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CHALLENGES OF WASTE MANAGEMENT IN CHIREDZI, ZIMBABWE

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Abstract:
Poor waste management has been one of the greatest challenges in most developing countries. Towns and cities in developing countries have experienced population explosions due to natural increase and rural-urban migration. Urbanization and modernization have also led to the increase of the amount and complexity of the waste being generated. Local authorities responsible for proper waste management are faced by various problems which include financial constraints, absence of the required professional personnel as well as poor public awareness on the dangers of poor waste management and the absence of properly engineered landfills. In the current study, waste management in Chiredzi was researched. A mixed methods research approach was used in the study, selected wards were used as representatives of the town in responding to questionnaires, and the relevant local authorities were interviewed. Chiredzi just like most towns in developing countries has poor waste management practices. There is need for an integrated approach to waste management and many recommendations are cited in this paper.

Keywords: waste management, challenges, solutions, recommendations, Chiredzi, Zimbabwe

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1. Introduction

1.1 Challenges of waste management in Zimbabwe

Waste management has emerged as one of the greatest challenges facing environmental protection agencies in developing countries (Ogwueleka, 2009). It is one of the biggest 'turn-offs' in the development process, particularly in developing countries which lack technological and financial capabilities. Many towns and cities in developing countries are not adequately meeting their refuse collection obligations due to financial constraints (Mohee and Simelane, 2015). The increasing volume and complexity of waste generated in the modern world has increased inefficiency in solid waste management and its impacts on the environment. A research conducted by the Training and Research Support Centre, Civic Forum on Housing (2010) claims that 11.2 billon tonnes of solid waste are collected yearly worldwide. Currently, more than 2, 5 million tonnes of household and industrial waste are produced in Zimbabwe's urban areas per annum and this continues to rise due to unprecedented rural flight and the absence of minimization strategies (Practical Action, 2005). Waste management has collapsed, and this has triggered chaotic and rampant waste dumping, putting the health of residents at great risk (Makwara and Magudu, 2013). According to Chidavaenzi (2006), the last forty five (45) years have witnessed a 50% decline in the density of waste being generated (460 to 230 kg/m3) while the volume of waste has increased two-fold and the trend is projected to continue rising. The past ten years in Zimbabwe have been challenging for local authorities' management systems, service delivery, primary social infrastructural development, planning and organization (Chikuruwo, 2006). The increasing complexity of the composition of solid waste and the failure by city authorities to integrate the formal and informal sector among other issues in developing countries have brought complicated challenges in solid waste management (Practical Action Southern Africa, 2007). In Zimbabwe, like in most third world countries, waste generation is still at relatively low levels but there is less scope for reduction. However, studies pertaining to waste management in Zimbabwe by, among others, Tevera (1995), Moyo (1997), Masocha and Tevera (2003), Mapira and Mungwini (2005), Mapira (2007), Makwara (2011) and Mapira, (2011) show that, because of lack of capacity to manage it, solid waste is one of the most visible and pressing urban environmental problems. Therefore, waste management has emerged as one of the greatest challenges facing local authorities throughout Zimbabwe. Most urban agencies and local authorities in Zimbabwe have time and again identified solid waste as a major problem that has reached proportions requiring drastic measures, notably from the 1990s up to the present day.

Chiredzi, among other towns is facing challenges of waste management. Following economic hardships and political instability in the country, there has been perpetual deterioration in the quality of services offered by city councils (Gukurume, 2011). Dilapidated social service infrastructure, lack of foreign currency and diversity in economic activities in Chiredzi has surpassed the ability of the town council to deal with waste management. Contrary to that, there has been a perpetual deterioration in

the quality of services offered by city councils (Gukurume, 2011). Brugmann (1994) contends that the situation has left the most vulnerable groups in the society to contend with the disposal of their waste through the creation of illegal dumping sites. In Chiredzi, this has resulted in the creation of illegal dumpsites especially in stands that have not been developed and all open spaces. EMA (2011) reported that 1.6 tonnes of waste were generated in Zimbabwe. In most urban towns like Chiredzi the issue of waste management including refuse collection, recycling and disposal has been a challenge. Zimbabwe's most waste generators often dispose uncollected waste at illegal dumping sites. In less economically developed countries most households do not recycle waste but simply find their way to the dumpsite (Akkucuk, 2015).The environmental issue is not only in Chiredzi and the impacts of the challenges of waste management were felt in other towns and cities like Mutare (Nyarai, et al 2016), Harare (Tsiko and Togarepi 2012) and Masvingo (Herald 17 September 2017).

2. Waste

Waste is generally defined as refuse generated from homes, street sweeping, industries, institutions and commercial areas which needs to be collected by or on behalf of the local authority (Hester and Harrison, 2002). Solid waste is generated by any activity such as food preparation, sweeping, cleaning and burning fuel, gardening and recreation (Medina, 2010). Solid waste comes in various forms such as garbage, rubbish and dirt that accumulate in residential, commercial, industrial and institutional areas of towns and cities (Botkin and Keller, 2000). Therefore, solid waste is the unwanted, useless and discarded non-liquid waste materials arising from domestic, commercial, manufacturing and trade industries as well as public service. Waste is generally considered hazardous and therefore toxic to the biological environment, including urban lifestyles and economic activity (Ireen, 2008). Therefore, there is need to manage waste as it poses danger to ecosystem and human health alike (Mapira, 2011).

2.1 Environmental implications of the poor waste management

The closure of existing open dumpsites and the introduction of sanitary landfill is an urgent priority everywhere in the developing world. Even where complementary disposal technologies, such as composting or incineration (waste to energy plants), are practiced, a landfill is still required and is the backbone of any sustainable disposal system. Matching grants designed to encourage landfill investments and sustainable operations may be an appropriate instrument to consider, primarily because the environmental damages and benefits tend to spill over into neighbouring municipalities and regions, or into underlying groundwater resources (Daniel, 1999). The reason simply being because waste in the landfills is not properly managed, this results to the impacts to the environment. Medina (2002) also supported the US Environmental Protection Agency. Pollutants deposited on land usually enter the human body through the medium of contaminated crops, animals, food products, or water. Land pollution

can also damage terrestrial ecosystems, resulting in the deterioration of the conservation on and amenity value of the environment.

2.2 Zimbabwe's legal reform on waste management (construction of dumpsites)

The legislative framework for managing waste is in place in the form of the Environmental Management Agency (EMA) (Cap 20:27), the supreme environmental law of the country .Environmental law in Zimbabwe criminalizes littering, illegal dumping, burning of waste by individuals and companies. Anyone caught on the wrong side is liable to a fine of $5 to $5 000 or imprisonment.

2.3 Objectives

There are three objectives in this paper. They include:

a) Examining waste management challenges faced by residents in Chiredzi;
b) Suggesting the possibility of recycling waste in the town, and
c) Proposing recommendations and solutions for waste management in the town.

2.4 Study area

Chiredzi District is located in the south eastern corner of Masvingo Province in Zimbabwe. In the north, it shares a boundary with Bikita and Zaka districts, to the East with Chipinge district, to the South with South Africa and Mozambique and to the West it borders with Mwenezi and Beitbridge. It is located in Natural Region 5 and is about 1 710 239 ha of which 625 618 ha is under large and small scale farming, 43 327 ha is under resettlement, 512 353 ha is for national parks, 465 541 ha is for communal settlement and 63 400 ha is under safari land-use. The district has rural 32 wards under Chiredzi Rural and 8 urban wards and falls within two Agro-ecological Regions which are 4 and 5. Natural region 5 occupies 85% of the district while region 4 occupies about 15%. The area receives erratic rainfall of less than or equal to 250 mm per annum with temperatures ranging from 25^0C to 27.5^0C. Temperatures as high as 40^0C are common in October and in mid-January. However, the temperatures can drop to 9^0C in early June to mid-July. Meanwhile November to mid-December will be the wettest months that receive 70% of the total rainfall received in the area per rain season.

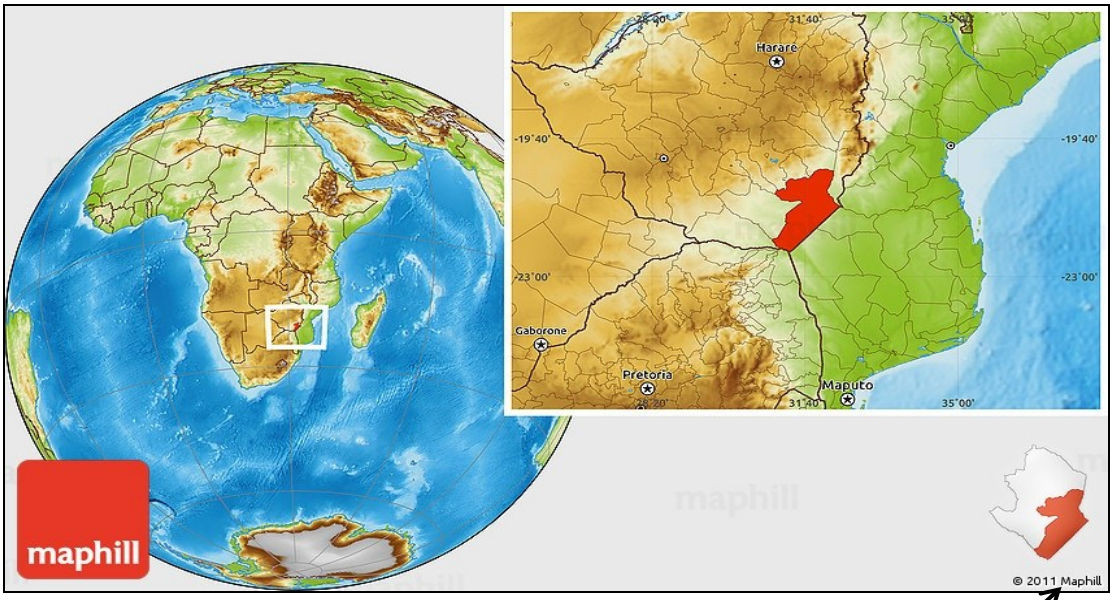

Figure 1: Study area - Chiredzi district

3. Research Methods and Methodology

The study focuses on Chiredzi town in Masvingo province. Aspects to be studied include: how waste is deposited and where it is being deposited, environmental health impacts of disposal methods, strategies to improve waste management. The statistical records for data to be used in the study was obtained from the Chiredzi Town Council, EMA, Chiredzi residents and `previously done researches. The target population of the research study was as follows: our target questionnaire respondents were residents in Chiredzi. The respondents were chosen because they could have seen events happening and watched how waste was being collected in their areas. The interviewees were chosen from waste management offices such as town council and EMA. Geographically, the research boundaries were as follows: Tshovani area and the town including wards 1,2,3,4,5,6,7, and 8.The main road in the study area includes: West road, Lion drive, and Magwaza road.

In this study, a mixed research design was employed. It was not possible to deal with the whole population of Chiredzi hence, sampling was done. The stratified sampling method was employed and the 8 wards were taken as strata. Since the strata were too many to handle 4 strata were selected using convenience sampling determined by high rates of illegal waste dumping, high population density, and the ward that is near the illegal dumpsite and the number of houses. The areas selected were ward 1, ward 3, ward 7 (with some houses that are near the MH6) and ward 2. A sample size of 5% was used to come up with the number of houses to be interviewed in each stratum. Systematic sampling was then used to determine the households to issue copies of a questionnaire. Sampling interval (SI) was obtained by dividing the population (P) by the sample size (n) (SI= P/n). Every n^{th} household unit from the sampling frame was selected. Table 1 summarizes the sampling procedure.

Table 1: Summary of Sampling Procedure (N=100)

Section of wards	Number of houses	Sample size (5%)	Sample size	Sample interval
Ward 1	671	5	20	33
Ward 2	2163	5	40	54
Ward 3	684	5	30	23
Ward 7	577	5	10	57
Total	**4095**	**20**	**100**	**167**

A total of 80 copies of the questionnaire were administered to 55 females and 25 males. Respondents aged 15-30 years were 40, 31-45 years were 30, 46-60 were 10. Eighteen respondents attained primary education, 59 attained secondary education and 23 attained tertiary education. The questionnaires were distributed through the give and return method. Interviews with the Environmental Health Officer, District Environmental Officer and the Town secretary on the challenges they are facing on waste management, causes and possible solutions they have were carried out. Frequent visits were done to the study areas making a direct observation on status of waste bins, illegal dumping sites, and composting activities. A digital camera was also used to take photographs of some remarkable features such as illegal dumpsites and over spilling bins. The dumpsite was visited. A check list used to ensure that important elements at the landfill site such as safety equipment, compaction, daily cover, site staff and waste reclamation activities was checked

3.1 Secondary Data Sources

This involved consulting and reviewing public documents that includes Chiredzi Town Council and Environmental Management Agency and Central Statistics Office records together with published articles on related topics.

4. Results and Discussion

4.1 Demographic data and respondents

The researcher administered 80 questionnaires to the Chiredzi residents to collect data. Gender distribution of the sample respondents is in percentages of the sample population of Chiredzi. Of the 80 respondents, 55 (68.75%) were females and 25 (31.25%) were males.

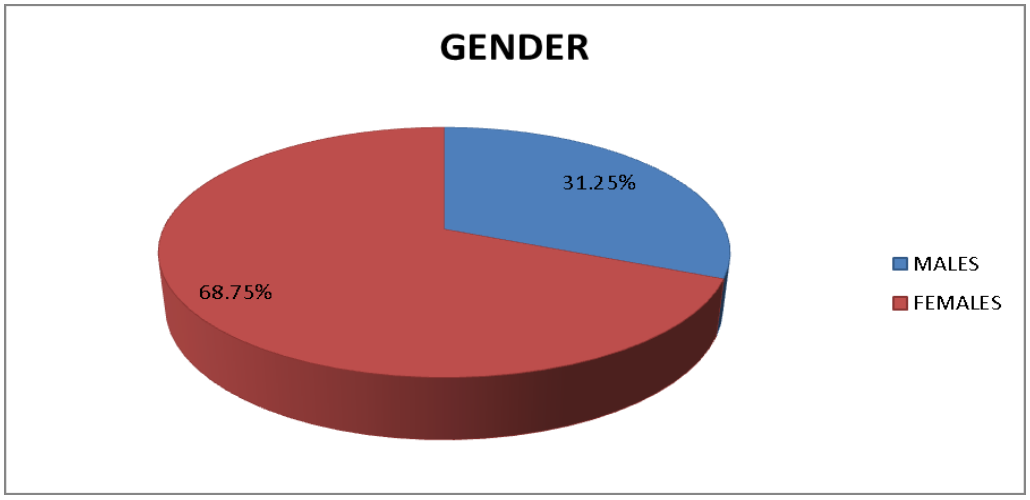

Figure 2: Gender distribution of residents

The age of the respondents ranged from <15years to 60years. Most of the participants were in the age group 15-30 years.

Figure 3 reflects that 80 of the respondents, 35(43.75%) attained secondary education whilst 23 (28.75) and 22(27.5%) attained tertiary (college or university) and primary education respectively. Educational attainment of respondents determined and attitudes of individuals on solid waste management issues. The highest proportion of 43.75% representing secondary education obtained by the residents has a positive impact on the perceptions, understanding and attitude of residents on different ways of waste management.

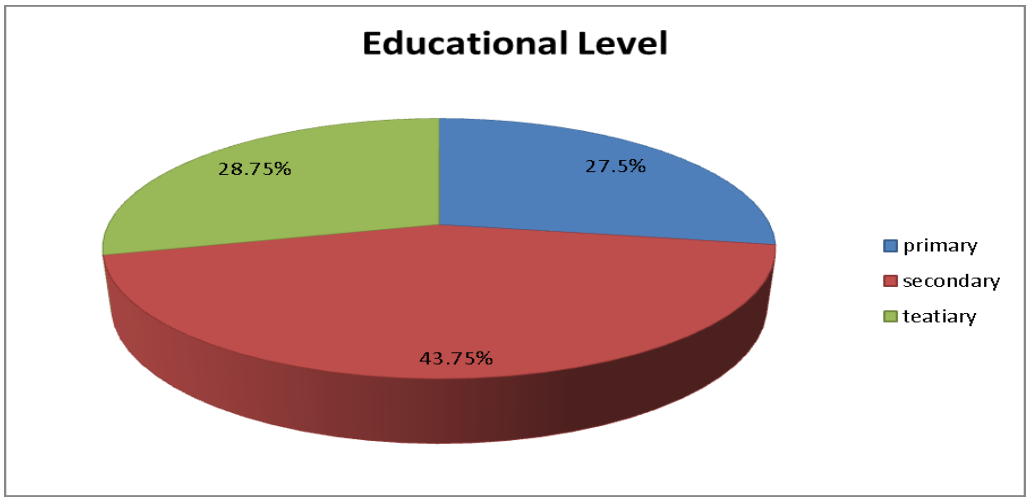

Figure 3: Educational levels

4.2 Solid waste collection by council

Data relating to council's schedule on solid waste collection is shown in Figure 4. Most of the respondents (32%) reported that waste collection is irregular while those who reported no collection of waste was 26%, 12% reported the collection of waste once a week and those who reported the collection of waste twice a week were 25%. The proportion of the sample population who reported that waste collection was only 5%.

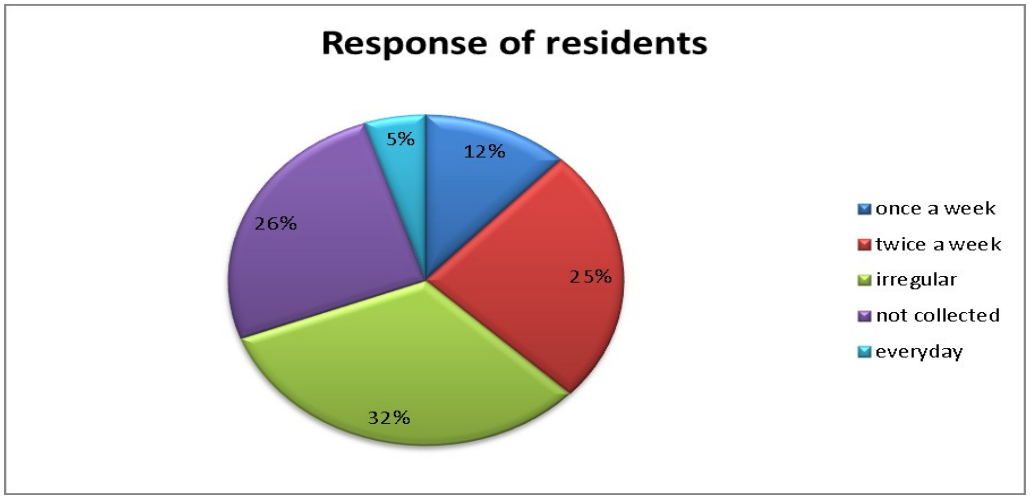

Figure 4: Response of residents on frequency of waste collection

4.3 Type of waste and Systems used by residents in solid waste disposal

The assessment did not attempt to quantify the amount of waste generated by each household but rather sought to find out the type of waste generated per household (Figure 5). This study revealed that all of the households surveyed generate plastic and food wastes. Of the four (4) wards surveyed those who produce paper/cardboard waste constitutes 45% while those who generate glass wastes are 20%. Other waste generated is shown in Figure 5. As for the other waste generated, the different activities that happen at the houses determine the type of waste being produced. At some households there are welding or carpentry activities which take place thus translating to metals and wood waste produced respectively. A lot of construction has resulted in builder's rubble generation alongside with some electrical cables. Some of the electrical gargets are coming from broken down household appliances such as stoves, geysers, DVD players, radios and electric irons, which are thrown away. Responses from questionnaires, interviews and field observations on the type of waste produced at each house hold were also used to calculate the volumes of waste generated as shown on figure 5 below.

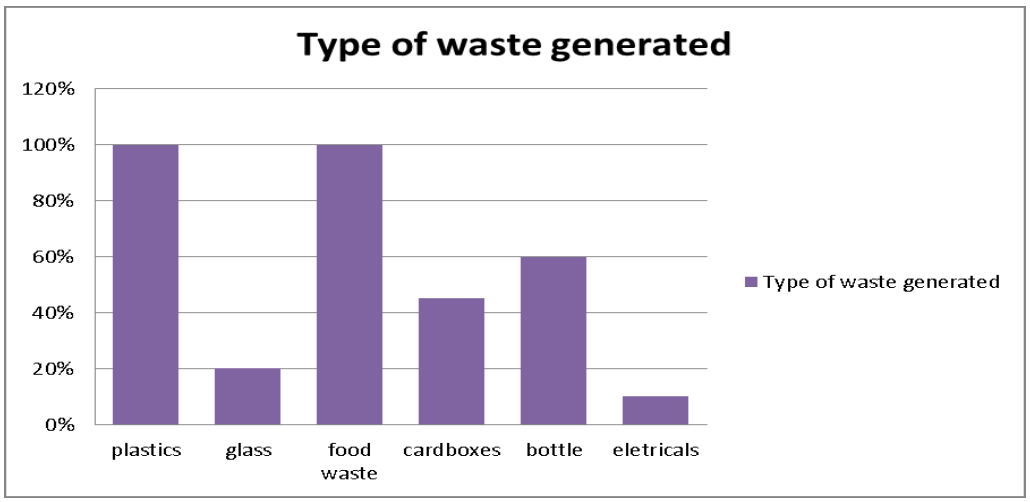

Figure 5: Type of waste generated

4.4 Waste systems used by the residents

The second functional component in the waste management system is waste handling and storage as shown on Figure 6. Diverse methods of handling and storing waste generated are used by residents of Chiredzi. Of the 80 samples, residents only 5% dispose their waste by digging pits either in their yard or on open spaces and bury household waste. Other commonly practised method of disposal of waste at household level in Chiredzi is through illegal dumping of waste and 35% of the residents use this method (see, Plate 2). Twenty five (25%) of the 80 households surveyed effectively dispose waste generated at their houses through the council when it comes to collect solid waste from the residents. However, investigation revealed that the most frequently practised method of waste disposal by Chiredzi residents is burning of waste.

Although these methods are the least desired, the residents attributed the use of these methods to the delay by council to collect waste and/or non-collection at all. Residents who are using improper receptacles are illegally dumping their solid waste as their receptacles fill up before the one week period. Places targeted mostly by illegal dumpers include vacant land, open spaces, unfenced housing stands awaiting development, storm water drains, market places, intersections of busy streets, road verges and areas of high waste generation with inadequate. These illegal open dumping often occurs mostly, but not exclusively, at night as a way of reducing chances of being seen.

Respondents however, suggested that town council should earmark certain areas within the communities as legal sites for solid waste collection for waste to be picked up by local authorities. These could be properly managed by providing for waste separation, fencing the area, and regularly disinfecting waste to reduce disease. This could reduce the costs of door to door collection of refuse and organize waste recovery and recycling in a safer manner.

4.5 Waste disposal methods

From the information gathered it was established that 35% of the respondents resort to dumping in open spaces, 25% is collected by council, 15% is burnt and 5% leave the waste to decompose (composting) and 5% of the waste are being deposited in pits.

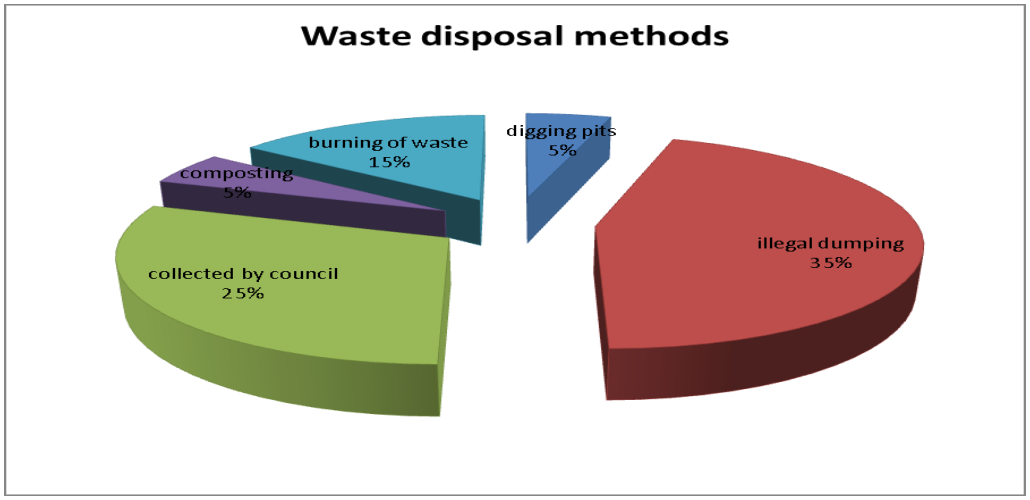

Figure 6: Waste disposal methods

The Plate 1 below is showing how other residents dispose their waste through burning which is causing the release of carbon dioxide which will is resulting to some health problems such as lung problems.

Plate 1: The burning of waste

Plate 2: Illegal dumping of waste

Table 2: Days Taken to Fill up Hard Plastic Bin (average home?) (N=100)

Days taken to fill up waste a plastic bin	Number of respondents	% frequency
1 – 3 days	5	5
4 – 6 days	30	30
7 – 9 days	50	50
10 – 12 days	3	3
13 – 16 days	12	12
Total	100	100

The table reflects that 50% which is the largest proportion of the respondents fill up their bins within a time frame of 7 – 9 days, 30% within 4 – 6 days, 12% within 13 – 16 days, and 3% within 10 – 12 days and finally 5% within1-3 days. The average number of days taken to fill up the bins is 7 days.

The waste receptacles such as empty bags and sacks (See Plate 3) have limited ability and for this reason fill up swiftly resulting in over spilling. The lack of suitable refuse storage containers has resulted in dominance of odours, housefly influx and visual pollution produced by the exposed and decomposing garbage. In Chiredzi the average number of people per residential unit is 8. Excess numbers whereby in many cases several individuals and families stay at one housing unit worsens the crisis of storage. Refuse generation per unit residential place is therefore larger to the extent that the refuse bins (See Plate 4 and 5) fall short to handle the refuse generated. This result in residents resorting to discarding surplus garbage at undesignated sites, burning and burying resulting in environmental-health problems

Plate 3: Sacks that are used for waste disposal

Plate 4 and 5: Bins that are being used for waste disposal

4.6 Waste disposal site

The dumpsite site in Chiredzi is located near the graveyard in Chiredzi town. It is full of non-biodegradable waste collected from surrounding locations like plastic papers, metals, papers and rubber as shown in Plate 6 and 7. This site is not protected like other landfills in the country which are fenced, lined and has a point of entry where any

vehicle carrying waste is liable for search to verify how toxic might be the wastes. Waste is compacted using a bulldozer which is not the proper equipment for compaction. A landfill compacter should be used but it is expensive for the Council to purchase. There is no daily cover of waste using earth to eliminate pests, birds and odours.

These operations do not constitute the qualities of a properly engineered landfill site. Hazardous and special wastes such as clinical waste, condemned food staff and chemicals are just deposited at the dumpsite. The dumpsite is poorly located; it is located near residents and graveyards. This has resulted in the increase of diseases such as malaria since the area is becoming a breading place. This scenario is similar to the situation of most landfill sites in developing countries.


Plate 6 and 7: The dumpsite area

4.7 Resident's response on quality of waste disposal by council

The waste management system of Chiredzi involves generation, storage, collection and disposal. The residents reported a high level of dissatisfaction with the council when it comes to waste collection and disposal. More than 50% of the respondents have reported a poor to very poor performance by the council in this regard (Figure 7). Households reported that they do not get support for accessing bins and have to buy these themselves. Majority of the respondents use black plastic paper bins and hard plastic bins for waste collection at household level (see, Plate 4 and 5).

However, the council does not provide these receptacles to the residents. Some of the receptacles used include sacks, cardboard boxes, mealie-meal plastics and metal tins. In an earlier study by Muchandiona, (2013) he found that the coverage of receptacles for all cities was above 50%. Receptacles are important for successful recycling programs because they enable separation and sorting of different types of waste. However, the available receptacles were not even enough for storing unsorted waste and different types of solid waste

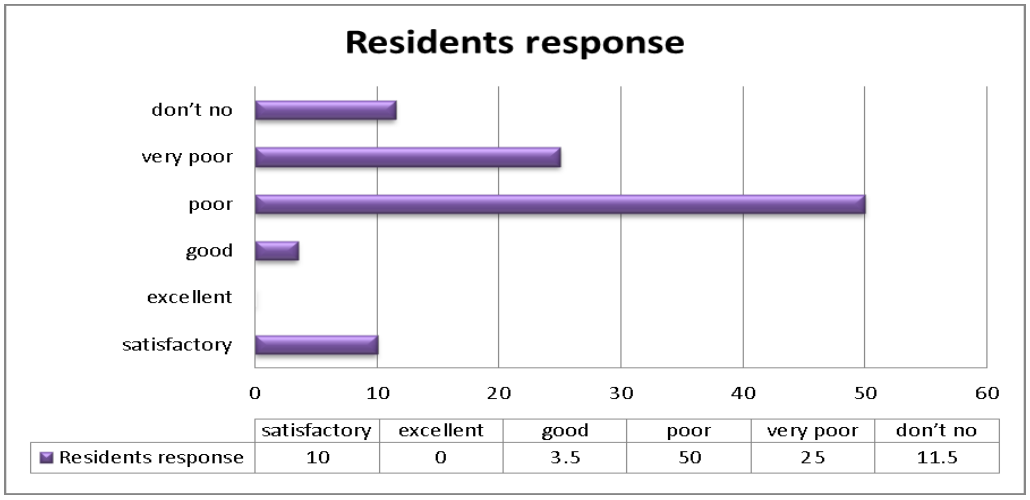

Figure 7: Residents response

4.8 Observations about the quality of waste collection system in Chiredzi

A total of 61% of the resident's rate the solid waste collection system as poor while 25% rates it as extremely poor. Only 14% rate the system as good. There are problems faced by inhabitants when waste is not collected. Problems encountered when waste is not collected include Flies, mosquitoes and other insects breed in some constituents of the solid waste, Smells from rotting garbage, Bins spill over, Waste dumped in drains resulting in blockage, Waste contamination and Illegal dumps as disease fermenting spot.

Figure 8: Quality of waste collection

In Chiredzi there are no recycling companies, there are a few groups of residents named Community Based Organizations practicing it. Chiredzi municipal council does not collect waste as often as it should; residents dispose waste through the burning and illegal open dumps. Also, Challenges of waste management are a major problem faced in Chiredzi. This is because of poor waste disposal due to the shortage of land to construct a registered landfill. Due to domestic and industrial waste being produced every day in the town, the waste is being dumped near the grave yard where the temporal dumpsite has been constructed. The temporal dumpsite is also near the

residents in ward 5 which is causing environmental health problems to the people. The dumpsite has become a place for mosquito breeding leading to the increase of diseases such as malaria. The dumpsite is also causing environmental pollution because of mixed waste dumped there. This has been a challenge of waste management in the town since Chiredzi Town Council does not have a proper landfill for waste disposal.

4.9 Aware of legislation

The data obtained by the researcher revealed that out of the 80 respondents 75% of them were not aware of the regulations that govern solid waste disposal (Figure 8). However, all the respondents who are aware of the regulatory legislation to do with solid waste disposal none of them gave mention of any act suggesting that they only head of the existence of these regulations but do not know what they say.

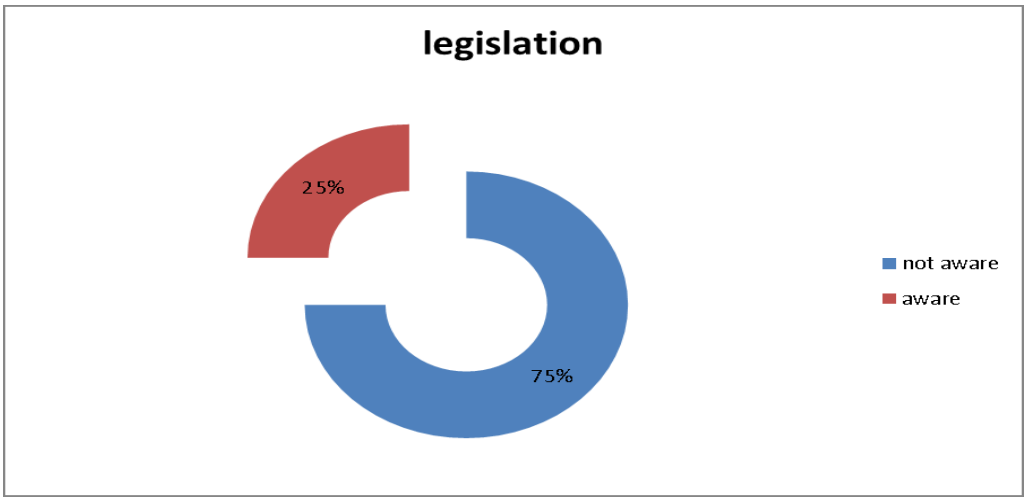

Figure 8: Responses of residents on legislation

5. Strategies to be put in place to achieve sustainable waste management in Chiredzi Recycling

Recycling should be introduced to promote sustainable waste management in Chiredzi and there are a few that are practising it hence it will not sustainably manage waste production. There is a need to develop recycling companies in the town. It should be developed as early as possible.

5.1 Waste segregation

Waste segregation enables easier recovery of waste at the source and promotes recycling as the waste is already sorted out and volume reduced. Segregation is also vital in the management of hazardous waste from households, for instance disposal of batteries. Only 35% of the residents separate waste at household level. This is normally done to recover some of the waste in form of plastic bags and plastic containers for reuse. Some of the respondents indicated that they separate household waste to facilitate for composting as well. Low levels of waste segregation were generally reported by households and cited various barriers to segregation of waste. Although

being the most promising method for conservation of natural resources only 45% of the residents recycle waste generated in their houses. The materials recycled largely comprise both paper and plastic bags and containers, and soap. On the other hand, because the recycling industry is still in its infancy compared to manufacturing, the compensation for recyclable materials fluctuates a lot making it a less attractive venture for these residents.

6. Conclusion and Recommendations

6.1 Conclusions

The outcome and discussions made in this study have shed some light on the waste management system in Chiredzi. The waste produced in Chiredzi has increased over the years resulting in failure of local authorities to manage the amounts of waste generated. Problems such as fuel shortages, shortage of vehicles, shortage of manpower, limited financial resources and weak institutional arrangements have resulted in variable waste management services. The condition of domestic solid waste management in Chiredzi is similar to that of most towns and cities in the developing world, that is, it is characterized by inadequacy, inefficiency, irregularity and inconsistency. Solid waste has become a threat to urban environments and this confirms the fact that solid waste management is one of the most important modern environmental and socio-economic challenges that face urban areas in the 21st Century. Sustainable waste management seems to be unachievable for several municipalities. Waste dumped on roadsides, streets, drainage systems and water ways are frequent in the developing world. Given such a representation of the depressing state of affairs in developing countries there is a need to agree to strategies to enhance the domestic solid waste management system.

6.2 Recommendations

In the light of the fact that there are solid waste management problems in Chiredzi the following recommendations may be considered to solve the problems. The Chiredzi City Council should:

- Increase equipment to meet the capacity of solid waste collection and disposal.
- Increase refuses removal human resources to optimum levels.
- Increase the number of proper receptacles to cover all areas.
- Encourage recycling, through supplying residents with adequate receptacles, public campaigns and involving users in the planning and collection of waste.
- Promote reuse, recycle, compost, or recover materials for use as direct or indirect inputs to new products.
- Improve interaction with residents so that their efforts of waste management are clearly understood by residents. This can be done by increasing the visibility of the Public Health officers visiting the residents.
- Increase residents' participation in solid waste management, and
- Construct proper registered landfills as soon as possible.

About the Authors
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