.17)	66 (47.83)
Is there a proper use of refuse bins in the markets?	98 (71.01)	40 (28.99)
Is there a disposal of refuse in drains or gutters?	29 (21.01)	109 (78.99)
Does the separation / segregation of waste happen in the markets?	130 (94.2)	8 (5.8)
Do the burning of solid waste take place?	64 (46.38)	74 (53.62)
Is there an application for reducing, reusing and recycling solid waste?	92 (66.67)	46 (33.33)
Are the bins covered properly while containing solid waste?	91 (65.94)	47 (34.06)
Do you follow processes of waste prevention?	60 (43.48)	78 (56.52)
Is there a recovery of solid waste from the market	119 (86.23)	19 (13.77)
Do you do Composting of solid waste?	112 (81.16)	26 (18.84)
Do you do incineration of solid waste?	80 (57.97)	58 (42.03)
What is the final disposal of solid waste at the Dzaleka market?	Open dump 119(83.3)	Landfill 23 (16.7)

4.4.2 Chi-square tests of independence on practices and demographic factors.

This section presents the Chi-square results of practice questions against the demographic factors of respondents, showing statistical significance on the use of bins against the level of education of study respondents with a value of $0.013 \leq 0.05$, age against recycling, $0.027 \leq 0.05$ (Table 10).

Table 10: Pearson Chi-square tests of independence of practices and demographics (n = 138)

	Age	*Gender*	*Marital status*	*Level of Education*	*Employment Status*
Does dumping of solid waste occur in designated dumpsites?	.363	0.847	.878	0.475	0.770
Is there proper use of refuse bins in the markets?	.778	0.961	.784	.123	0.093
Is there a disposal of refuse in drains or gutters?	.608	0.084	.140	.624	0.579
Does the Separation /segregation of waste happen in the markets?	.797	.899	.610	.304	.010*
If yes, mention reasons for waste separation	.291	.717	.315	.675	.221
Do the burning of solid waste take place?	.631	0.634	.732	0.983	0.200
Is there an application for reducing, reusing and recycling the solid waste	.737	0.278	.180	0.061	0.576
Do disposal of organic waste take place instead of recycling?	.715	0.733	.294	0.215	1.000
Is there Involvement of the authorities from the district council or	.335	0.104	.331	0.087	.013*
Are the bins covered properly while containing solid waste?	.795	0.584	.443	.013*	0.136
How often is solid waste collected from the markets by authorities	.230	0.378	.637	.140	0.318
Do you follow processes of waste prevention?	.721	0.050	.103	0.527	0.477
Is there a recovery of solid waste from the market	.511	0.127	.240	.264	.184
Do you do Composting of solid waste?	.406	0.850	.663	.071	0.764
Do you do incineration of solid waste?	.274	0.102	.888	0.374	0.494
Would you like to recycle waste in your market?	.027*	.157	.000*	.573	.626

**. The Chi-square statistic is significant at the .05 level.*

Figure 6, shows solid waste management methods at Dzaleka Market. Less than half of respondents (33.33%, *n* = 46), reported composting, (27.78%, *n* = 38) reported incineration, landfilling (22.22%, *n* = 31), sorting (16.67%, *n* = 23) respectively. A majority preferred performing solid waste composting, and a few people would be involved in the sorting of the solid waste at Dzaleka Market.

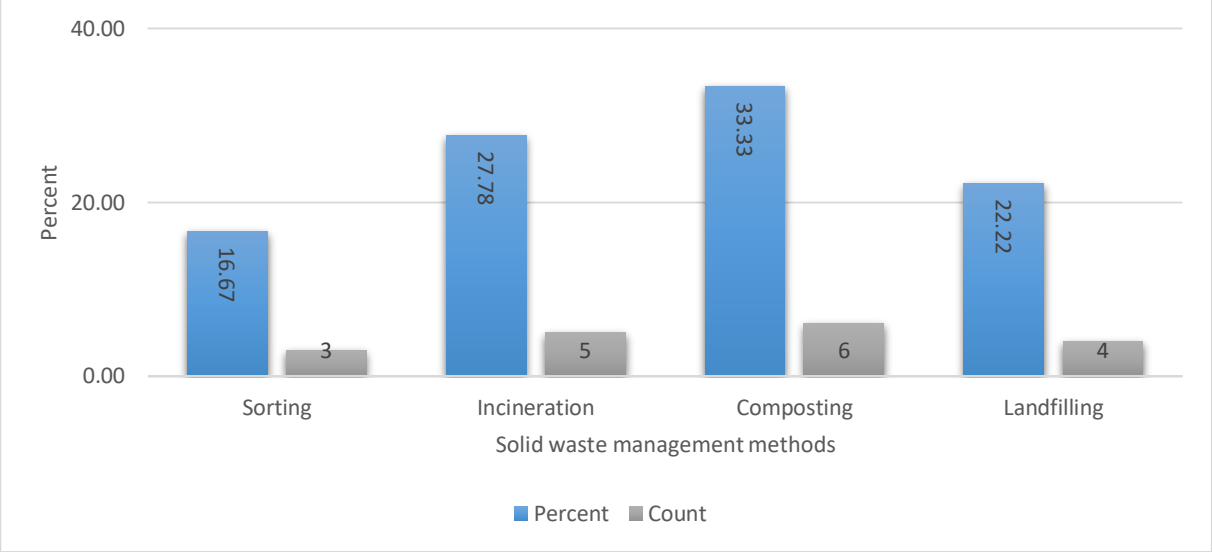

Fig. 6: Solid waste management methods

4.4.3 Solid waste as a resource

This section presents the results of the study respondents' views on solid waste business practices at Dzaleka Market. The results of the Chi-square test of independence are shown in Table 13. Less than half (40.07%, *n* =55) of respondents reported generation of food waste, plastic waste (35.21%, *n* = 49), (21.72%, *n* = 30) reported paper waste, (0.75%, *n* = 1) of the respondents reported textile waste and (2.25%, *n* = 3) (Fig.7).

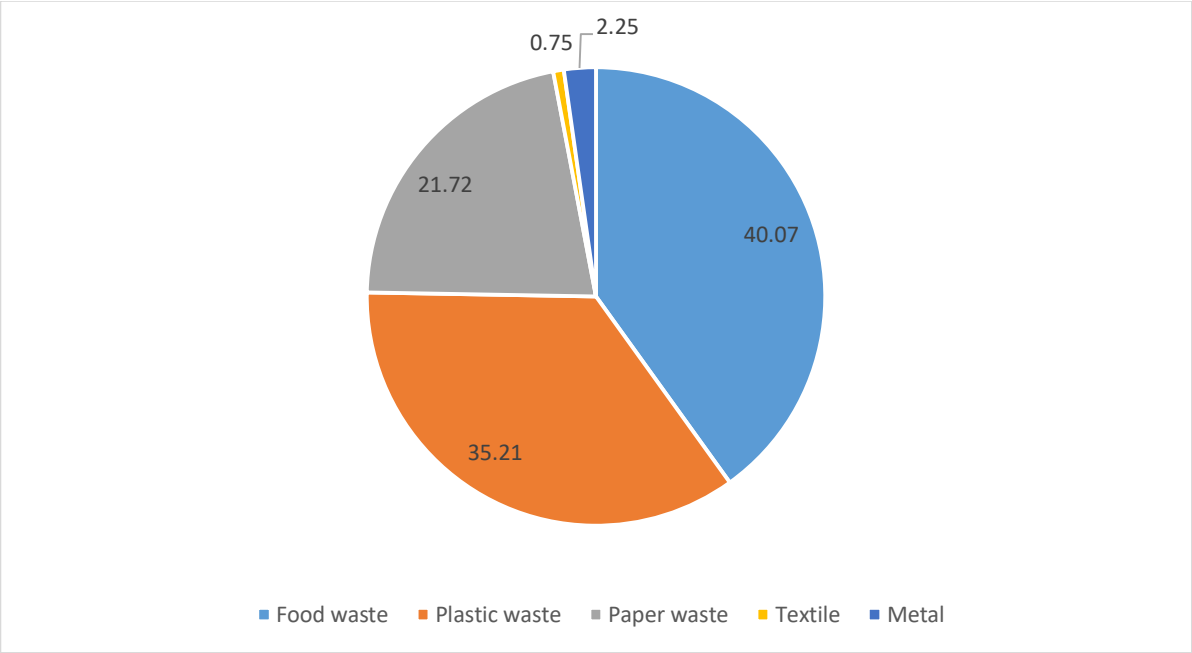

Fig. 7: Proportion of solid waste generated at the Dzaleka Market (responses in percentages).

A few respondents less than 50% (47.62%, *n* = 66); reported solid waste being used for composting for the generated solid waste from Dzaleka Market, while (42.86%, *n* = 59), reported metal recycling as a significant for the solid waste generated from Dzaleka Market. (Table 11). Less than half (35.03%, *n* = 48) of the respondents reported solid waste as being used for revenue generation. (Table 11). Some respondents (31.21%, *n* = 43) reported composting as one of the specific uses of solid waste that is being generated at Dzaleka Market. Other respondents (33.76%, *n* = 47) reported that there is no specific use of the solid waste generated at the Dzaleka Market. No respondent reported the production of biogas as one specific use of the solid waste generated at Dzaleka Market. Recycling and reuse were reported to be practised on a small scale, this could be attributed to a lack of adequate knowledge of reuse and recycling practices by the market users at Dzaleka.

4.4.4 Economic Practices of the generated solid waste

Table 11: Use of solid waste generated from the Dzaleka Market

	Frequency	*(%)*
Significance of solid generated at the Dzaleka market		
Metal recycling	59	(42.86)
Composting	66	(47.62)
Reduction of waste	10	(7.14)
Waste recovery	3	(2.38)
What is the specific use of solid waste from the Dzaleka market?		
Revenue generation	48	(35.03)
Composting	43	(31.21)
Biogas	0	(0.00)
None	47	(33.76)

4.4.5 Waste Business Practices

Slightly above half of respondents (55.07%, *n* = 76), reported that waste business takes place at the Dzaleka market. (Table 12). Another group of respondents slightly above half (57.25%, *n* = 79), indicated that sometimes exploitable materials are collected by informal waste pickers or waste entrepreneurs for business and a few (20.29%, *n* = 28), respondents reported that solid waste was often collected for business (Table 12). The least respondents (13.04%, *n* = 18) reported that they did not know that solid waste exploitable materials were collected by informal waste pickers or entrepreneurs for business.

.***Table 12: Solid waste materials recollected by Informal Pickers or waste entrepreneurs***

Research Question	**Responses**	**freq.**	**%**
Is there any waste business practice taking place at Dzaleka	Yes	76	55.07%
	No	62	44.93%
Are exploitable waste materials recollected by informal pickers or waste entrepreneurs?	Never	8	5.80%
	Sometimes	79	57.25%
	Often	28	20.29%
	Almost always	5	3.62%
	I don't know	18	13.04%

Almost half of respondents (44.05%, *n* = 61) reported selling cabbages as animal feeds (Fig. 8). A few respondents (26.19%, *n* = 36) reported metals and bottles, recycling and reuse, Few (14.29%, *n* = 20) respondents reported generating revenue, K8, 500 for a tonner truck loaded for solid waste collection from the market. (Fig.8). The least respondents (4.74%, *n* = 6) indicated that solid waste could be sold to local waste entrepreneurs for briquette making (10.71%, *n* = 15) (Fig. 8).

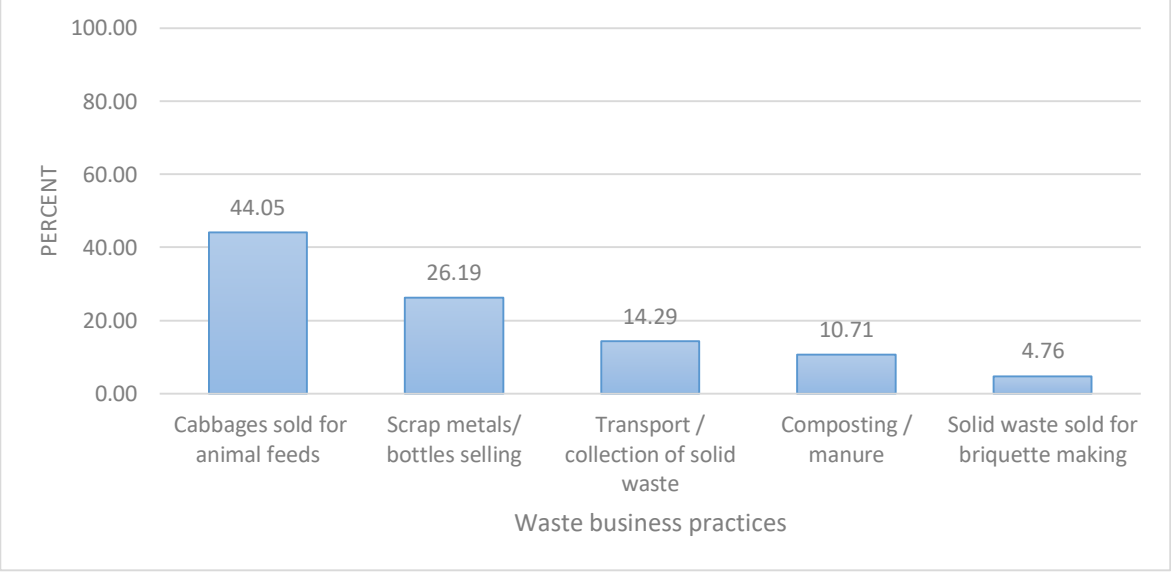

Figure 8: Type of waste business practices at Dzaleka Market

4.4.6 Chi-square tests of independence solid waste as a resource.

This section presents the Chi-square results of solid waste resource questions against the demographic factor of the study respondents, statistical significance was observed on the age of respondents against the practice of recycling indicating a value of $0.027 \leq 0.05$ (Table 13).

Table 13: Pearson Chi-square tests of solid waste as a resource and demographic factors.

	Age	*Gender*	*Marital status*	*Level of Education*	*Employment Status*
Would you like to recycle waste in your market?	.027*	.157	.000*	.573	.626
Solid waste recycling has benefits here at the Dzaleka market?	.717	0.170	.253	.412	0.500
If a recycling program was set up, would you be willing to separate materials into separate bags for collection purposes?	.879	.026*	.040*	.710	.172
Is there any waste business practice taking place here at the Dzaleka market?	.250	0.644	.089	0.354	0.774
Are exploitable waste materials recollected by informal pickers or waste entrepreneurs?	.209	.231	.768	.057	.017

**. The Chi-square statistic is significant at the .05 level.*

4.4.7 Observations of Solid Waste Management Practices

This section presents the results of observations of solid waste management practices at Dzaleka Market. The openly dumped solid waste was observed in different areas of Dzaleka Market such as beside the road, inside the market and near areas where traders sell their goods. Some solid waste disposal sites were observed near the restaurants, where there was an accumulation of solid waste that seemed to have stayed there for a longer period. This posed a danger to the communities of sanitation-related diseases including diarrhoea, typhoid and Cholera which is fatal. Drains clogging due to the disposed solid wastes in the drains and gutters could have created breeding grounds for the mosquitoes which are the vectors of Malaria, a risk factor to public health.

Fig. 9. (A) Solid waste accumulation inside (B) Solid waste in drains at Dzaleka Market. Market at Dzaleka . Source: (Field observation by researcher)

Figure 10(A), unsorted/ unseparated solid waste, a mixture of organic waste, plastic bottles, and paper waste are shown inside Dzaleka Market awaiting collection by authorities. Figure 10(B) shows open dumping practices inside Dzaleka Market, blockage of drainage with solid waste materials dumped. Creating a conducive environment for the breeding of mosquitoes is a risk factor for Malaria's spread.

Fig. 10 :(A) Unsorted solid waste at the Dzaleka Market. (B). Solid waste openly dumped Source: (Field observation by researcher).

4.5 Developed themes from the qualitative data

This section presents the results of qualitative data after the thematic analysis. Themes and sub-themes are presented in Table 14, indicating a comprehensive overview of the challenges and practices of solid waste management in the Dzaleka market. The analysis highlighted issues such as awareness and communication on waste management, solid waste accumulation and the economic aspects of waste through reuse, recycling, and commercialisation. Some of the significant quotes presented by the respondents through focus group discussions and key informant interviews have been selected in relationship with themes.

Table 14: Thematic analysis of Qualitative data

Initial category/ sub-themes	Main themes
Waste management awareness	Behavioural change Communication
Waste management campaigns	
Routine educational programs	
Community radio sanitation programs	
Indiscriminate waste disposal	Accumulation of solid waste
Inadequate sanitation equipment	
Low solid waste collection	
Lack of waste collection vehicles	
Reuse of solid waste	Commercialisation of Solid waste
Recycling of solid waste	
Revenue generation	
Lack of space for solid waste separation	Inadequate sanitation infrastructure
Inadequate disposal infrastructure	
Lack of recycling facility	

4.5.1 Behavioural change communication

Respondents showed a good knowledge of solid waste management, the majority seemed to be aware of the information of waste management through routine health education programs by the extension of health workers and awareness campaigns organized by Welt Hunger an NGO working on sanitation at the Dzaleka Refugee Camp,.

When the health extension workers and officials from the Welt Hunger organization were asked how information is being spread concerning solid waste management at Dzaleka they explained as follows:

"*We usually share the information with the market users at Dzaleka Market through awareness campaigns on waste management to sustain sanitation in the market to prevent the occurrence of diarrhoea diseases, including deadly Cholera.* (HSA, Key informant interview (KII).

"*People are well informed of best solid practices as we have been conducting awareness campaigns on waste management here at Dzaleka Refugee Camp. The people have a negative attitude as they lack ownership of the generated waste, they fully rely on us as an organisation to take care of the waste they generate, and this has had an impact on solid waste management* (Key informant, WASH Engineer, Welt Hunger).

"*Even in the unfinished buildings, people could defecate and in the morning could be used as cooking sites for people with restaurants. This has been minimised recently".* (KII, Assistant Environment Health Officer, Dzaleka Health Facility).

The majority of the respondents in the focus group discussion revealed acquiring waste management information through awareness campaigns and health education sessions conducted by the Health Surveillance Assistants from the Dzaleka health facility and officials from an organization called Welt Hunger. Some indicated that they could get information about waste management through radio stations which included the Yethu Community Radio situated at Dzaleka. There was good knowledge of waste management among the market users, a positive attitude and poor practices were observed such as indiscriminate disposal of solid waste. The public incompliance on waste management was observed despite the provision of waste management information to the public through different media.

4.5.2 Commercialisation of solid waste

The thematic analysis showed the commercialisation of solid waste. The respondents reported using solid waste for business in forms of reuse, recycling and direct revenue generation.

The respondents revealed that they gained income through the reuse of solid waste:

"*Some people collect plastic bottles discarded in the market. They clean them and resell them to people who sell thobwa (local drink) in the same market of Dzaleka and some are sold to the shop owners who reuse them for selling cooking oil". (*FGD, woman, trader).

"*Most often we see vegetable/cabbage waste being sold to animal farmers who feed their livestock at Dzaleka Refugee Camp. It is a common business of solid waste taking place here*" (FGD, woman, trader).

This indicated that the reuse of solid waste was done for financial gain by the market users at Dzaleka. After awareness, it could be done on a larger scale as compared to the current situation.

The respondents explained how they benefitted economically from the recycling business of solid waste and further highlighted how revenue was also being generated through the transportation of solid waste, they explained as follows;

"*Usually some people come into the market to buy organic manure from the cleaners of the market, as one way of collecting the solid waste from the market"(*Key informant interview, market member on sanitation).

" *Some people here at Dzaleka Market recollect metal scraps from the disposal area and sell them to metal scrap dealers who usually come from other areas*". (FGD, Potato trader).

"*As an organisation working on sanitation at Dzaleka Refugee Camp, we are also responsible for waste collection from the market, but we only have two vehicles which are not enough as they also cater for household solid waste. We hire private vehicles for which we pay them K8,500 per trip for a 3-tonner truck". (*Key informant, WASH Engineer, Welt Hunger).

" *In the previous years, we used to see some people who are residents at Dzaleka used to come in the market to collect solid waste especially those from groundnuts usually during the dry season when crops are being sold, using them for making briquettes*". (KII, market chairman).

Recycling of solid waste was reported to be done on a smaller scale which could be promoted, through awareness and information sharing of its significance in the management of solid waste.

This could further help as an economic activity for financial gain as recycling of the solid waste in the form of compost manure sold to farmers for improving soil quality. The promotion of metal recycling could reduce the solid waste disposed of in the dumpsites and improve financial gain as they are sold to scrap metal dealers.

4.6 Institutional Capacity on Solid Waste Management at Dzaleka Market

4.6.1 Accumulation of solid waste

The theme of the accumulation of solid waste at Dzaleka Market was developed. Majority of respondents in the focus group discussion highlighted the reasons why they were involved in the indiscriminate disposal of solid waste. They attributed the problem to the shortage of sanitation equipment such as bins.

When respondents were asked why they were disposing off solid waste indiscriminately in the market they highlighted some of the reasons as follows:

"*We prefer to dispose off solid waste near our businesses, due to the limited number of bins inside this market which is a problem*" (FGD, Tomato, trader).

The respondents described a lack of vehicles for solid waste transportation as reported by the authorities. This led to low frequencies of solid waste collection for a period of greater than 2 weeks, which contributed to an accumulation within the disposal sites in the market.

The respondents explained what happens when the solid waste accumulates in the market as follows:

"The workers in the market collect the solid waste and pile in disposal sites within the market leading to accumulation and as it is decomposing produces bad smell which is a danger to public health."(Key Informant, market committee member).

"The district council does not usually collect the solid waste from the market. It is collected by the officers working on sanitation at Welt Hunger a UNHCR organisation, which does not have a scheduled timetable for collection. This leads to the accumulation of solid waste in the market, thereby posing a risk to public health". (FGD, shop owner).

The observational results showed piling and accumulation of solid waste within the disposal sites inside Dzaleka Market. This is a risk factor for the growth of microorganisms such as bacteria which may lead to the spread of diarrhoea and cholera. The stakeholder coordination in solid waste management was observed to be poor, as activities were done in isolation.

4.6.2 Inadequate Sanitation Infrastructure

The thematic analysis developed a theme of inadequate sanitation infrastructure. Respondents reported a lack of space for the separation of solid waste and inadequate disposal and recycling infrastructure.

The respondents revealed how they disposed of the solid waste from Dzaleka market as follows:

"*Separation of waste is a problem here because the market does not have facilities that can be used for separation of waste". (KII, Market cleaner).*

"*The Dzaleka Market does not have a landfill. The solid waste after being collected is dumped at the dumpsite somewhere near the market and it's also close to the community becoming a risk to public health".* (Key informant interview, District Environmental Officer).

The toilet facilities are few and we are told to pay for us to use these public toilets. Some market users would defecate in unfinished shop buildings since they do not have money to pay for the public toilets." (FGD, Tomato, trader).

This indicated a problem with solid waste separation which is significant for the promotion of recycling initiatives. It also indicated that the solid waste is being dumped at the dumpsite due to a lack of a landfill, which could promote transmission of diseases in the community which is close to the dump site, a risk to public health.

4.6.3 Other Factors Affecting Waste Management in Dowa

Interview with the Environmental officer at the Dowa District Council on the factors affecting the performance of waste management activities. He revealed as follows;

"*Some of the factors affecting the operations of the Dowa council on waste management include; low investment due to lack of financial resources, weak coordination and low private sector participation"* (KII, Environmental Officer, Dowa District Council).

This showed that there are several factors which affect the Dowa District Council in carrying effective management of solid waste apart from the public incompliance. Dealing with the factors affecting waste management performance prevents environmental pollution, and reduces the burden of disease, eventually being cost-effective in reducing the drug budget.

The thematic analysis highlighted the availability of behaviour change communication among the market users which was being provided by the health surveillance assistants, officials from the Welt Hunger and other stakeholders. It revealed the problems of accumulation of solid waste due to low collection rates of solid waste, as a result of the lack of vehicles for transportation of solid waste. The analysis further showed factors that contributed to low recycling rates, as it was reported that there is a problem with the lack of recycling equipment. It was revealed that solid waste was a resource for economic gain, as some people explained generating income through it.

4.7 Summary of the Results Chapter

The results of the first objective suggest the availability of good knowledge on solid waste management among the market users at Dzaleka. However, though a majority of respondents showed good knowledge, some market users reported inadequate knowledge of effective solid waste management practices.

The results for objective two indicated a positive attitude among the market users at Dzaleka Market. However, the positive attitude of the study respondents was not related to the observed results of poor solid waste management practices. This suggests a need for improvements in people's behaviours. The results for objective three indicated that the majority of the study respondents reported poor practices of solid waste management. This suggests problems with awareness and lack of adequate knowledge of effective solid waste management practices, requiring to be addressed. The results for objective four suggest factors affecting solid waste management at Dzaleka such as the lack of sanitation infrastructure for solid waste disposal for instance no landfill, accumulation of solid waste due to lack of vehicles for solid waste collection and lack of resources for investment in waste management. The lack of coordination between stakeholders was also reported to be a factor affecting the performance of solid waste management at Dzaleka market. The results are discussed in the next chapter five.

CHAPTER FIVE: DISCUSSION

This section discusses the study findings in comparison with related literature and other studies previously conducted. Furthermore, it provides a critical analysis and understanding of all key study findings. The quantitative research findings collected through the questionnaire concerning the objectives are discussed. The qualitative results collected from the two focus group discussions and the key informants' interviews are discussed in this section. The study assessed the knowledge, attitudes and practices of market users on solid waste management at the Dzaleka Market.

5.1 Socio-demographic characteristics of the respondents

The demographic characteristics of respondents such as age, marital status, education level, and gender are vital components when evaluating people's knowledge, attitudes, and practices, as described by *Chu, et al.* (2016); as cited in (Joseph 2022). All the (*n* = 138) respondents consented to answer the questions, there was a 100% response rate. Slightly above half (52.17%, *n*=72) of respondents were males and (47.83%, *n*=66) were females. The findings were consistent with those from a study by Omar *et al.* (2019), which found that 57.3% of respondents were males and 42.7% were females. A similar study by Ekoro *et al.* (2022), found that 54.4% of respondents were females, while 45.6% were males.

The majority of respondents had formal education, with primary (44.93%, *n*=62), secondary (33.33%, n = 46) and those with tertiary (11.59%, n= 16). The findings of this study were also inconsistent with the study by (Joseph 2022); who found that slightly above half (55.9%) of respondents had a secondary level of education. According to Seng *et al*. (2018) and Han *et al*. (2018) in (Giao and Thien 2022), high education levels significantly improve one's understanding of solid waste management.

Similarly, in a study by Almasi *et al.* (2019), the recycling practices were influenced by the education level of the respondents. In this study, the majority (71.01%) of respondents who were in the age range of 18-39 reported a willingness to do the recycling of solid waste. This may be attributed to the acquired formal education, as well as exposure to information on waste management among the productive youth group through different platforms including Radio and other media of communication. It was expected that since the majority of the study respondents had formal education, this was likely to translate to good practices in solid waste management. The study found no significant relationship between high levels of education and practices.

5.2 Knowledge of solid waste management among Market users.

This section discusses the results of the knowledge of the market users on the effects of solid waste management on the environment and public health. The majority of respondents reported poor solid waste management as contributing to environmental pollution and disease burden. Solid waste collection, open disposal methods and composting were mostly practised at Dzaleka Market. The majority of respondents did not know the benefits of solid waste segregation and were also not aware of effective solid waste disposal methods. The Chi-square results of knowledge questions against the demographic factors were statistically significant on the benefits of solid waste segregation against the level of education of the study respondents.

5.2.1 Knowledge of the effects of poor solid waste management

The study found that majority (77.54%, n=107) of respondents had good knowledge of solid waste management. The findings were consistent with the study of Omar *et al*. (2019), who found that majority (58%) of respondents had good knowledge towards solid waste management.

Similarly, a study by Giao and Thien (2022) found that 54% of the household respondents had good knowledge of solid waste management. The majority (90.58%, *n* =125) of respondents knew the effects of solid waste on public health and the environment (Table 4). The respondents reported good knowledge, and a positive attitude but displayed poor solid waste management practices. Observational results indicated open dumping, indiscriminate disposal of solid waste and an accumulation of solid waste within the market setting. The level of knowledge of the market users did not translate to good practices, suggesting a need for further research to identify other factors.

The other majority (65.94%, *n* = 91) agreed that poor management of solid waste has effects on the health of human beings, causing sanitation-related diseases such as diarrhoea, typhoid and Cholera. The findings of the study are consistent with the study of Fadhullah *et al.* (2022), where 95.9% of respondents were aware that improper solid waste management leads to diseases such as diarrhoea and Malaria. Similarly, findings agree with the study of Eshete *et al.* (2023), which found that 90% of households correctly understood the adverse effects of improper solid waste disposal on the environment as a source of waterborne diseases including diarrhoea, cholera and typhoid. The poorly disposed waste acts as vectors for disease-causing organisms for conditions such as Malaria, diarrhoea and Cholera (Njewa *et al.* 2022). Good knowledge of sustainable solid waste management has significant impacts on the practices of individuals significant for public health.

A few respondents (22.46%, *n* = 31) reported air pollution (table 5). The findings agree with those from the study of Kubanza and Simatele (2020); which found that 33% of respondents reported that solid waste contributed to the destruction of the vegetation, and 30% and 20% of the respondents described water and air pollution respectively. Turpie *et al.* (2019); describe the impacts of illegal dumping of solid waste in deposit sites as contributing to air and water pollution.

Good waste disposal systems lead to significant improvements in the health of the masses in the communities (Orhorhoro and Oghoghorie 2019). The findings of the study showed that the market users were aware of the effects of poor solid waste management, which was supposed to translate to good observed practices. It was reported that behavioural change communication messages were being shared to the market users through awareness campaigns, and routine educational programs by the health surveillance assistants and other stakeholders. In addition, the Yethu community radio station played a big role in sharing information on waste management within the Dzaleka catchment area, this has an impact on individuals' understanding.

5.2.2 Knowledge of effective solid waste disposal methods

Half (50.72%, n = 70) of respondents reported inadequate knowledge of effective solid waste disposal methods (Table 4). The majority of respondents reported being more knowledgeable about solid waste composting. In this study, solid waste disposal methods mostly practised by the majority were open dumping, collection and disposal, mainly used for ease of solid waste disposal. The findings were similar to those of Eshete *et al.* (2023); who found that respondents had correct knowledge and positive attitudes but 80% practised improper solid waste disposal, open dumping in roads, gullies and burned solid waste. This was a risk factor for disease spread of sanitation-related diseases including cholera. Similarly, a study by Lema *et al.* (2019), found that 83% of the respondents of Assella town in Ethiopia lacked knowledge in removal methods which led to improper waste disposal. The study findings are consistent with those from a cross-sectional study by Laor, *et al.* (2018), in Northern Thailand, who found that despite market traders' overall knowledge, their practices towards proper solid waste disposal were below average. The management of waste is focused on how to find value and redirect it back to the community (Omar *et al*. 2019).

The findings suggest a significant gap in public awareness and understanding regarding waste management practices. A need for improved communication and education to encourage responsible waste disposal practices among market users.

The observational results showed open dumping of solid waste which was attributed to poor solid waste disposal of solid waste. The poor solid waste disposal by market users could be attributed to inadequate awareness and negative attitudes among some individuals. It is also suggested that the shortage of sanitation equipment such as bins availability contributed to poor disposal of solid waste by some market users. The lack of regulations and by-laws by the Dowa District Council on solid waste management practices might also be a contributing factor to poor solid waste disposal. The accumulation of solid waste is a risk factor to the environment contributing to soil pollution and groundwater contamination.

5.2.3 Knowledge of solid waste segregation benefits

Slightly above half (55.07%, n = 76) of the respondents in this study reported having inadequate knowledge of the benefits of solid waste segregation (Table 4). The findings in this study are similar to that reported by Manyazewal and Waleign (2019), in JigJiga city in Ethiopia, where the majority (65.95%) of the respondents did not separate solid waste as they were not aware of its benefits. The findings of this study are consistent with those from the household study by Donacho *et al.* (2023), who found that (21.53%) of the respondents knew about waste separation in the town of Bedelle in Ethiopia. The findings of this study are also consistent with those of the study of Oyeleye *et al.* (2021), who found that 43% of the generated solid waste in the Mowe Market in Ogun state in Nigeria ended up in landfills due to the lack of adequate knowledge on sorting. The lack of solid waste separation among respondents in this study could signify inadequate awareness. This could lead to increased amounts of solid waste disposed off in dumpsites.

Observation results showed unseparated solid waste in the disposal sites. This might also have contributed to the limited reuse and recycling of solid waste which was reported by the majority of respondents in both the quantitative and qualitative results. The reason for a low level of solid waste separation was attributed to inadequate knowledge and awareness of its significance. The other reason why the market users would not separate solid waste would be the lack of available market for recyclable materials which could be acting as a motivating factor to be involved in the recycling initiative. The knowledge of the benefits of solid waste separation for economic gains would facilitate reuse and recycling among the market users. Waste separation and recycling at source help in the reduction of waste that is sent to landfill (Orhorhoro and Oghoghorie 2019).

5.2.4 Knowledge of solid waste collection methods.

The majority (87.68%, n = 121) of respondents knew waste collection methods at the Dzaleka market (Table 4). The other majority (76.81%, n = 106) of respondents knew that solid waste could be sorted and recycled, and composted. The study findings were similar to the study of Njewa *et al.* (2022), who found that organic matter was being recycled into farm yard manure, while plastic and metals were being recycled on a smaller scale. Another study by Sarbassov *et al.* (2019), found that waste reuse, recycling, and recovery were significant for the reduction of disposed waste in landfills. Observation results showed mixed solid waste, biodegradable and non-biodegradable, signifying less knowledge of the benefits of waste segregation. This was in agreement with the quantitative results of the study as less than half (33.33%, n = 46), of respondents reported composting as a preferred method, while a few (22.22%, n =31) of respondents reported disposal in a landfill and (27.78%, n = 38) indicated that they would do incineration (Fig. 6). The study findings shows that less than 50% of market users were involved in composting of solid waste.

Its promotion would lead to a reduction of solid waste which is sent for disposal to the dumpsites at Dzaleka Market. The findings of the study are in contrast with those of Nyampundu *et al.* (2020), in the Majengo Market in Tanzania, who found that (1%) of the respondents practised incineration, (18.9%) burned solid waste and (80.1 %) reported disposing of solid waste into the dumpsites.

The quantitative results were consistent with the qualitative results as the majority of respondents from the focus group discussion and key informant interviews reported that solid waste recycling through compost was mostly being practised. The majority described the collection, transporting, and disposal, as the common solid waste methods taking place at Dzaleka market. There was a need for improvements in the levels of composting as a reduction method. The qualitative observational results showed solid waste disposed off in a dumpsite close to the community, signifying inadequate disposal infrastructures. This posed a risk to the environment with market users becoming prone to sanitation-related diseases such as diarrhoea and cholera. In this study on average (77.54%, n = 107) of the respondents showed satisfactory knowledge, and positive attitudes towards solid waste management through the face-to-face interviews but displayed poor solid waste management practices. This is a risk factor to public health, necessitating improvements in awareness that would change the behaviours of the market users.

The poor response rate on practices on solid waste management indicated inadequate knowledge among the market users that needs improvement to prevent environmental pollution and sanitation-related diseases such as diarrhoea and deadly cholera. Zavodska *et al.* (1996) in Olukanni *et al.* (2020); described knowledge as it influences effective solid waste management practices. In the study, the market users showed knowledge as key in the provision of influence towards any situation including that of solid waste management at Dzaleka Market.

Knowledge, attitudes, and practices were analysed using a Pearson chi-square of independence. According to Agwu (2012), Jatau (2013), Alkhatib, *et .al* (2009) in (Ekoro *et al*.2022) these factors were selected on the theoretical assumption that they are significant in studying solid waste management in a population. The Chi-square is statistically significant at the level of ≤ 0.05, the study showed statistical significance on demographic factors which included the level of education, age and employment status of respondents. Its significance was seen in the knowledge and practices questionnaire against the socio-demographic characteristics of study participants.

The Pearson Chi-squared test of independence showed statistical significance on knowledge of the benefits of solid waste segregation, against the respondents' level of education, which indicated a P-value of $0.03 \leq 0.05$ (Table 6). The findings of the study agree with those of the study of Almasi *et al.* (2019), in Kermanshah, Indonesia, who found that in the chi-squared analysis, the educational level factor was associated with the good practice level of the study respondents. Those with formal education were motivated to do recycling of solid waste. In this study, some of the solid waste management practices, and use of sanitation equipment, such as the use of bins were promoted by people with formal education as they understood better as compared with those with informal education. Seng *et al*. (2018) and Han *et al*. (2018) as cited in (Giao and Thien 2022) describe that a high educational level significantly improves the understanding of solid waste management. The attitude questionnaire did not show any statistical significance on the Chi-square test of independence against the demographic characteristics of study participants (Refer to Table 8). The observational results showed the behaviours of open dumping and indiscriminate disposal of solid waste by a few individuals with negative attitudes

5.3. Attitudes of respondents towards solid waste management.

This section discusses the results of the attitudes of respondents towards solid waste disposal. The majority of respondents showed good knowledge and positive attitudes through face-to-face physical responses. However, their practices were poor as there was open dumping of solid waste. The other majority agreed that poor disposal of solid waste would lead to pollution of the environment and lead to the spread of sanitation-related diseases such as diarrhoea and Cholera. The respondents reported that they would be involved in solid waste management activities for ease of disposal, and to prevent environmental pollution and diseases. The solid waste management practices of reuse and recycling were reported to be done but on a small scale, as the majority had inadequate knowledge.

5.3.1 Attitude of respondents toward solid waste disposal

The findings of this study indicate that the majority (75.36%, n = 104) of the respondents agreed on the significance of not dumping solid waste in open spaces and drains. The other majority (90.58%, n = 125) of respondents reported the occurrence of pollution as an effect of improper solid waste disposal. The findings of the present study are similar to those of the study of Adetola and Omonijo (2019) who found that (94.5%) of the respondents believed that careless waste disposal constituted a public health risk. The findings are consistent with the study of Olukanni *et al.* (2020); who found that (63.4%) of respondents reported not disposing of their solid waste at open dumps. Similarly, the findings are consistent with the study of Mochache *et al.* (2020); who found that (63%) of households in Embu state in Nigeria did not discard their solid waste in open dumps. Despite the positive attitude reported by respondents through the face-to-face interviews, they showed poor practices. The findings suggest a gap in public awareness needs improvement.

In the study (58.70%, *n* = 81) respondents reported not being aware that individuals play a key role in solid waste management. The findings were similar to the study of Joseph (2022), who found that (82.6%) of respondents reported that not everybody had a responsibility in solid waste management. This indicated a lack of awareness among the market users, which influenced their attitude toward behaviour change by taking a role in preventing poor practices of solid waste management and protecting the environment and public health. Byamba and Ishikawa (2017) in Iraguha *et al.* (2022) argue that the attitude of individuals plays a key role in solid waste management, behaviour as a barrier.

Observations made during the survey indicated that open dumping was the standard practice that was being done by the majority of the market users. The findings of the face-to-face physical interviews with the market respondents showed good knowledge and a positive attitude, but poor solid waste management practices were mostly displayed by the majority. Some market users had negative attitudes which influenced the poor practices. It is suggested that other factors such as the lack of adequate sanitation equipment such as bins, might have played a role in market users' displayed practices. Furthermore, the lack of sanitation infrastructure such as landfills, might also have contributed to improper final solid waste disposal. These might expose the community to environmental and health issues due to the poorly disposed solid waste. The openly dumped solid waste in drains is a breeding ground for vectors such as mosquitoes a risk for the transmission of Malaria. Previous studies have related solid waste such as plastics to cholera spread. Plastics in the environment acted as significant reservoirs for *V.Cholerae*, pathogens transferred to water bodies from plastic and organic waste spreading Cholera (Ormsby *et al.*, 2024).

In the key informant interviews with the health surveillance assistants at Dzaleka Health Centre, the majority indicated that they provided health education on waste management to the people surrounding the catchment area of Dzaleka. The officials from the Welt Hunger an organization working on WASH at Dzaleka reported that the majority of people lacked ownership and had a mentality that individuals do not have a role to play in solid waste management. Behaviour change is key in the prevention of diseases that come as a result of bad behaviours. Bad behaviours such as poor disposal of solid waste bring ill health to the communities (Laverack 2017). The study has indicated that the availability of good knowledge is not the only factor that can help in changing bad behaviours of poor solid waste disposal, but there is a need for a change of mindset to change people's attitudes.

5.3.2 Public participation in solid waste management

The majority (84.05%, n = 116), of respondents, agreed that participating in solid waste management activities is everybody's responsibility (Table 7). The majority of respondents in the study reported participating in solid waste management activities such as cleaning sources of solid waste generation and the use of disposal sanitation facilities such as bins. The findings were similar to the study conducted by Almasi *et al.* (2019), in Kermanshah City in Iran, who found that the participation of citizens led to the success of household segregation and mitigation.

The findings of this study are in contrast with the study of Joseph (2022), in a study on KAP on solid waste management in Eastleigh South Ward in Kenya, who found that the majority (82.6%) of respondents thought that not everybody had a responsibility in waste management. There is a need for awareness of the effects of poor solid waste management to market users through capacity building and sensitisation to promote public compliance in waste management.

5.3.3 Attitudes of the respondents toward collection of solid waste.

In this study, the majority (84.78%, *n* = 117), of respondents (Table 7), reported that there should be a regular collection of solid waste from Dzaleka Market as this could help to prevent its accumulation and avoid the transmission of sanitation-related diseases such as cholera. The findings of the study are similar to the study by Giao (2021) which found that (83.3%) of respondents agreed that garbage collection locations had a very high impact on the aesthetic area and human health. This study showed slightly above half (56.52%, *n* = 78) of the respondents reported that solid waste is collected once a week, the least (7.25%, *n* = 10) indicated as being collected within 2 weeks and (36.23%) reported collection of solid waste from the market as being done once a month. The findings are similar to the study of Joseph (2022); who found that (61.0%) of respondents reported a solid waste collection interval of once a week, and (28.8%) reported a solid waste collection interval of twice a week.

The quantitative data did not agree with the qualitative data as the focus group discussion and key informant interviews indicated that there was a low collection of solid waste from the markets due to a lack of adequate vehicles for collecting solid waste. Observational results showed accumulation of solid waste in most disposed sites within the market signifying a frequency of solid waste of an interval of greater than 2 weeks. Figures (9A, 9B) of openly dumped and accumulation of solid waste within the market signified problems with the disposal, transport and collection system which is a risk factor for the growth of microorganisms that lead to the spread of sanitation-related diseases such as diarrhoea and cholera. Solid waste should at least be collected within one week of its generation. The accumulation of solid waste in disposal sites within the market is a risk factor as it may lead to the development of harmful toxins and bacteria. This leads to pollution and may also lead to soil and groundwater contamination.

The knowledge of proper solid waste disposal methods and collection is significant for the prevention of sanitation-related diseases. The up-surge of cholera cases in Malawi in 2022 in the dry season was partly attributed to poor hygiene and solid waste management. (WHO 2022).

5.3.4 Attitude of the respondents towards solid waste management practices

In this study, the majority (77.53%, *n* = 107) of respondents (Table 7), showed a positive attitude toward solid waste reuse, reduction and recycling. The findings in this study are similar to the study by Almasi *et al.* (2019), in Kermanshah, which found that (79%) of respondents' households knew to reuse and recycle and (86%) of respondents had a positive attitude toward reducing, reusing and recycling municipal solid waste. In a similar study by Ram and Kumar (2021), on KAP in Yirgalem town communities in Ethiopia, (91.3 %) of respondents reported practicing solid waste reuse and recycling. The lack of adequate information and awareness may have contributed to negative attitudes towards reuse and recycling initiatives. According to Ao *et al*. (2022); cited in (Giao and Thien 2022), attitude has been shown to have a great influence on practices. Christiam *et al.* (2023) found that attitude and knowledge were the best predictors of waste separation behaviour. The findings demonstrate that the market users had a positive towards sustainable solid waste management practices of reuse and recycling which should be reinforced.

In practice, it was observed that the reuse and recycling of solid waste was done at a low level as compared to the solid waste which was being disposed off in the dumpsite. Majority of respondents from focus group discussions indicated that plastic bottles were mostly reused by market users. Some respondents reported selling metal scraps to traders for recycling purposes. The qualitative thematic analysis showed themes of reuse, recycling and commercialisation of solid waste done by the market users (Table 14). The district council and other stakeholders would help in the formation of recycling cooperatives in the community surrounding Dzaleka Market.

In this study, the majority (84.06%, *n* = 116), of respondents, disagreed that open burning is a good method. The other majority (59.42%, *n* = 82), of respondents, disagreed that open burning of solid waste does not affect the health of the human being (Table 7). The findings from the present study show that respondents were knowledgeable, and viewed the burning of waste as a poor practice. Majority reported that it would cause respiratory problems to the public. The findings are similar to the study of Olukanni *et al.* (2020); in Ogun state Nigeria, who found burning as one of the standard practices that was observed during the survey. The open burning of solid waste is one of the poor practices in solid waste management that brings respiratory problems to the community (Mihai and Grozavu 2019). The market users at Dzaleka showed a positive attitude, as they regarded solid waste burning as a bad practice.

The recent study findings indicate that almost half (48.55%, *n* = 67) of respondents were not satisfied with solid waste collection services, (42.75%, *n* = 59) were partly satisfied and a few (8.70%, *n* =12) respondents were satisfied. The majority of respondents reported the reason for not being satisfied, as the low solid waste collection rate at Dzaleka Market. The accumulation of solid waste in most areas of the market was a risk factor for environmental pollution, which leads to soil and groundwater contamination. The findings were similar to those in a study by Manyazewal, and Waleign (2019) which found that a few (20%) respondents were unsatisfied with the solid waste collection service from the municipality. The recent study findings are inconsistent with the study of Drimili *et al.* (2020) who found that (60%) of the respondents showed satisfaction with the municipal waste collection services, regarding the distance the bins were allocated. This promoted the recycling of solid waste which eventually influenced the solid waste collection frequency.

In this study, the quantitative results agreed with the qualitative data from the focus group discussion, as the majority of respondents were not satisfied with the solid waste collection service. The solid waste collection rates were more than 2 weeks to a month which was a catalyst for being the breeding grounds for mosquitoes and feeding sites for animals such as rodents. These may facilitate the spread of diseases. The solid waste collection service needs improvement in coordination efforts between the Dowa district council and stakeholders like Welt Hunger a UNHCR organization which was reported to be mostly involved in the collection of solid waste at Dzaleka Refugee Camp.

5.4.0 Market user's practices on solid waste management

The study respondents showed good knowledge, and a positive attitude, but displayed poor solid waste management practices. There was dumping of solid waste in undesignated places such as drains and gutters which was observed in many areas surrounding the market of Dzaleka. The accumulation of waste in disposal sites showed problems with the disposal and collection systems. This was critical for the growth of the microorganisms aiding in the spread of sanitation-related diseases such as diarrhoea and Cholera. The poor disposal of solid waste in the drains and gutters would lead to clogging blocking the drainage system and aid in the breeding of the vectors for malaria.

5.4.1 Solid waste disposal practices at Dzaleka Market

Slightly above half (52.17%, $n = 72$) of respondents reported dumping solid waste in undesignated places (Table 9). The findings are similar to the study of Ekoro *et al.* (2022) who found that (84%) of respondents displayed poor disposal practices, (46%) had poor knowledge, while in this study (22.32 %) of respondents had poor knowledge.

The findings were inconsistent with the study of Mochache *et al.* (2020), who found that (37%) of households discarded their waste in open places. The study findings signify a lack of adequate information and awareness on the proper solid waste disposal which is a risk to public health. Open dumping causes air, water and land pollution.

The majority (78.99%, n = 109) of respondents reported that there is a practice of disposing off solid waste in drains and gutters (Table 9). The findings of this study are similar to the study of Omar, *et al.* (2019), which found that (58%) of respondents had good knowledge, 62% had a positive attitude, (65%) of respondents showed poor practices and there was indiscriminate disposal of solid waste. Similarly, in a study by Joseph (2022); respondents had good knowledge which did not influence good solid waste management practices. The disposal of solid waste in drains and gutters is a risk factor for the breeding of mosquitoes spreading malaria and cholera. It can further contribute to flooding in the areas where people live due to blockage of the drainage.

Another majority of respondents (71.01%, n = 98) reported that there was no proper use of refuse bins at the Dzaleka Market (Table 10). The practice of improper use of bins was attributed to a lack of awareness and negative attitudes of the market users which required a mindset change. The lack of adequate sanitation equipment might also have contributed to the behaviour of open disposal of solid waste in the market. Observational results showed a few bins were placed at far distances within the market, full of solid food waste, with spillage around the bins. The qualitative data analysis indicated poor disposal of solid waste due to inadequate sanitation equipment. An interview with the WASH (Water Sanitation and Hygiene) Engineer for Welt Hunger, a UNHCR organization, described problems with the negative attitude of some individuals who could encourage the open dumping practice usually at night.

There is a need for continued education and awareness programs to influence behavioural change in individuals towards solid waste management. The findings suggest a large gap in understanding effective waste management practices. This suggests a need for effective communication strategies, public awareness campaigns and educational initiatives to bridge the knowledge gap.

The majority (94.2%, n = 130) of respondents reported that there was no practice of separation or segregation of solid waste at the Dzaleka Market (Table 9). The findings agree with Iraguha *et al.* (2022), (98%) of respondents did not separate solid waste due to a lack of information and awareness. Similarly, Manyazewal and Waleign (2019), in Jigjiga Ethiopia, found that 65.95% of respondents did not separate the solid waste from the market. The findings of this study are inconsistent with the study of Fadhullah *et al.* (2022), in East Coast Malaysia, who in a household study on solid waste management practices and perceptions, found that 50.3% of the respondents practised waste segregation at home.

In a study by Almasi *et al.* (2019), in Kermanshah, (56.65%) of the respondents were involved in the separation of solid waste as a social duty. Chu *et al*. (2016) as cited in Almasi *et al.* (2019), described the motivation of people and marketing of recycled products as driving factors that would increase the participation of people in solid waste separation. According to Bonrood *et al.* (2015), as cited in Mpanang'ombe *et al.* (2021), behavioural change and educational programs increased waste separation from 20% to 35% in Thailand. The majority of respondents had an inadequate knowledge of solid waste separation and did not understand its significance. The low separation of solid waste implied low levels of reuse and recycling, which is significant in reducing the amount of disposed waste. Promotion of source separation of solid waste would reduce the amount of disposed waste in open dumpsites (Krecl *et al.*, 2021). The lack of solid waste separation has the effect of reducing the recyclability of solid waste.

In a present study, the low solid waste separation could be due to inadequate knowledge of the market users. A study by Sarbassov *et al.* (2019) in Nur-Sultan City in Kazakhstan, found that 31% of the respondents in households reported public awareness as a hindrance to solid waste separation, and at least (24%) of the households were involved in sorting the solid waste. Miezah *et al*. (2015) cited in Addae *et al.* (2021), found that (17.6%) of households could promote solid waste separation practices in plastic waste as they could understand the monetary value of the recycled products. The observational qualitative results showed that there was no separation of solid waste, as food waste, bottles, plastic papers and other waste were seen unseparated in the disposal sites. The majority of the respondents from the focus group discussion did not understand the significance of solid waste separation. There is a need to encourage active participation in creating sustainable solutions by following sustainable solid waste management practices.

In this study, above half (66.67%, $n = 92$) of respondents reported that there was no application of reducing, reusing and recycling of waste at Dzaleka Market (Table 9). There was low participation in the sorting of solid waste at Dzaleka Market contributing to low reuse and recycling initiatives. The reason for reuse and recycling to be done on a low level by the market users could be attributed to inadequate knowledge of the market users of its significance. The findings of this study are inconsistent with the findings of the study by Ram and Kumar (2021), in Yirgalem town in Ethiopia, in which (91.3%) of the respondents in municipal solid waste management practised solid waste reuse and recycling and 43% of solid waste was reused, this promoted sorting. In a study by Kalina *et al.* (2021), in Chembe, in Mangochi, on conceptualizing reuse in African households, it was found that respondents' reuse of solid waste was motivated by the earning of income which was realized through reselling of waste items.

The creation of a market of recyclable items could promote solid waste separation (Manyazewal and Waleign 2019). Nyarko *et al* (2021) and Wang *et al* (2020), as cited in Njewa *et al.* (2022) describe recycling as being of significance both to the environment and to the community, in reducing solid waste which is sent for disposal. Reuse and recycling help in the reduction of disposed solid waste in dumpsites, helping to reduce environmental pollution and economically, and socially preventing disease spread.

A few respondents (33.3%, $n = 46$); reported that they indulge in composting solid waste, as the processing is done at the Dzaleka market (Fig. 6). The present study findings are similar to those of Adetola and Omonijo (2019), in Nigeria, who found that (25.8%) of households practised solid waste composting. Similarly, Almasi *et al.*, (2019), in Kermanshah, in a household study found that (16.91%) of respondents were aware of recycling organic matter, and home composting was used as a waste reduction method. In this study, food waste was reported by almost half (40.07%, $n = 55$) of the respondents (fig.7). Composting brings benefits to the environment through the reduction of greenhouse gas emissions and enrichment of soil quality (Chen *et al.* 2020).

The observational results indicated open dumping, an accumulation of solid waste in undesignated places, displaying unhygienic conditions at Dzaleka Market a risk factor for public health. It was observed that composting of the solid waste was done at the dumpsite and in some selected areas where the solid waste could accumulation for longer periods. The practice of composting was seen to be beneficial for economic gain, with a need for its promotion as it is known to reduce the organic degradable solid waste dumped in disposal sites.

The Chi-square test of independence showed statistical significance on practice questions. The demographic factor of the age of the respondents who would be willing to recycle solid waste if the recycling program was set up showed a statistical significance value of $0.02 \leq 0.05$ (Table 10).

In this study, younger respondents with the age range of 18 up to 50, showed more willingness to do recycling of solid waste than the older respondents. The study findings were consistent with that of Almasi *et al.* (2019) who found that the younger study respondents who had attained academic education enjoyed better knowledge, attitudes and practices of solid waste management. The findings of this study were inconsistent with Sarbassov *et al.* (2019), who found that two-thirds of waste was sorted by the elderly greater than 50 years old. The results suggest attention by the government through the district council and other stakeholders for the provision of educational programs and awareness campaigns to encourage active participation in sustainable solid waste management. This could be done through the promotion of recycling cooperatives among the communities, for improvement of reuse and recycling initiatives.

5.5.0 Composition of waste generated at Dzaleka Market

Slightly less than half (40.07%, *n* = 55); of respondents reported food waste as being generated in abundance, plastic waste (35.21%, *n* = 49), paper waste (21.72%, *n* = 30), textile (0.75%, n = 1) and metals (2.25%, *n* = 3) (Fig.7). The reuse and recycling could be promoted for reduction of the solid waste to be sent for disposal. In a similar study by Nyampundu *et al.* (2020) in Majengo Market in Tanzania, the solid waste generated was as follows; food waste (54.4%), plastic waste (49.1%) and paper waste (17%). Similarly, Lema *et al.* (2019); in a household study assessing solid waste, in Asse town in Ethiopia, found that solid waste generated was as follows; plastics (34.8%), food residues (31. 4%), paper waste (30.3%) and metal waste was (1%). In another study by Donacho *et al.* (2023), in Bedelle town in Ethiopia, solid waste generated was as follows; food waste (53.30%), paper (2.30%), plastics (1.91%), metals (0.40%), and textile (0.44%). Chen *et al* (2018), in (Awogbemi, *et al.* 2022), describe that metal, paper, plastics, food waste, and textiles can be recycled and reused for economic gains.

Reuse and recycling can also help in reducing environmental pollution. In this study, the reuse and recycling of solid waste was done at a lower level, as few respondents reported doing the practice. Observational results indicated organic waste being in abundance which could be composted and plastic bottles could be reused reducing solid waste for disposal.

5.5.1 Economic Practices of Solid Waste at Dzaleka Market

Almost half of respondents (47.62%, *n* = 66); reported solid waste as being used for composting at the Dzaleka market, this was being sold by some individuals. The compost manure was reported to be sold to the people doing farming business. A few respondents (35.03%, *n* = 48); reported solid waste as being used for revenue generation through the waste collection business. (Table 11). The management of waste was focused on how to find value and how the community benefited (Omar *et al.* 2019).

The findings from the current study are similar to the study of Ram and Kumar (2021) in a municipal solid waste management practice study in East Asia, in which 47.1% of organic waste was used as fertilizer, (22.8%) of solid waste sorted was for salable to Quaraleos, (43.3%) and (2.3%) were sorted for reuse and recycling respectively. The findings of this study showed that slightly less than half (42.86%, *n* = 59) of respondents indicated doing metal recycling for economic gain. (Table 11). In the current study, a few respondents (14.29%, *n* = 20) reported that they could be paid by a UNHCR NGO Welt Hunger based at the Dzaleka for solid waste collection from the market (Fig.8). The findings of the thematic analysis indicated that solid waste commercialisation was one of the themes that were developed. The WASH engineer for Welt Hunger confirmed paying 8,500 Malawi kwacha per 3-tonner vehicle to private sanitation providers for the collection of solid waste from the market. This indicated that some market users benefitted revenue from solid waste collection through transportation.

Slightly above half (55.07%, *n* = 76), of respondents reported that waste business practices take place at the Dzaleka Market. (Table 12). The findings are similar to the study of Yu *et al.* (2020), who found that (56%) of informal waste pickers earned income through their work of collecting waste. Similarly, the findings are in agreement with the study of Iqbal *et al.* (2023) who found that in Pakistan revenue generation was found in sales from (70%)of recyclables and 50% of compost. The waste was a resource that contributed to 5.5 % of its budget and contributed to a GDP (gross domestic product) of (1.4%). Millions of people worldwide make a living by obtaining their income through solid waste resources such as metal recycling (Morais *et al.*, 2022). The findings of the current study signify the benefits realised through the waste management business which needs promotion.

The qualitative results were in agreement with the quantitative results as a theme of commercialisation of solid waste through the reuse of solid waste was reported by the majority of respondents in the focus group discussion. The majority reported that plastic bottles were collected and sold to traders with shops to sell cooking oil, while some were sold to local people who used them for selling locally made drinks. The majority of respondents reported finding income through the sale of food waste such as vegetables which were sold to livestock farmers to be used as feeds. These practices contributed to good sanitation and hygiene at the market as the solid waste was collected.

Slightly above half (57.25%, *n* = 79), of the respondents, indicated that sometimes exploitable materials are collected by the informal waste pickers or waste entrepreneurs (Table 12). The findings are similar to the study of Kalina *et al.* (2021) who found that the majority of the respondents reported the practice of reuse such as metal cans which were reused as flower pots.

The clothes thrown away were recollected the rags were made into mops which were a source of income for the villagers of Chembe as they created their waste market. According to Dinler (2016) in Morais *et al.* (2022) waste pickers have helped in the protection of the environment as solid waste is being collected and recycled from public places. In a study by Kasinja and Tilley (2018), in Zingwangwa, Blantyre, informal waste pickers collected significant amounts of plastics of up to 20 kilograms and metals of up to 30 kilograms per day. The promotion of the collection of solid waste for reuse and recycling could contribute to a reduction of waste disposed of in dumpsites, preventing environmental contamination in the process.

Results from the observations showed unseparated solid waste in most of the disposal sites within the market and at the dump site. This indicated that the separation was not being practised, a situation that was attributed to a lack of recycling infrastructure and lack of awareness. This could have contributed to the low reuse and recycling of solid waste. This raises a need for awareness of the significance of solid waste separation that contributes to waste recovery options such as recycling. The promotion of initiatives to increase the collection of recyclables through sensitisation campaigns can lead to improved waste management practices.

In the present study, (26.19%, n =36) of the respondents reported the business of metals and bottles recycling and reuse respectively (Fig.8). The findings of the study are inconsistent with those from a study by Onesmo *et al.* (2024) in Arusha, in which there was a high level of scrap metal recycling and an increased awareness of the value of these materials. The findings are also inconsistent with Morais *et al.*(2022) who found that the scrap metal trade had helped in encouraging solid waste recycling bringing economic gains to the informal waste pickers and reducing pollution in the environment. The present study has shown that people did not have a good understanding of the value of metal recycling.

An increase in awareness would help in the reduction of the amount of metal scraps in dumpsites, which causes injuries to informal waste pickers as they move. The results also suggest a change in focus for metal recycling by the authorities as they promote the business.

The least respondents (4.74%, n = 6) indicated that solid waste could be sold to local waste entrepreneurs for briquette making (Fig. 6). Some of the respondents reported that solid waste from agricultural products was collected and used for making briquettes on a low level. The findings of the study are inconsistent with those from the study of Saidan *et al*. (2017), in Addae *et al.* (2021), in Kumasi, Ghana, who described the practice of recycling and waste business as being strengthened by the availability of the markets for the recycled products. According to Pinha and Sagawa (2020), the adoption of an increase in the collection of recyclables, was due to investment in cooperated training, and sensitization campaigns for recycling, as they are key to economic as well as environmental improvements.

In the present study, almost half (44.05%, *n* = 61) of respondents reported the selling of cabbages which are used as animal feeds by farmers at the Dzaleka Refugee Camp and the surrounding areas (Figure 8). The findings of the study agree with those from the study of Kumar *et al*. (2018) in Addae *et al.* (2021) who reported that (35%)of respondents reported plastic reuse. The reuse of solid waste was reported by less than half of the respondents during interviews. Plastic bottles were collected and sold for reuse purposes, this contributed to hygienic conditions. Similarly, in a KAP study in Ibadan, Babei *et al*. (2015), cited in Eshun *et al* (2021), in Kasoa in Ghana, found that (1.7%) of home participants practised the reuse of solid waste materials. The findings are inconsistent with those from the study of Kalina *et al.* (2021) in which the majority of respondents had diverse reuse practices, which reduced solid waste disposed off in sites.

The results from the focus group discussions revealed that majority of respondents reported selling cabbage waste to the farmers as animal feed. This was one of the practices of waste reuse that could help in the prevention of environmental pollution. The briquette making was reported to be done on a smaller scale by a certain local organisation previously. Some of the respondents in the focus group discussion reported a change in government policy towards the metal scraps trade contributed to the reduction in the business compared to previous years. The promotion of recycling cooperatives helps in environmental management by reducing solid waste accumulation within the market.

The Chi-square test of independence showed statistical significance on waste as a resource, on solid waste collection by informal pickers or waste entrepreneurs a P-value of $0.01 \leq 0.05$, against the demographic factor of employment status and level of education P-value of 0.05 (Table 13). The study respondents with a high level of education were more willing to be involved in recycling solid waste for economic gain. The findings of the study agree with the study of Drimili *et al.* (2020) which found that educational factors increased the likelihood for people to be involved in recycling. Practically there was a low level of recycling, however, the majority (66.2%) of respondents showed willingness to participate in composting.

Similarly, the findings of the study agree with the study of Ayeleru *et al.* (2023) who found that the involvement of respondents in recycling municipal solid waste depended on the level of awareness of the public. In the current study, the majority of respondents who reported willingness to do recycling had formal education, they were able to understand solid waste as a resource. The majority of respondents were willing to participate in the recycling of solid waste. The lack of recycling infrastructure such as recycling bins, prohibited the recycling practice.

5.6 Institutional Capacity on Solid Waste Management at Dzaleka Market

This section discusses study findings related to challenges realised in the implementation of solid waste management by different stakeholders at the Dzaleka Market. The challenges included inadequate disposal infrastructure, inadequate sanitation equipment and the lack of vehicles for the collection of solid waste which led to its accumulation. The other problems reported include the lack of funding at the District council and a low private sector participation that has contributed to low investment in sanitation services.

5.6.1 Inadequate Sanitation Infrastructure

The majority (83.3%, n = 119) of respondents in the study reported that the final disposal of solid waste was an open dump, (Table 9). The collection and disposal method of solid waste in dumpsites was mostly practised at the Dzaleka market for easy disposal, due to the lack of landfill. The findings of the present study are similar to those of Aluko *et al.* (2022) in South-western Nigeria, which found that (72%) of respondents disposed of waste in open dumps. In that study, (95%) of respondents had good knowledge, (85%) had positive attitudes and the residents were prone to malaria, breathing difficulties, dermal and injuries as people moved in the dumpsites.

Turpie *et al.* (2019), described the effects of illegal dumping of waste on the environment as causing air pollution and groundwater pollution. The lack of landfills is a problem for the environment and public health. Orhorhoro and Oghoghorie (2019), in Nigeria, reported that open dumps were being used for waste management, due to a lack of engineered landfills. In this study reuse and recycling of solid waste was not highly considered due to inadequate knowledge among the market users.

The qualitative results indicated a theme of inadequate sanitation infrastructure such as landfills for disposal of solid waste this encouraged the use of dumpsites which are a risk to public health due to the spread of diseases, as there is air and land pollution.

In this study, there was stakeholder involvement in solid waste management, as Welt Hunger assisted in paying private transporters for the collection of solid waste from the Dzaleka market. Observational results also showed some disposal pits constructed within the market close to the Dzaleka camp where people could dispose off solid waste. The findings were inconsistent with those from the study of Rai, et al.(2019) who found that the lack of municipal solid waste management infrastructure was due to the lack of stakeholder involvement.

Findings from this study, suggest the significance of more involvement of stakeholders to help in the development of sanitation infrastructure at the Dzaleka Market to achieve sustainable solid waste management. One of the national sanitation and hygiene policy's objectives highlighted is to promote cost-effective, socially inclusive and resilient infrastructure for the sanitation and hygiene services across the service chain (Malawi Government 2023). This explains the significance of effective sanitation infrastructure that would help to prevent environmental pollution and the transmission of sanitation-related diseases such as diarrhoea and Cholera

5.6.2 Accumulation of Solid Waste at Dzaleka Market

The theme of the accumulation of solid waste was developed from the thematic analysis. Observational results also indicated an accumulation of solid waste within the market setting. This signified problems with the frequency of solid waste collection from the market. An interview with the Engineer from the Welt Hunger attributed the problem to a lack of vehicles for the transportation of solid waste.

Private vehicles were hired for the collection of solid waste, this was done on irregular frequencies. It was also observed that there was no availability of skip bins in strategic points for solid waste collection, this contributed to problems with the hauling system, and this resulted in open dumping of the solid waste by the market users. Oyedele and Oyedele (2017) in (Kwakye *et al.* 2024), reported the effects of dumping waste as causing environmental pollution and spreading of the vectors for Malaria and Cholera. Inefficient solid waste collection affects the aesthetic value of the environment (Chikowore 2020). The findings suggest a need for regular and consistent waste collection services.

An interview with the Dowa District Environmental revealed the problem of a shortage of staff working at the Dzaleka market as market cleaners and a lack of supplies. This contributes to an accumulation of waste in the market as cleaning is done on selected days due to the insufficient number of staff and supplies. The findings were similar to those of the study of Kwakye *et al.*, (2024) who found that the efficacy of market cleaning was compromised due to insufficient staff and equipment, which resulted in the accumulation of solid waste in the Market, which was a risk to the environment and public health.

5.6.3 Factors Affecting Solid Waste Management in Dowa

The study revealed other factors that affected the performance of the institutions that work on waste management activities in Dowa District. Interview with the District Environmental officer at the Dowa District Council reported a lack of funding which led to low investments in waste management. The findings are similar to those from a study by (Ishawu *et al.* 2020), in Ghana, who found that waste services provided by local governments were hampered by budgetary restrictions and unproductive delegation of authority from the national to local government.

The findings of this study, suggest the promotion of public-private partnerships, which could help in the development of necessary sanitation infrastructure. The Dowa District Environmental officer further reported that poor coordination and low private-sector participation contributed to inefficiencies in solid waste management. The national sanitation and hygiene strategy recommends district-based investment plans and promotes private partnerships for managing solid waste (Malawi Government 2018). This implied the need for significance for the promotion of private partnerships to achieve sustainable solid waste management according to the national sanitation and hygiene strategy. The Malawi 2063 vision is to ensure the provision of sanitation and hygiene services at the household and community level.

Institutional capacity building plays a role in enhancing technical efficiency in public service delivery which includes waste management. The public needs to have a better understanding of waste management issues. A participatory approach in the governance of municipal solid waste management has been one way of overcoming poor practices (Massoud *et al.* 2019; Yang *et al.* 2019). Improving awareness and education efforts regarding waste management practices would contribute to its effective management. The findings also suggest a need for the formulation of local regulations or bylaws that would be reinforced by the authorities on waste management issues.

5.7 Summary of the Discussion Chapter

The study was aimed at assessing the knowledge, attitudes and practices of market users on solid waste management at Dzaleka Market in Dowa District. The expected result was that as the market users showed good knowledge, they would also perform good practices of solid waste management. However, the market users displayed poor solid waste management practices.

The second objective of the study showed a positive attitude which was shown through face-to-face interviews, but did not translate to good behaviours towards solid waste management, as poor practices were observed at the market. It was expected that as the market users showed good knowledge and a positive attitude through face-to-face interviews, the solid waste management practices were expected to be good. This indicated a lack of awareness and inadequate knowledge among the market users on solid waste management. The fourth objective of institutional capacity on the provision of solid waste management at Dzaleka market is a lack of resources for investment in waste management, the market lacked significant sanitation infrastructure such as landfill. The solid waste collection was a challenge as demonstrated by the accumulation of solid waste within the market which was a risk to the environment and public health.

CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The study assessed the knowledge, attitude and practices of market users on solid waste management at Dzaleka Market. It employed a mixed methods approach; whereby qualitative and quantitative data were collected. A questionnaire was used to collect quantitative data, FGDs and key informant interviews were used to collect qualitative data and observations of the practices were recorded using a checklist. Purposive sampling was used to select key informant study participants and FGDs, while random sampling was used to select the market study respondents. Quantitative and qualitative data were analyzed using Statistical Package for Social Sciences (SPSS) version 26 and thematic analysis using Microsoft (2013) respectively. The study had four specific objectives; a) *to determine the level of knowledge of market users on solid waste management at Dzaleka in Dowa*; b) *to assess the attitudes of the market users on solid waste management at the Dzaleka market in Dowa*; c) *to determine the practices of market users on solid waste management at Dzaleka in Dowa* and; d) *to evaluate institutional capacity on solid waste management at Dzaleka Market in Dowa.* This section presents a summary of the findings, conclusions and recommendations according to the specific objectives.

6.1.1 To determine the level of knowledge of Market users on solid waste management at Dzaleka Market.

The study showed that (77.54%) of the market users had good knowledge of solid waste management. The majority (90.58%) of the respondents knew the effects of poor solid waste management on the environment and public health. A majority (87.68%) of the respondents knew waste collection methods.

Slightly above half (50.72%) of the respondents reported less knowledge of effective solid waste disposal methods. Slightly above half (55.07%) of the respondents were not aware of the benefits of waste segregation. The knowledge of solid waste management among people is significant as it influences people to perform a particular good behaviour towards solid waste management. The majority of respondents in the study had good knowledge, but a few respondents showed inadequate knowledge of solid waste management practices. The majority reported less knowledge of solid waste segregation for reuse and recycling. The majority of the study respondents would collect solid waste for easy disposal and to prevent diseases, and a few respondents would collect solid waste for economic gains.

Despite the market users knowing, they displayed poor solid waste management practices such as open dumping which is a risk factor to the public health. The Pearson chi-square test showed statistical significance on the benefits of waste segregation against the demographic factor of the level of education for the study respondents. The level of knowledge of people influences the practices of solid waste management in the community. This can be confirmed through the observation of practices between the percentage of people deemed to know and those a few with less knowledge as identified through the responses from the survey.

6.1.2 To assess the attitudes of the Market users on solid waste management at Dzaleka in Dowa.

On average (77.46%) of the respondents showed positive attitudes toward solid waste management at the Dzaleka market. Majority (75.36%) of respondents reported not dumping solid waste in drains and gutters. Majority (90.58%) of respondents reported the occurrence of pollution as an effect of poor solid waste disposal. Majority (84.05%) of the respondents reported that participating in solid waste is the responsibility of any individual.

Slightly above half (58.70%) of respondents disagreed that individuals were to play a big role in solid waste management activities. The study found that the majority of respondents showed a positive attitude toward solid waste management at the Dzaleka market through face-to-face interviews. However, observational results showed open dumping as the standard practice that was being displayed by the majority of market users. Some market users displayed negative attitudes as they could dispose off solid waste anyhow in drains and gutters which was a risk factor for public health. Behaviour change is key to achieving effective solid waste management among the public.

6.1.3 To determine practices of Market users on solid waste management at Dzaleka in Dowa.

In this study, majority (69.80%) of the respondents reported poor practices of solid waste management. Majority (83.3%) of respondents reported disposing of solid waste in open dumps. Slightly above half (52.17%) of respondents practised open dumping, and majority (78.99%) of respondents reported disposing of solid waste in undesignated places in drains and gutters. Majority (94.2%) of respondents reported not separating or segregating solid waste before disposal, which contributed to a low application of reusing and recycling. The study found that majority of respondents' practices were poor, a risk factor for the transmission of diarrhoea and cholera, significant for promotion of hygiene behaviour change through educational programs.

The chi-square test showed statistical significance on the use of sanitation equipment such as bins against the level of education of the respondents. Market users with formal education reported to know good use of sanitation equipment and infrastructures. The youthful productive ages of 18 to 50 showed a willingness to be involved in the reuse and recycling of solid waste. Slightly above half (57.25%) of respondents reported solid waste as being collected by market users for reuse and recycling.

The Chi-square test showed a statistically significant relationship between the levels of education of respondents against the involvement of informal waste pickers in the collection of solid waste. Participants with a high level of knowledge through formal education were more willing to be involved in the reuse and recycling of solid waste.

6.1.4 To evaluate institutional capacity on solid waste management at Dzaleka Market in Dowa.

The study found that there was a lack of sanitation infrastructure such as landfill. The dumpsite which is being used has an impact on the soil, air and groundwater pollution. The people surrounding the disposal area are prone to diseases such as respiratory, diarrhoea and cholera. An accumulation of solid waste within the market signified problems with waste collection systems, affecting the aesthetic value of the environment and causing pollution. Interviews with key informants indicated the lack of financial resources that leads to a low investment in waste management. It was also revealed that there is a weak coordination between the players involved in waste management with the council. Furthermore, it was reported that there was a low private sector participation, which has resulted in the low investment in waste management activities at Dzaleka Market

6.2 Recommendations

The study has shown that the market users at Dzaleka had good knowledge, positive attitudes and poor practices of solid waste management. The study has also shown solid waste management at Dzaleka Market is affected by the inefficiencies in the institutional capacity of the stakeholders, poor coordination and lack of funds which results in low investments in the sector.

In light of these findings, the following recommendations have been made according to the specific study objectives.

6.2.1 To determine the level of knowledge of Market users on solid waste management at Dzaleka in Dowa

Slightly above half (50.72%) of respondents showed inadequate knowledge of solid waste disposal methods and (55.07%) of respondents were not aware of the benefits of solid waste segregation, in view of these findings;

- There should be a promotion of awareness and education programs for sustainable solid waste management activities by the district council and some stakeholders working in the sanitation sector. This would impart knowledge to the market users which would influence changes in solid waste management practices.

6.2.2 To assess the attitudes of Market users on solid waste management at Dzaleka Market in Dowa.

The study found that slightly above half (58.70%) of respondents disagreed that individuals would take a big role in the management of solid waste. Majority of the market users indiscriminately disposed off the solid waste and open dumping despite having knowledge displayed through face-to-face interviews. In view of the findings on the attitude of respondents;

- There is a need for mindset change of the market users which could be attained through civic education through awareness and sensitization programs to change the peoples' attitudes, dealing with mental waste that would eventually change their practices.
- Development of behavioural change modification programs among the community surrounding the Dzaleka catchment area.

6.2.3 To determine the practices of Market users on solid waste management at Dzaleka Market in Dowa.

The study found that majority (94.20%) of respondents reported not doing solid waste separation, majority (79.99%) of respondents indiscriminately disposed off solid waste in drains or gutters and slightly above half (52.17%) of respondents reported doing open dumping. In view of these research findings concerning the practices of solid waste management among the market users. The following recommendations should be made according to the findings;

- There should be a formulation and enforcement of by-laws and regulations on solid waste management for Dzaleka by the Dowa district council.
- Participation of the local government through the district council and other stakeholders in building the capacity for the local community to handle solid waste management activities. The formulation of a sanitation master plan for the district council.

6.2.4 To evaluate the institutional capacity on solid waste management at Dzaleka Market in Dowa.

The study found that there was a lack of sanitation infrastructure for solid waste disposal such as landfills. There was an accumulation of solid waste within the market, this was reported to be due lack of vehicles for the collection of solid waste. It was reported that there was low private sector participation in waste management, this contributed to low investment in the sanitation sector due to financial constraints. The lack of coordination among stakeholders was also reported to affect the performance of solid management at Dzaleka. In view of these findings, the following recommendations should be made;

- There should be a strengthening of the institutional capacity by promotion of public-private partnerships with the Dowa district council to help in the delivery of waste management services.
- There should be a promotion of stakeholder involvement and coordination in sanitation services delivery. The utilization of community-based organizations and non-governmental organizations. This will improve the poor operations management in solid waste management.

6.3 Areas of Further Studies

- Studies should be done on the quantification of solid waste, assessing the impacts on the environment, soil, water and air quality in Malawi.
- Studies should be done on the development of a waste management strategy with communities such as that of Dzaleka.

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APPENDICES : Appendix A: Ethical Approval form MZUNIREC

MZUZU UNIVERSITY

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MZUZU UNIVERSITY RESEARCH ETHICS COMMITTEE (MZUNIREC)

Ref No: MZUNIREC/DOR/23/11 **01/02/2023.**

Malani Changaya,
Mzuzu University,
P/Bag 201,
Luwinga,
Mzuzu 2.

mgchangaya@gmail.com

Dear Malani,

RESEARCH ETHICS AND REGULATORY APPROVAL AND PERMIT FOR PROTOCOL REF NO: MZUNIREC/DOR/23/11: ASSESSMENT OF KNOWLEDGE, ATTITUDES AND PRACTICES OF MARKET USERS ON SOLID WASTE MANAGEMENT AT DZALEKA IN DOWA.

Having satisfied all the relevant ethical and regulatory requirements, I am pleased to inform you that the above referred research protocol has officially been approved. You are now permitted to proceed with its implementation. Should there be any amendments to the approved protocol in the course of implementing it, you shall be required to seek approval of such amendments before implementation of the same.

This approval is valid for one year from the date of issuance of this approval. If the study goes beyond one year, an annual approval for continuation shall be required to be sought from the Mzuzu University Research Ethics Committee (MZUNIREC) in a format that is available at the Secretariat. Once the study is finalised, you are required to furnish the Committee with a final report of the study. The Committee reserves the right to carry out compliance inspection of this approved protocol at any time as may be deemed by it. As such, you are expected to properly maintain all study documents including consent forms.

Wishing you a successful implementation of your study.

Committee Address:
Secretariat, Mzuzu University Research Ethics Committee, P/Bag 201, Luwinga, Mzuzu 2; E-mail address: mzunirec@mzuni.ac.mw

Yours Sincerely,

Gift Mbwele

SENIOR RESEARCH ETHICS ADMINISTRATOR

For: CHAIRMAN OF MZUNIREC

Committee Address:
Secretariat, Mzuzu University Research Ethics Committee, P/Bag 201, Luwinga, Mzuzu 2; E-mail address: mzunirec@mzuni.ac.mw

Appendix B: Consent Form

Muzzy University Research Ethics Committee (MZUNIREC)

Informed Consent Form for Research in

Knowledge, Attitudes and Practices of Market Users on Solid Waste Management at Dzaleka in Dowa.

Introduction

I am **Malani Geoffrey Changaya** from **Mzuzu University**, We are researching the **knowledge, attitudes and practices of market users on solid waste management at Dzaleka in Dowa.** This consent form may contain words that you do not understand. Please ask me to stop as we go through the information and I will take time to explain. If you have questions later, you can ask them of me or another researcher.

Purpose of the research

This research aims to assess the level of knowledge, attitudes, and practices of market users on solid waste management at Dzaleka in Dowa.

Type of Research Intervention

This research will involve your participation in a group discussion and/or individual interview.

Participant Selection

You are being invited to take part in this research because you have been chosen to represent other people in the market to answer a few research questions.

Voluntary Participation

Your participation in this research is entirely voluntary. It is your choice whether to participate or not. If you choose not to participate nothing will change. You may skip any question and move on to the next question.

Duration

The research takes place for a period of **15 to 20** minutes.

Risks

You do not have to answer any question or take part in the discussion/interview/survey if you feel the question(s) are too personal or if talking about them makes you uncomfortable.)

Reimbursements

You will not be provided with any incentive to take part in the research.

Sharing the Results

The knowledge that we get from this research will be shared with you and your community before it is made widely available to the public. Following this, we will publish the results so other interested people may learn from the research.

Who to Contact

If you have any questions, you can ask them now or later. If you wish to ask questions later, you may contact: 1) Dr Russel Chidya (Lecturer), Mzuzu University, P/Bag, 209, Luwinga, Mzuzu 2. Phone: 0999317176, 0884023509. Email: Research2022chidya@gmail.com.

2) Mr. Willys C. Mwandira, Executive Director, WESNET, Area 47, Sector 1. Phone: 0991004786. Email: glorymw@gmail.com

This proposal has been reviewed and approved by Mzuzu University Research Ethics Committee (MZUNIREC) which is a committee whose task it is to make sure that research participants are

protected from harm. If you wish to find out more about the Committee, contact Mr. Gift Mbwele, Mzuzu University Research Ethics (MZUNIREC) Administrator, Mzuzu University, P/Bag 201, Luwinga, Mzuzu 2, and Phone: 0999404008/0888641486

Do you have any questions?

Part II: Certificate of Consent

I have been invited to participate in research about the **Assessment of knowledge, attitudes and practices of market users on solid waste management at Dzaleka**

In Dowa.

I have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it and any questions I have been asked have been answered to my satisfaction. I consent voluntarily to be a participant in this study

Print Name of Participant_____

Signature of Participant _____

Date _____

Day/month/year 

If illiterate [1]

I have witnessed the accurate reading of the consent form to the potential participant, and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.

Print name of witness_____ Thumb print of participant

Signature of witness _____Date _____Day/month/year

[1] A literate witness must sign (if possible, this person should be selected by the participant and should have no connection to the research team). Participants who are illiterate should include their thumb print as well.

Statement by the researcher/person taking consent

I have accurately read out the information sheet to the potential participant, and to the best of my ability made sure that the participant understands the research project. I confirm the participant was allowed to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

Signature of Researcher /person taking the consent_____

Date _____ Day/Mont

Appendix C: English Questionnaire.

QUESTIONNAIRE for RESEARCH PROJECT

1.0 INTRODUCTION

As part of the school requirement at Mzuzu University, I am undertaking a research project. I would greatly appreciate your help in answering a few questions, about the assessment of knowledge, attitudes and practices of market users on solid waste management at Dzaleka in Dowa.

2.0 Purpose of the Study

Answers to this questionnaire will be for academic purposes only. Your cooperation is highly solicited.

3.0 Participant: Selection

The participants in the study will be randomly selected, while key informants will be purposively selected as they are linked to the activities pertaining to this study.

4.0 Ethics and Confidentiality

The information which will be collected in the study will be used solely for academic purposes.

5.0 Duration and Risks

The interview is going to take 10 – 15 minutes approximately.

6.0 Reimbursement

There is going to be no payment that is going to be given after the interview.

7.0 Contacts

For more information or if you have questions regarding this research project, you can contact

1) Dr. Russel Chidya, (**Lecturer**).

Mzuzu University,

P/Bag 209, Lunjika, Mzuzu 2.

Cell: **0999317176, 0884023509**.

Email address: Russelchidya2@gmail.com.

2) Mr. Willys C. Mwandira.

Executive Director, WESNET, Area 47, Sector 1.

Cell: **0991004786**.

Email address: glorymw@gmail.com.

8.0 Declaration and Certificate of Content

The information collected in the study will be used for academic purposes and the findings will also be shared with the relevant authorities who are concerned with waste management.

Instruction: Please, tick in the box ☐ to respond to the questions. For open ended questions you are free to use an extra sheet of plain paper.

A. Social Demographic Characteristics

1. Age: a)18- 29 ☐ b) 30-39 ☐ c) 40-49 ☐ d) 50-59 ☐ e) 60-64 ☐

2. Sex : M ☐ F ☐

3. Marital Status: Married ☐ Single ☐ Divorced ☐ Widowed ☐

4. Level of Education: Primary ☐ Secondary ☐ Tertiary ☐

   No formal education ☐

5. Employment Status : Yes ☐ No ☐

B) KNOWLEDGE QUESTIONNAIRE

6. Do you know waste? 1) Yes ☐ 0) No ☐

7. Do you have any knowledge on effects of solid waste on public health and environment?

   Yes ☐ No ☐

   If yes, what effect? a) Floods ☐ b) Air pollution ☐ c) Disease ☐ d) None ☐

8. Do you agree that the quantity of waste sent for disposal to landfill should be minimized?

   Yes ☐ No ☐

9. Are you aware of any waste collection methods?

   Yes ☐ No ☐

10. Are you aware of effective solid waste methods disposal?

Yes ☐ No ☐

If yes, what are these methods?

a) Landfill ☐ b) Incineration ☐ c) Composting ☐ d)

11. Do you know any benefits of waste segregation?

Yes ☐ No ☐

If yes, what are these benefits you know?

a) .....

b) .....

c) .....

...

12. Can waste be sorted or recycled?

Yes ☐ No ☐

13. Do you have any knowledge of composting of solid waste?

Yes ☐ No ☐

14. Do you know any methods of waste reduction?

Yes ☐ No ☐

15. Are there laws governing solid waste management in the market of Dzaleka Yes ☐ No ☐

If yes mention them,

a).....

a) .....

b) .....

16. Does the Dowa district council or any organization take part in the provision of information on awareness of solid waste management?

Yes ☐ No ☐

17. Are you aware that participation in solid waste management is the responsibility of everyone

Yes ☐ No ☐

C. ATTITUDE QUESTIONNAIRE

18. Waste management is important?

Strongly disagree ☐ disagree ☐ not sure ☐ agree ☐ strongly agree ☐

19. Dumping of solid waste in open spaces, drains and gutters is not bad

Strongly agree ☐ disagree ☐ Not sure ☐ Agree ☐ strongly agree ☐

20. Open burning of refuse is a good method

Strongly disagree ☐ disagree ☐ not sure ☐ Agree ☐ strongly agree ☐

21. Open burning of solid waste has no negative effect on health of human being

Strongly disagree ☐ disagree ☐ not sure ☐ agree ☐ strongly agree ☐

22. Improper refuse disposal can cause occurrence of environmental pollution

Strongly disagree ☐ disagree ☐ not sure ☐ agree ☐ strongly agree ☐

23. Individuals play key roles of solid waste management in the market of Dzalcka

Strongly disagree ☐ disagree ☐ not sure ☐ agree ☐ strongly agree ☐

24. I feel comfortably the way solid waste is managed in the market of Dzalcka

Strongly disagree ☐ disagree ☐ not sure ☐ agree ☐ strongly agree ☐

25. Putting wastes in bins is responsibility for everybody

Strongly disagree ☐ disagree ☐ not sure ☐ agree ☐ strongly agree ☐

26. Participating in solid waste management activities is everybody's responsibility

Strongly disagree ☐ disagree ☐ Not sure ☐ agree ☐ strongly agree ☐

27. There is a satisfaction with waste service collection in the market of Dzalcka

Not Satisfied ☐ partly satisfied ☐ satisfied ☐

28. Reusing plastic bags for shopping is good for reducing waste

Strongly disagree ☐ disagree ☐ not sure ☐ agree ☐ strongly agree ☐

29. I care about waste management reduce, reuse and recycling

Strongly disagree ☐ disagree ☐ not sure ☐ agree ☐ strongly agree ☐

30. Public education could be good to fix the challenge of poor solid waste management

Strongly disagree ☐ disagree ☐ not sure ☐ agree ☐ strongly agree ☐

31. It is important that local government put recycling laws and programs in place

Strongly disagree ☐ disagree ☐ not sure ☐ agree ☐ strongly Agree ☐

32. Regular collection of solid waste is the only solution to solid waste management

Strongly disagree ☐ disagree ☐ not sure ☐ agree ☐ strongly Agree ☐

D. **Practice: Questionnaire**

33. Do dumping of solid waste occur in designated dumpsites?

Yes ☐ No ☐

34. Is there a proper use of refuse bins in the markets?

Yes ☐ No ☐

35. Is there a disposal of refuse in drains or gutters?

Yes ☐ No ☐

36. Do the Separation / segregation of waste happen in the markets?

Yes ☐ No ☐

If yes give reasons for your answer

a) .....

.....

b) .....

c).....

If no, is there recovery of materials from solid waste in any form

a) .....

c) .....

37. Do the burning of solid waste take place?

Yes ☐ No ☐

38. Is there an application of reducing, reusing and recycling to the solid waste?

Yes ☐ No ☐

39. Do disposal of organic waste take place instead of recycle?

Yes ☐ No ☐

40. Is everybody involved in solid waste management activities?

Yes ☐ No ☐

41. Is there Involvement of the authorities from district council or any stakeholders in solid waste management activities?

Yes ☐ No ☐

42. Are the bins covered properly while containing solid waste?

Yes ☐ No ☐

43. How often is solid waste collected from the markets by authorities?

Once a week ☐ once every two weeks ☐ once a month ☐

Do you process or treat waste before disposal? Yes ☐ ☐

If yes, what are the treatment options you use?

a) .....

b).....

c) .....

44. Do you follow processes of waste prevention?

Yes ☐ No ☐

45. Is there a recovery of solid waste from the market?

Yes ☐ No ☐

46. Do you do Composting of solid waste?

Yes ☐ No ☐

47. Do you do incineration of the solid waste?

Yes ☐ No ☐

48. What is the final disposal for solid waste from markets?

Landfill ☐ Open dump ☐

49. Would you like to recycle waste into your market place?

No ☐ Yes ☐ I do not know ☐

Solid Waste as a Resource for Business Questionnaire

50. What category of waste is dominant in the waste generated in the market?

a) Food waste ☐ b) Plastic waste ☐ c) Paper waste ☐ d) Textile ☐ e) Metal ☐

51. Is there specific use of waste generated in the market individually or collectively?

a) Revenue generation ☐ b) Composting ☐ Biogas ☐ None ☐

52. What waste management practice is performed here at Dzaleka market?

a) Collection ☐ Transportation ☐ c) Separation / sorting ☐ Disposal ☐

e) Recycling/ Composting ☐ f) Incineration/ Landfilling ☐

53. Are there benefits of solid waste recycling here at Dzaleka market?

Yes ☐ No ☐ Not sure ☐

54. If a recycling programme was set up, would you be willing to separate materials into separate bags for collection purposes?

a) Yes ☐ b) No ☐ c) Don't Know

55. What are the significances of solid waste recycling here at Dzaleka market?

A) Economic gains ☐ B) reducing pollution/ disease ☐ c) Reduction of waste ☐

d) Composting ☐

.....

56. Is there any waste business practice taking place here at the Dzaleka market? Yes ☐ No ☐
What type of business?

a).....

57. Are exploitable waste materials recollected by informal pickers or waste entrepreneurs?

Never ☐ Sometimes ☐ often ☐ almost always ☐ I do not know ☐

58. What are the activities in solid waste management at the Dzaleka market that are opportunities for waste business? a) .....

b).....

c).....

Appendix D: Chichewa Questionnaire

APPENDIX D

QUESTIONNAIRE for RESEARCH PROJECT

1.0 MAU OYAMBA

Mnzanu, zanu la zofunikira za sukulu pa yunivesite ya Mzuzu, ndikuchita kafukufuku. Ndingayamikire kwambiri thandizo lanu poyankha mafunso angapo, okhudza kuwunika kwa chidziwitso ndi machitidwe pa kasamalidwe ka zinyalala zolimba pakati pa ogwiritsa ntchito msika ku Dzaleka ku Dowa.

2.0 Cholinga cha Kafukufuku

Mayankho a mafunsowa adzakhala a maphunziro okha. Mgwirizano wanu ndiwofunidwa kwambiri.

3.0 Kusankhidwa kwa otenga nawo mbali

Otenga nawo mbali mu kafukufukuyu adzasankhidwa mwachisawawa, pomwe otsogolera adzasankhidwa mwadala chifukwa akugwirizana ndi zochitika zokhudzana ndi kafukufukuyu.

4.0 Chinsinsi

Zomwe zidzasonkhanitsidwe mu kafukufukuyu zidzagwiritsidwa ntchito pazolinga zamaphunziro.

5.0 Nthawi ndi Zowopsa

Kuyankhulana kudzatenga pafupifupi mphindi 10 kapena 15.

6.0 Cholowa

Sipadzakhala malipiro omwe adzaperekedwe pamapeto pa kuyankhulana.

7.0 Olankhula Nawo

Kuti mudziwe zambiri kapena ngati muli ndi mafunso okhudzana ndi kafukufukuyu, mungathe kulankhula ndi:

1) Dr. Russel Chidya, (**Lecturer**).
Mzuzu University,
P/Bag 209, Luwinga, Mzuzu 2.
Cell: **0999317176, 0884023509.**
Email address: Russelchidya2@gmail.com.
2) Mr. Willys C. Mwandira.
Executive Director, WESNET, Area 47, Sector 1.
Cell: **0991004786.**
Email address: glorymw@gmail.com.

8.0 Chidziwitso ndi Satifiketi Zamkatimu

Zomwe zasonkhanitsidwa mu kafukufukuyu zidzagwiritsidwa ntchito pazolinga zamaphunziro ndipo zotsatira zidzagawidwanso kwa akuluakulu omwe akukhudzidwa ndi kasamalidwe ka zinyalala.

Malangizo: Chonde, chongani m'bokosi kuti ayankhe mafunso ☑
Pamafunso otseguka muli omasuka kugwiritsa ntchito pepala lina.

A. Social Demographic Characteristics

1. Zaka: a)18- 29 ☐ b) 30-39 ☐ c) 40-49 ☐ d) 50-59 ☐ e) 60-64 ☐

2. Mwamuna/Mkazi : Mwamuna ☐ Mkazi ☐

3. Banja: Okwatira/Kukwatiwa ☐ Opanda banja ☐ Osudzulidwa ☐ Wamasiye ☐

4. Mlingo wa Maphunziro: Pulayimale ☐ Sekondale ☐ Aukachenjede ☐ Osaphunzira ☐

5. Muli pa ntchito: Inde ☐ Ayi ☐

B) KNOWLEDGE QUESTIONNAIRE

6. Kodi mukudziwa zinyalala? 1) Inde ☐ 0) Ayi ☐

7. Muli ndi chidziwitso chilichonse chokhudza zotsatira za zinyalala pamoyo wa anthu komanso chilengedwe?

Inde ☐ Ayi ☐

Ngati inde, zotsatira zake? a) Kusefukira Kwa madzi ☐ b) Kuonongeka kwa mpweya ☐
c) Matenda ☐ d) Palibe ☐

8. Kodi mukuwonetsera kuti kuchuluka kwa zinyalala zomwe zimatumizidwa kuti zikatayidwe kumalo otayirako zimayenera kuchepetsedwa?

Inde ☐ Ayi ☐

9. Kodi mukudziwa njira iliyonse yosonkhanitsira zinyalala?
Inde ☐ Ayi ☐

10. Ndiyo anakhutitsidwa ndi ndondomeko zosonkhanitsira zinyalala pamsika uno wa Dzaleka?

Inde ☐ Ayi ☐

11. Kodi mukudziwa njira zoyesera zotayira zinyalala zolimba?

Inde ☐ Ayi ☐

Ngati inde, njira izi ndi ziti?

a) .....

b) .....

c) .....

12. Kodi mukudziwa ubwino uliwonse olekanitsa zinyalala?

Inde ☐ Ayi ☐

Ngati inde, ndi ubwino uti omwe mukudziwa?

a) .....

b) .....

c) .....

13. Kodi zinyalala zikhoza kusankhidwa kapena kugwiritsidwanso ntchito?

Inde ☐ Ayi ☐

14. Kodi muli ndi chidziwitso chilichonse cha kompositi ya zinyalala zolimba?

Inde ☐ Ayi ☐

15. Kodi mukudziwa njira iliyonse yochepetsera zinyalala?

Inde ☐ Ayi ☐

16.1 Kodi pali malamulo kuyang'anira kayendetsedwe ka zinyalala pamsika uno wa Dzaleka?

Inde ☐ Ayi ☐

Ngati inde, atchuleni,

a).....

a) .....

b) .....

16.2 Ngati inde ; Kodi malamulowa ndi okwanira: Inde ☐ Ayi ☐

Ngati ayi, chifukwa chani sali okwanira:

a) .....

16.3 Kodi malamulo alimbikitsidwa bwino? Inde ☐ Ayi ☐

Ngati ayi, ndi zovuta zotani zomwe zilipo polimbikitsa malamulo akayendetse ka zinyalala zolimba?

a).....

b).....

c).....

d).....

17. Kodi khonsolo ya boma la Dowa kapena bungwe lina lililonse likutengapo gawo popereka uthenga wodziwitsa anthu za kasamalidwe ka zinyalala mumsika muno?

Inde ☐ Ayi ☐

18. Kodi mukudziwa kuti ndi udindo wa aliyense ayenera kutengapo mbali pa chisamaliro cha zinyalala zolimba?

Inde ☐ Ayi ☐

C. ATTITUDE QUESTIONNAIRE

19. Kusamalira zinyalala ndikofunikira??

Ndikutsutsa mwamphamvu ☐ Ndikutsutsa ☐ Osatsimikiza ☐

Vomerezani ☐ Vomerezani mwamphamvu ☐

20. Kutaya zinyalala zolimba m'malo otseguka, ngalande ndi sikoipa

Ndikutsutsa mwamphamvu ☐ Ndikutsutsa ☐ Osatsimikiza ☐

Vomerezani ☐ Vomerezani mwamphamvu ☐

21. Kuwotcha kwa zinyalala zolimba pambalambanda ndi njira yabwino

Ndikutsutsa mwamphamvu ☐ Ndikutsutsa ☐ Osatsimikiza ☐

Vomerezani ☐ Vomerezani mwamphamvu ☐

22. Kuwotcha kwa zinyalala zolimba pa mbalambanda sikungawononge thanzi la munthu

Ndikutsutsa mwamphamvu ☐ Ndikutsutsa ☐ Osatsimikiza ☐

Vomerezani ☐ Vomerezani mwamphamvu ☐

23. Kutaya zinyalala molakwika kungayambitse kuwonongeka kwa chilengedwe

Ndikutsutsa mwamphamvu ☐ Ndikutsutsa ☐ Osatsimikiza ☐

Vomerezani ☐ Vomerezani mwamphamvu ☐

24. Anthu amatenga gawo lalikulu pakuwongolera kusamalira zinyalala zolimba pamsika wa Dzaleka

Ndikutsutsa mwamphamvu ☐ Ndikutsutsa ☐ Osatsimikiza ☐

Vomerezani ☐ Vomerezani mwamphamvu ☐

25. Ndikumva bwino koma mowa zinyalala zolimba zimayendetsedwera pamsika wa Dzaleka.

Ndikutsutsa mwamphamvu ☐ Ndikutsutsa ☐ Osatsimikiza ☐

Vomerezani ☐ Vomerezani mwamphamvu ☐

26. Kuyika zinyalala motayila mwake ndi udindo wa aliyense

Ndikutsutsa mwamphamvu ☐ Ndikutsutsa ☐ Osatsimikiza ☐

Vomerezani ☐ Vomerezani mwamphamvu ☐

27. Kutenga nawo mbali pa ntchito ya kayendetsedwe ka zinyalala ndi udindo wa aliyense

Ndikutsutsa mwamphamvu ☐ Ndikutsutsa ☐ Osatsimikiza ☐

Vomerezani ☐ Vomerezani mwamphamvu ☐

28. Pali kukhutitsidwa ndi Kasonkhanitsidwe ka zinyalala pamsika wa Dzaleka.

Osakhutitsidwa ☐ Okhutitsidwa pang'ono ☐ Okhutitsidwa ☐

29. Kugwiritsanso ntchito matumba apulasitiki pogula zinthu ndikwabwino pochepetsa zinyalala

Ndikutsutsa mwamphamvu ☐ Ndikutsutsa ☐ Osatsimikiza ☐

Vomerezani ☐ Vomerezani mwamphamvu ☐

30. Ndimasamala za kuchepetsa kasamalidwe ka zinyalala, kugwiritsiridwa ntchitonso ndi kuzikonzanso

Ndikutsutsa mwamphamvu ☐ Ndikutsutsa ☐ Osatsimikiza ☐

Vomerezani ☐ Vomerezani mwamphamvu ☐

31. Maphunziro a anthu onse angakhale abwino kuthetsa vuto la kusasamala bwino kwa zinyalala

Ndikutsutsa mwamphamvu ☐ Ndikutsutsa ☐ Osatsimikiza ☐

Vomerezani ☐ Vomerezani mwamphamvu ☐

32. Ndikofunikira kuti maboma akhazikitse malamulo ndi mapulogalamu obwezeretsanso

Ndikutsutsa mwamphamvu ☐ Ndikutsutsa ☐ Osatsimikiza ☐

Vomerezani ☐ Vomerezani mwamphamvu ☐

33. Kusonkhanitsa zinyalala zolimba pafupi pafupi ndi njira yokhayo yothetsera zinyalala zolimba

Ndikutsutsa mwamphamvu ☐ Ndikutsutsa ☐ Osatsimikiza ☐

Vomerezani ☐ Vomerezani mwamphamvu ☐

D. Practices Questionnaire

34. Kodi kutaya zinyalala zolimba kumachitika m'malo osankhidwa mu msika uno wa Dzaleka?

Inde ☐ Ayi ☐

35. Kodi pali kugwiritsa ntchito moyenera motayila zinyalala m'msika uno wa Dzaleka?

Inde ☐ Ayi ☐

36. Kodi pali mchititidwe otaya zinyalala mu ngalande mu msika uno wa Dzaleka?

Inde ☐ Ayi ☐

37. Kodi Kulekanitsa / kugawa zinyalala kumachitika m'msika uno wa Dzaleka?

Inde ☐ Ayi ☐

Ngati inde, perekani zifukwa za yankho lanu

a) .....

c).....

Ngati ayi, pali kubwezeretsedwa kwa zinthu kuchokera ku zinyalala zolimba mwanjira iliyonse Mu msika uno wa Dzaleka?

a) .....

b) .....

c) .....

38. Kodi kuwotcha zinyalala zolimba zochokera mu msika uno wa Dzaleka kumachitika?

Inde ☐ Ayi ☐

39. Kodi pali ntchito yochepetsera, kugwiritsanso ntchito ndi kubwezeretsanso ku zinyalala zolimba Mu msika uno wa Dzaleka?

Inde ☐ Ayi ☐

40. Kodi kutaya zinyalala kumachitika m'malo mobwezeretsanso Mu msika uno wa Dzaleka?

Inde ☐ Ayi ☐

41. Ndi aliyense amene akutenga nawo mbali pa ntchito za kasamalidwe ka zinyalala zolimba mu msika uno wa Dzaleka?

Inde ☐ Ayi ☐

42. Kodi pali kutengapo mbali kwa akuluakulu a boma kuchokera ku khonsolo kapena ena onse okhudzidwa ndi ntchito zosamalira zinyalala mu msika uno wa Dzaleka?

Inde ☐ Ayi ☐

43. Kodi mosangira zinyalala zimakutidwa bwino pa nthawi yomwe zinyalalazo zilimo?

Inde ☐ Ayi ☐

44. Ndi kangati komwe zinyalala zolimba chotsedwa m'musika uno wa Dzaleka ndi a boma kapena ena?

Kamodzi pa sabata ☐ Kamodzi pa masabata awiri alionse ☐

Kamodzi pa Mwezi ☐

45. Kodi mumakonza kapena kuyika mankhwala zinyalala zisanatayidwe?

Inde ☐ Ayi ☐

Ngati inde, njira zamankhwala zomwe mumagwiritsa ntchito ndi ziti?

a) .....

b) .....

c) .....

46. Kodi mumatsatira njira zopewera zinyalala?

Inde ☐ Ayi ☐

47. Kodi pali kubwezeretsa zinyalala zolimba pamsika uno wa Dzaleka?

Inde ☐ Ayi ☐

48. Kodi pali kugwiritsanso ntchito zinyalala zolimba monga matumba apulasitiki kuti achepetse kutulutsa zinyalala pamsika?

Inde ☐ Ayi ☐

49. Kodi pali kulekanitsa zinyalala zolimba ku musika uno wa Dzaleka zisanatayidwe?

Inde ☐ AYI ☐

51. Mumawotcha zinyalala zolimba?

Inde ☐ Ayi ☐

52. Kodi kutaya komaliza kwa zinyalala zolimba kuchokera ku msika uno ndi kotani?

Kukwilira ☐ Kutaya poyera ☐

53. Kodi mungafune kukonzanso zinyalala pamsika wanu?

Inde ☐ Eya ☐ Sindikudziwa ☐

. Solid as a resource for Business Questionnaire

54. Ndi mtundu wanji wa zinyalala zomwe zimakhala zambiri kuchokera pa msika wanu?

a) Zakudya ☐ b) Mapulasitiki ☐ c) Mapepala ☐ d) Zovala ☐ e) Zitsulo ☐

55. Kodi pali kugwiritsidwa ntchito kwachindunji kwa zinyalala zomwe zimapangidwa pamsika payekhapayekha kapena palimodzi?

) Kupezera Ndalama ☐ b) Kompositi ☐ c) Gasi ☐ d) Palibe ☐

56. Ndi mchitidwe wotani wosamalira zinyalala womwe ukuchitikira kuno pamsika wa Dzaleka?

) Kusonkhanitsa ☐ b) Kunyamura ☐ c) Kuputukana/kusankha ☐ d) Kutaya ☐

d) Kubwezeretsanso/ Kompositi ☐ f) Kuwotcha/Kuthira pansi ☐

57. Kodi munamvapo za kufunika kobwezeretsanso?

Inde ☐ Ayi ☐

Ngati inde, kodi mukuvomereza zobwezeretsanso zinyalala?

a) Inde ☐ b) Ayi ☐ c) Sindikutsimikiza ☐

58. Kutakhala kuti pulogalamu yobwezeretsanso yakhazikitsidwa, kodi mungalole kulekanitsa zinyalala m'matumba osiyanasiyana ndicholinga choti zitoleredwe?

) Inde ☐ b) Eya ☐ c) Sindikudziwa ☐

59. Fotokozani chifukwa chomwe kusamalira zinyalala kuli kofunika kwa inu?

a) .....

b) .....

c) .....

60. Kodi pali mabizinesi ya zinyalala yomwe ikuchitika pano pamsika wa Dzaleka?

Inde ☐ Ayi ☐

Bizinesi yamtundu wanji?

a).....

61. Zinyalala zopezekeratu zimatoleredwa ndi otolera mwamwayi kapena a malonda otolera zinyalala?

Ayi ☐ Nthawi zina ☐ Kawirikawiri ☐ Pafupifupi nthawi zonse ☐

Sindikudziwa ☐

9. Ndi ntchito ziti za zinyalala pamsika wa Dzaleka zomwe ndi mwayi wabizinesi yazinyalala?

a) .....

b)..... .....

c).....

d).....

Appendix E: Checklist for Solid Waste Management Practices

CHECKLIST FOR SOLID WASTE MANAGEMENT PRACTICES AT DZALEKA MARKET.

Are waste bins available in the market?

☐ Yes ☐ No ☐ N/A

Are number of bins and dumpsters adequate?

☐ Yes ☐ No ☐ N/A

Are waste bins appropriate for use? (for example bins should have lids)

☐ Yes ☐ No ☐ N/A

Are waste bins emptied regularly?

☐ Yes ☐ No ☐ N/A

Are waste bins lined properly and scattered in all parts of the market?

☐ Yes ☐ No ☐ N/A

Are waste from the different sections of the markets sorted and separated?

☐ Yes ☐ No ☐ N/A

Are the waste storage areas free from odors, contaminants, or signs of vermin?

☐ Yes ☐ No ☐ N/A

Are collection points available for solid waste in the market?

☐ Yes ☐ No ☐ N/A

Do solid waste segregation occur in the market?

☐ Yes ☐ No ☐ N/A

Is there a space available for storage of solid waste after segregation?

☐ Yes ☐ No ☐ N/A

Are recycling bins available in the market?

☐ Yes ☐ No ☐ N/A

Have measures been put in place to deal with any hazardous waste?

☐ Yes ☐ No ☐ N/A

Is waste removal appropriately scheduled?

☐ Yes ☐ No ☐ N/A

Is there availability of dumpsites?

☐ Yes ☐ No ☐ N/A

Is the location of dumpsters appropriate? (i.e., away from the people's houses)

☐ Yes ☐ No ☐ N/A

Is there availability of landfills?

☐ Yes ☐ No ☐ N/A

Is there public access to landfills?

☐ Yes ☐ No ☐ N/A

Open burning is prohibited at disposal sites?

☐ Yes ☐ No ☐ N/A

Access to disposal site is controlled with signs, fencing and gates?

☐ Yes ☐ No ☐ N/A

Other observations.....

Recommendations.....

(Full Name and Signature)

.....

Appendix F: In-depth Interview Guide: Key Informant

Introduction

I am **Malani Geoffrey Changaya**, a Master of Science student from **Mzuzu University**, under Department of Water and Sanitation. I am doing a research entitled: **knowledge, attitudes and practices of market users on solid waste management at Dzaleka in Dowa.** The main purpose of the interview is to get your feedback on understanding of solid waste management at Dzaleka Market. Therefore I would appreciate if you could spend some time to do an interview. It will take 60 minutes to 90 minutes.

Participant Selection

You have been asked to participate in the study because of your position, we believe you have the knowledge about solid waste management at Dzaleka market, so you could be in a position to provide useful information, hence considered. You are encouraged to participate and provide needful feedback on the topic of study.

Ethics and Confidentiality

Be ensured that the interview will be treated anonymous and your comments will be handled with confidentiality. The data after analysis will be used for academic purposes only.

Duration and Risks

The research takes place for a period of one month from the day of the interview. You do not have to answer any question or take part in the discussion/interview/survey if you feel the question(s) are too personal or if talking about them makes you uncomfortable.)

Reimbursements

You will not be provided with any incentive to take part in the research, but your participation will be highly appreciated, any participant will be acknowledged accordingly.

Sharing the Results

The knowledge that we get from this research will be shared with you and your community before it is made widely available to the public. Following this, we will publish the results so other interested people may learn from the research.

Who to Contact

If you have any questions, you can ask them now or later. If you wish to ask questions later, you may contact: 1) Dr Russel Chidya (Lecturer), Mzuzu University, P/Bag, 209, Luwinga, Mzuzu 2. Phone: 0999317176, 0884023509. Email: Research2022chidya@gmail.com.

Researcher: Malani G. Changaya, Kamuzu Central Hospital, P.O Box 149, Lilongwe.

Email: mgchangaya@gmail.com., cell: 0999678615, 0885487337.

Declaration and Certificate of Content

I have been asked to help in giving information related to this research. I have read the foregoing information and hereby agree to voluntarily participate.

Sign Interviewer **Sign Interviewee**

…….. **……..**

Thank you for your participation

Key Informant Interview Guide

1. Administrative Unit / Department……
2. Age: …….
3. Gender ……..
4. Level of Education ……
5. Designation ……
6. How solid waste is currently managed at the Dzaleka market?
7. What are the types and volumes of Solid waste that are generated at the Dzaleka market? (Paper and cardboard, plastics and rubber, metals and glass, organic wastes, market slaughter, and animal wastes).
8. What are the solid waste collection methods that are relied upon at the Dzaleka market? What is the frequency of its collection? What is the disposal site?
9. What are the main key challenges of solid waste management observed at the Dzaleka market?
10. What is the general attitude of the market users toward solid waste management at Dzaleka
11. How is the solid waste generated at the Dzaleka market used? Is there any use for business?
12. What are the rules, guiding principles, or regulations that are put in place by the authorities for market users to follow in solid waste management at the Dzaleka market?
13. What activities are being undertaken to reduce solid waste, (Is there recycling or reuse of solid waste?).

14. What are the stakeholders involved in the provision of awareness and public education to the market users concerning solid waste management at the Dzaleka market?

15. What are the activities that must be done at the Dzaleka market to improve solid waste management? What do you feel are key solutions to the problems of poor solid waste management, if there are any?

Appendix G: Focus Group Discussion Guide

Introduction

Thank you for agreeing to participate in this study, you have been selected to participate in this study to represent other market users which includes traders and buyers. We believe you have knowledge about solid waste management activities at the Dzaleka Market. As part of the market users (buyers, traders and some members of sanitation committee at Dzaleka market), your experiences and views are very important to us. Feel free to share your experiences and views, even if they are different from other group members.

a) For the discussion to be in an orderly manner, one speaker will be given a chance to speak at a time.
b) We prefer each one would select a number or a name one would prefer to use during the entire session of the discussion.
c) During the discussion if someone has different views or wants to add to the speakers opinion, may be free to interject, will be given a chance to speak, lets refer to the names or number selected by individuals.
d) We request to respect each other as participants and that things discussed here will not be shared with other people who are not participating in this discussion.
e) All views discussed here will be kept confidential, the discussion will take place for 1 hour up to 30 minutes.
f) My fellow researcher will be taking notes, while I will be asking questions and listening attentively. Participants will be given freedom to speak and communicate views.
g) Everybody will go through the informed consent form which is given and each one will get it signed, as the informed consent is contained the overall study information.

h) Your participation in the study is voluntary, if you feel like stopping the interview at any time feel free to stop me. All the information discussed here will be confidential.

Contact Details: If you have any questions, you can ask them now or later. If you wish to ask questions later, you may contact: 1) Dr Russel Chidya (Lecturer), Mzuzu University, P/Bag, 209, Luwinga, Mzuzu 2. Phone: 0999317176, 0884023509. Email: Research2022chidya@gmail.com.

Researcher: Malani G. Changaya, Kamuzu Central Hospital, P.O Box 149, Lilongwe.

Email: mgchangaya@gmail.com., cell: 0999678615, 0885487337.

Focus Group Guiding Questions

1. How is the solid waste managed after being generated here at the Dzaleka Market? Do we have knowledge of the proper methods of solid waste disposal? What are the collection schedules for the solid waste generated from the market?
2. What are the attitudes of the market users towards solid waste management at Dzaleka? Do people agree that participating in solid waste management activities is everybody's responsibility?
3. What are the challenges that are faced in the management of solid waste at Dzaleka market? Are we as market users satisfied with the waste management practices being done at Dzaleka market, as helping prevention of pollution to the environment or improving on sanitation of the areas around the market? What are the solid waste management practices that we feel need improvement?
4. What are the uses of the solid waste which is generated at the Dzaleka market? Is there reuse or recycling or any form of reduction of solid waste? What are the solid waste business that takes place here at the Dzaleka market? What do we think are the opportunities for solid waste business at the Dzaleka market?

Ending Question

Our discussion was meant to help us understand the knowledge, attitudes and practices of market users on solid waste management at the Dzaleka Market in Dowa. We are going towards the end of the question session, is there anyone with the information that may want to be added.

Thank you for your participation

Appendix H: Photographs of solid waste management at the Dzaleka Market.

1

Photograph 1.

2

Photograph 2.

3

Photograph 3.

4

Photograph 4.