

MASTER THESIS

“PARTICIPATION OF HOUSEHOLDS IN SOLID WASTE MANAGEMENT AND CIRCULAR ECONOMY TOWARDS SUSTAINABILITY: A CASE STUDY OF KABWE TOWN, CENTRAL PROVINCE OF ZAMBIA.”

FINAL DRAFT

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LIST OF ACRONYMS

3R's: Reduce, Reuse, and Recycle

CBD: Central Business District

CH₄: Methane

CO: Carbon monoxide

CO₂: Carbon dioxide

ECZ: Environmental Council of Zambia

ZEMA: Zambia Environmental Management Agency

EIA: Environmental Impact Assessment

EPA: Environmental Protection Agency

EPPCA: Environmental Protection and Pollution Control Act

GRZ: Government of the Republic of Zambia

LCC: Lusaka City Council

MSWM: Municipal Solid Waste Management

N₂O: Nitrous Oxide

NEAP: National Environmental Action Plan

NEMA: National Environmental Management Agency

NGOs: Non-Governmental Organisations

NMVOCs: Non – Methane Volatile Organic Compounds

NO_x: Oxides of Nitrogen

SWM: Solid Waste Management

UNEP: United Nations Environment Programme

USEPA: United States Environmental Protection Agency

KMC: Kabwe Municipal Council

CE: Circular Economy

ME: Mabaleka Enterprises

PAR: Participatory Action Research

ABSTRACT

This study is about solid waste management in Kabwe Town, Central Province of Zambia. The study focuses on the actual current situation on the participation of the town's households in solid waste management. The reason of studying the current situation is that within the town there is less participation of households in solid waste management which results in indiscriminate dumping. Additionally, there is irregular collection of waste generated thereby causing heaping of wastes and consequently, out breaks of communicable diseases such as cholera, dysentery and typhoid.

The study uses the concepts of circular economy to investigate how household participation in SWM can contribute to sustainability. Under circular economy, the concept of the 3R's (Reduce, Reuse and Recycle) is discussed. The existing situation concerning the awareness level of the households, challenges, and the outcomes of participation in solid waste management is explored and elaborated. The study aims at analysing the existing situation and integrate it with circular economy concepts to give recommendations on how the existing situation can be improved.

Key words: Solid waste management, circular economy, sustainability, household participation.

CHAPTER 1: INTRODUCTION

In this chapter, the main elements that frame this project are indicated as the background that touches up on the current situation in countries like Zambia regarding the waste management particularly solid waste management practices.

1.1 Back ground of the study

The solid waste management challenge is a worldwide concern at different levels in the various parts of the world. The magnitude of the challenge is driven by the amount of effort put in by different countries to contain the solid waste problem. In the developed countries, solid waste is not as alarming a problem as it is in developing countries. The disparity can be explained by the fact that in developing countries, the rate at which solid waste is generated is not in consonance with the capacity to properly manage it (Bournay, E, 2006). The population seems to be leaving the burden of solid waste (that they generate) to the administrative units or authorities.

In most developing countries, the urban authorities, such as municipalities are responsible for waste management. Waste management is one of the most visible urban services whose effectiveness serves as an indicator for good local governance, sound municipal management and successful urban reforms. In the African context, the waste management in urban centres has for a long time been centralised (Liyala, 2011), with the use of imported refuse truck (Rotich, et al., 2006; Okot-Okumu & Nyenje, 2011) that collect waste from sources or transfer point and deliver to designated waste dumps. Land filling has become the immediate most possible way of managing solid waste in most of the African countries because of the high prevalence of indiscriminate waste dumping. The authorities that primarily bear the responsibility to clean up the cities, towns and residential areas find it easier and time saving to collect the waste and carry it to a landfill rather than sorting out the wastes -for recycling and composting. This latter rarely takes place.

Zambia is one of the countries in the world that rank low in urbanization but notwithstanding that the urban population is growing (Ministry of Local Government and Housing, 2010). The implication of this growth is that issues such as solid waste management already demand closer attention.

As Kabwe's urban areas increase in number and expand in geographical and population size, solid waste is swiftly emerging as a significant issue in environmental management (CSO, 2011). Particularly, solid waste volumes have increased in Zambian urban areas of the country due to the growing population, consumption of residents, and inadequate finance and

facilities to manage waste collection and disposal. This state of affairs has led to the volume of solid waste generated to go beyond what the available facilities can accommodate. One of the major factors that have contributed to poor waste collection and management in Zambia, in general, is the limited household participation in solid waste management (Mulenga, 2001). The limited participation has originated from co-ordination and collaboration problems that exist among the three stakeholders in solid waste management, namely- the communities (households), the public (government) and the private sector.

In Kabwe town of Central Province of Zambia, there is a lot of waste generated with little and, in some instances no indication of public concern in containing the problem. Closer involvement and/or household participation is very important in order to achieve sustainable solid waste management. Thus, this research aims to identify sustainable schemes and instruments for household involvement in sustainable solid waste management by using the principles of Circular Economy (CE). Circular economy is an economic concept which emphasizes on maintaining the value of materials throughout the life cycle of a product by a well-planned design (Ellen MacArthur Foundation, 2015).

Kabwe Town in Central Province of Zambia will be used as a case study. Household participation in the existing solid waste management will be investigated and the challenges faced in solid waste management will be identified.

1.2 Problem Statement

In many parts of the world, household communities continue to be looked at as passive recipients of government services, very often disregarded in local decision making process (Tadesse, 2006). This approach results in the people failing to know the role they can play in those processes. Therefore, in the midst of several solid waste management and disposal methods, participation could be the missing link or component in a possible recipe for better solid waste management.

Due to the increased volumes of solid waste generated in Kabwe town of Central Province in Zambia, it has become necessary to find ways of reducing solid waste generation. The population explosion and the booming of economic activities demand for the search for better and sustainable ways to manage wastes. The government, through the municipal council has been responsible for the management of solid waste by using the top-bottom approach and it's time to try other approaches. Due to the failing top-down management, the bottom-up approach, through the participation of households can be combined with the current approach. There are several examples of communities dealing with their wastes by using CE

principles. However, some barriers have already been observed such as the lack of solid waste recycling plants in Kabwe.

Lack of sorting is another problem in the town and without waste sorting it practically becomes difficult to manage the solid waste in a sustainable way. There is indiscriminate dumping and irregular collection of waste produce heaping of waste and overflows coupled with inadequate resources. This situation has resulted into out breaks of communicable diseases such as cholera, dysentery and typhoid. All of that increases public concerns and demands immediate local authority's provision of waste management services.

Therefore, it is important to study household participation in sustainable solid waste management to know the gaps that exist in the solid waste management practices and give possible recommendations. To make recommendations, the study seeks to ascertain the participation of households in sustainable solid waste management, a case study of Kabwe District of Zambia.

1.3 Research objective

The overarching objective of the study is to investigate household participation in solid waste management under CE tenets towards sustainability. Two aspects make part of this research: the identification of the current level of household participation and the identification of other possible households' contribution to their own solid waste management.

The specific objectives of the study are:

- To describe the existing solid waste management system in Kabwe Town, Central Province of Zambia.
- To find out the impact of household participation in solid waste management.
- To assess the challenges faced by households involved in sustainable solid waste management.
- To access the possibility to enable circular economy through household participation in solid waste management in the town.

CHAPTER 2: LITERATURE REVIEW

This chapter seeks to present the literature review by introducing the key concepts and terminologies that are relevant to this study. Then a review of the related literature is presented on the situation of solid waste management in Zambia, where the research will be conducted.

2.1 Waste Management

Waste management refers to the “collection, transportation, processing, recycling or disposal of waste materials” (Tsai , 2007). It is recognised that waste management practices differ for developed and developing countries, for urban and rural areas, and for residential and industrial producers. In waste management strategies, an appreciation of quantities and characteristics of the waste generated is crucial in developing robust and cost effective management methods. However, little attention is given to different characteristics of waste, seasonal variations and future trends of waste generation (PDAC, 2009).

There are different steps in waste management strategies such as identification of source of waste, reduction and minimization, effective waste management disposal options. Avoiding waste disposal on site, categorization of waste accordingly enhances waste recycling process. (PDAC,2009). This process is part of sustainable waste management which deals with the optimization of scarce raw materials and minimization of use of energy.

2.1.1 Sustainable Waste Management (SWM)

Sustainable waste management is understood as supervised handling of waste materials from source through recovery processes to disposal of it. It involves the control of generation, storage, collection, transportation, processing and disposal of solid waste with the aim of protecting environmental quality, human health and preservation of natural resources (Daskalopoulos , et al., 1999). Used as conservation approach, the emphasis is laid on reduction, reusing and recycling of bio-degradable and non-biodegradable waste (Ogunrinola & Omosalewa, 2012) and providing an environmentally friendly option to manage waste (Crown , 2012). According to Lansink (1979) there are two options in waste management: the most favoured option is preventing waste so that there is little waste to be disposed and on the other hand least favoured option is allowing a lot of waste to go to be disposed.

The first R (reduce) involves prevention and reduction of waste. To reduce waste means to minimize amounts of waste generated. Waste reduction stresses upon judicious use of resources in manufacturing. The second R (reuse) involves secondary and subsequent uses of waste materials either in part or as a whole. Reuse of waste is exemplified by trade in second-

hand goods, such as: - cloths, electronics, automobiles, furniture and other merchandise (Goldman & Ogishi, 2001). 'Reuse' is achieved through sorting done at source rather than disposal site (ADB and IGES, 2008) and through detailed processes of checking, cleaning, refurbishing, repairing whole items or spare parts (Chalmin & Gaillochet, 2009). The third R (recycle) depends on waste materials, which cannot be reused directly but can be converted to new products or raw materials through the processes of transformation (Crown, 2012). For instance, used paper is recycled into files, envelopes and cards. In addition, energy is recovered through recycling by pyrolysis, which is a process that involves combustion of waste in the absence of oxygen to create gases, liquids and solid compounds.

The '3Rs' is aimed at achieving sustainable solid waste management and also relates to other global environmental challenges. These challenges include climate change mitigation and specifically, the emission of greenhouse gases that could create sustainable development co-benefits and reduction in the emissions of methane (CH₄), biogenic carbon dioxide (CO₂), non-methane volatile organic compounds (NMVOCs), nitrous oxide (N₂O), nitrogen oxide (NO_x) and carbon monoxide (CO) from landfills (Crown, 2012).

2.2 Circular Economy towards SWM

The concept of Circular Economy (CE) is about an 'industrial economy' that promotes greater resource productivity to reduce waste to avoid pollution by design or intention, in which material flows are of two types namely; (i) biological nutrients, designed to re-enter the biosphere, and (ii) technical nutrients, which are designed to circulate while maintaining quality in the production system without entering the biosphere as well as being restorative and regenerative by design (Ellen MacArthur Foundation, 2015). Waste traditionally has been seen as having no value. In a resource-efficient economy and society, the term 'waste' would refer only to those residual materials that have absolutely no potential to be utilized and, therefore, economic value. Under this definition, traditionally 'valueless' streams of waste can be considered resources for a new tier of the economy. They can be recovered (or prevented from being lost) through greater efficiency and management at every stage of production and consumption. Even some hazardous or toxic materials may be recycled or re-refined for reuse (Ellen MacArthur Foundation, 2015).

In one way or linear economy little effort is made to reduce the amount of materials consumed in production and hence the wastes are produced (Mohanty, 2011). Also, little effort is made to reuse or recycle those wastes which mainly go for landfill as it can be seen in the figure 1 below;

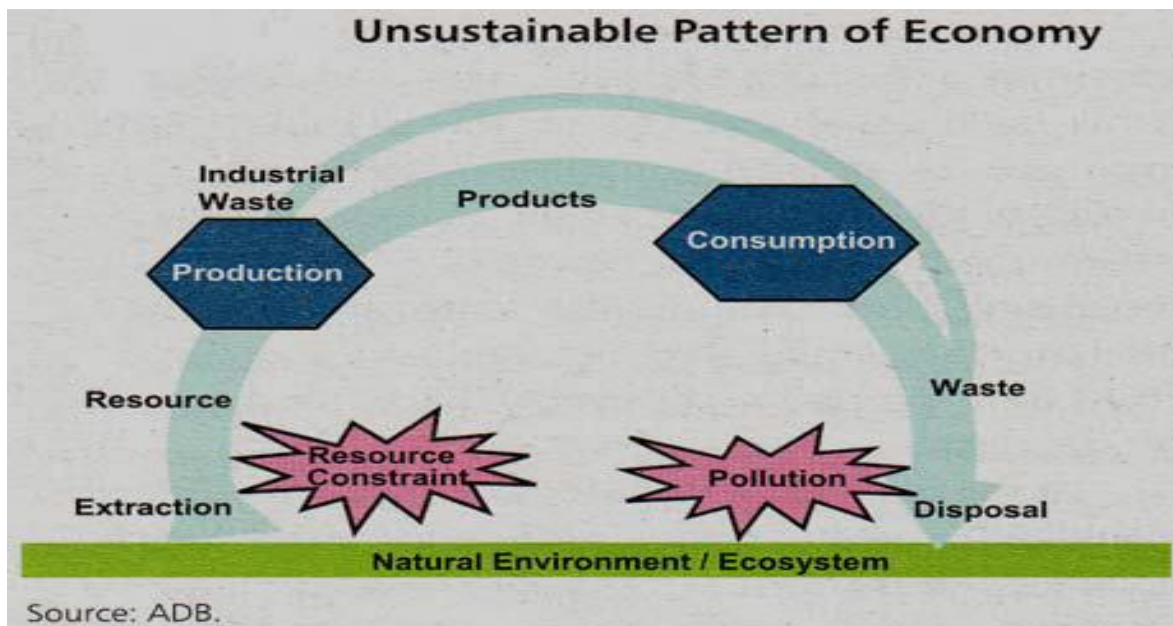


Figure 1: Unsustainable Pattern of Economy (ADB, 2002)

In a circular economy, nearly all outputs either become inputs to other manufacturing processes or are returned to natural systems as benign emissions rather than as pollutants. For example, a closed-cycle processing plant takes in fresh water and does not discharge any liquid effluents. Instead, the water is constantly recycled and possibly utilized in the final product itself as described in the following figure 2.

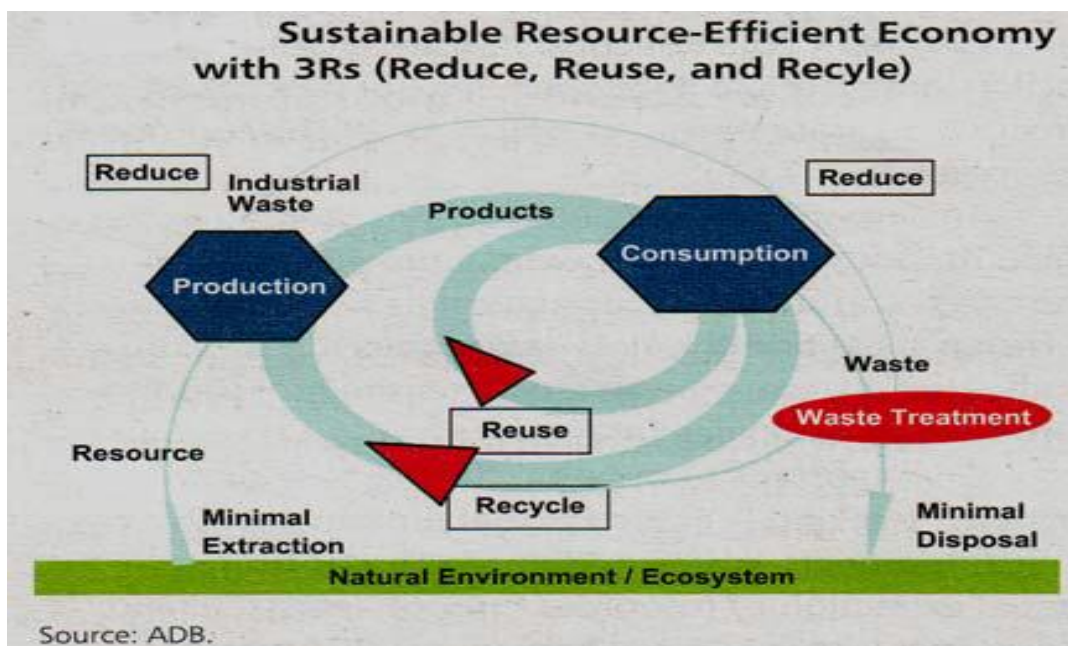


Figure 2: Sustainable Resource-Efficient Economy with 3Rs (ADB, 2002)

As mentioned in the previous section, a circular economy is based on the concept of “3R” particularly in the context of changing consumption and production patterns. It calls for an

increase in the ratio of recyclable materials, further reusing of raw materials and manufacturing wastes, and overall reduction in resources and energy used (Ellen MacArthur Foundation, 2015). These ideas are applied to the entire lifecycles of products and services from design and extraction of raw materials to transport, manufacture, use, dismantling or reuse and disposal (Mohanty , 2011). A circular economy saves money, conserves resources, and satisfies the human urge to be creative. “A circular economy has benefits that are operational as well as strategic, on both a micro and macroeconomic level. This is a trillion-dollar opportunity, with huge potential for innovation, job creation and economic growth (Ellen MacArthur Foundation, 2015).

Separation of waste at source is of paramount importance in the 3Rs initiative (Ellen MacArthur Foundation, 2015). Waste by virtue of its diverse sources will have mixture of materials. However, recently it is observed that recyclables with economic value such as wastepaper, plastic, broken glass, metal etcetera, is not segregated and is thrown on the streets by people along with domestic or trade or institutional waste. By throwing such recyclable materials on the streets or into a common dustbin the quality of recyclable materials deteriorates as it gets soiled by wet waste which is often contains even contaminated and hazardous waste (Ellen MacArthur Foundation, 2015). Without waste separation, the composition of wastes will not be known and planning, designing and implementation of waste management systems is not possible. Waste separation therefore is a key activity in any successful 3R initiative.

According to the Department of Environmental Affairs and Tourism, wastes can be separated at three levels; household and community level, in the process of collection and transportation by municipal workers, and at the waste disposal site by the workers and waste pickers from informal sector (Government of the Republic of South Africa, 1998). It is also important to note that in absence of recycling industries or buyers for the segregated wastes, the sorted wastes end up discarded and mixed with unsorted wastes in open spaces or at disposal sites. According to MacArthur, (2014), the successful promotion and implementation of the 3R strategy require that all stakeholders become fully involved from development stage of the strategy through its implementation. Priority should be given to household participation in the implementation of the 3Rs so as to achieve effective results.

2.3 Household participation in waste management

In many parts of the world, communities continue to be looked at as passive recipients of government services and are very often disregarded even in local decision-making processes (Tadesse, 2006). In the presence of several solid waste management methods, participation could be a missing link for better solid waste management. There is also growing consensus regarding the immediate stakeholders in the issue of solid waste. The generators of waste, in this case the residents need to join hands with the authorities in dealing with this problem that has far-reaching environmental and human health effects. Particularly, waste volumes have increased in urban areas due to the growing urban population, concentration of industries, consumption of residents and inadequate finance and facilities to manage waste collection and disposal (NEMA, 2007). This state of affairs has led to the volume of solid waste generated to go beyond what the available facilities can accommodate.

Participation as a concept came to the lime light as a result of rising advocacy for the end of the top-down strategies to development action in favour of greater inclusion of the subjects of the development programs (Cohen, et al., 2000). Although participation is widely known to be a voluntary process, in some instances it practically requires that people are dragged into getting involved in operations that are of no interest to them, but they are coerced in the name of participation.

The scale of public participation in solid waste management is noticeably different between the developed and developing countries (Oberlin, 2011). In developed countries, household participation in solid waste management may go as far as sorting of the waste generated. The private firms then collect the already sorted waste at a fee. The fees paid cover up for the processes in which the public should have participated in the waste management process. In other words, the burden is passed on to the private waste collectors at a fee (Oberlin, 2011).

Success story of sustainable solid waste management is reported in a case study in Nepal with European Union funding. This involved activities such as expansion of house-to-house waste collection, employment generation for community members for street sweeping and addition of 58 new dumpsters. It also involved the installation of organic waste compost machine at Bhaktapur, creation of landfill at Katuwu Khola which replaces dumping of municipal waste at the river bank and public private partnership in waste management in Biratnagar. (Practical Action Nepal, 2008).

In Chennai India, the Greater Chennai Corporation was unable to cope with the growing volume of waste generated from rapid urbanization. There has been greater involvement of

individuals, communities and non-government organizations who have taken initiatives not only to manage the waste, but to turn it into a resource (Greater Chennai Corporation , 2016). All communities, and especially those that are most affected, have a critical role to play in waste management services.

2.3.1 Solid waste management and Household participation in developing countries

In developing countries, the picture is different. In the first place, the majority of the population is too poor to regularly afford fees for waste collection. Secondly, many of the people ignorantly dispose of waste carelessly with little concern about the imminent effects their careless disposal will ultimately cause. Thirdly, in some instances the people just do not think out the complexity of the waste problem and on whom the effect will finally rest.

Households seem to think that it is completely the concern of the local administration to ensure proper waste management at no extra charge (Bournay, E, 2006). The households must be well informed on key issues and how they can actively participate in national solid waste management.

The quality of the urban council wastes can be illustrated by a study done in Uganda. Household wastes are stored in bins by the affluent and in sacks, plastic bags, cut jerry cans, cardboard boxes by the low-income households, and a large percentage of domestic waste storage containers (e.g. sacks, polythene bags and boxes) used by the poorer urban community are dumped with the wastes (Lin, et al., 2008). There is no sorting as such, but households separate components of wastes considered of value such as vegetables and food leftover (for animal feeds used at source or sold, sometimes given free). Other components recovered are plastic bags (reuse), bottles- plastic or glass (reuse and sale), tins (reuse and sale) and scrap metals (for sale) are separated by some households from waste that is usually stored mixed (Rotich, et al., 2006). Sorted or separated waste is either reutilised at source or sold to itinerant buyers who afterwards sell them to middlemen who supply recycling industries (Okot-Okumu & Nyenje, 2011). This clearly shows how some individuals put already in practice the circular economy principles even without knowing the term and its principles. Even further, for some families these kinds of activities represent an important component of their revenue schemes, mostly as part of the informal economy. Whilst in other contexts, the “wastes” are collected and transported by private (legally registered) organizations that make sure of their recuperation. As it can be concluded, the institutional array plays a crucial role on the “wastes” management which in theory stands on the regulatory local frameworks but in practice it relies on local capacities.

The study by Liyala (2011), of Kisumu in Kenya clearly illustrates the solid waste management financing dilemma due to inability by a large percentage of urban community to pay for waste collection services due to low income levels in the East African Community (EAC) region. Therefore, households without waste collection service have to develop their own waste management systems. The most common household waste management methods identified are waste burning and backyard burying or indiscriminate open dumping, Liyala (2011), Oberlin (2011), Okot-Okumu and Nyenje (2011).

2.3.2 Impacts of household participation in sustainable waste management

Many local authorities in developing countries face a lack of financial, technical and human resources and are therefore not capable or willing to deliver and maintain urban basic services like solid waste management. Household participation may provide this much-needed human resource in dealing with solid waste management and can go a long way in reducing the stress on the little available financial resources. Involving household communities in local projects can increase ownership of projects and enhance a sense of responsibility for maintaining services provided by local authority (Cotton, et al., 1998). Such participation can be used to enhance the understanding and agreement of cost sharing (both financial and physical contribution). Furthermore, household participation can be used to prevent conflicts and to stimulate cooperation and agreement between different actors. In this way delays in project execution can be reduced and overall costs minimized (Colon & Fawcett , 2006). Household participation may for instance increase awareness and capacities, may improve the ability to negotiate as equals with authorities and other stakeholders to promote common objectives, and increase responsiveness to conflicts within the community. Household participation may give people the opportunity to devise and initiate strategies to improve their situation.

Apart from individual responsibility, households can be collectively responsible in more or less organised activities, like meetings, clean-up campaigns, and awareness-raising activities (Colon & Fawcett , 2006). Furthermore, household participation may involve making material, financial or physical contributions to activities of solid waste management, for instance working as cart operator or sweeper, and paying fees for waste collection.

As recycling increases, there will be a growing supply of materials generated. In order to utilize these recycled materials, manufacturing facilities will emerge to find uses for them. As more recycling plants are built and more products are manufactured, there is a greater understanding of the entire process. There will also be opportunities for the start-up of micro-

enterprises in recycling, for example recycling of paper, Tetra Pak cartons and Pet bottles (ADB, 2002).

It is estimated that recycling 10,000 tons of materials would create employment for 36 people compared to six for land filling the same amount of waste (EPA, 2002). Some communities have formed working partnerships with workshops for the disabled, developed and administered job training partnerships, or otherwise found work for unemployed labour in recycling programs. Apart from cutting costs of management and disposal, since waste collection, sorting and processing are in most cases, labour intensive, they serve to employ a substantial number of people. It is revealed that in India, over one million people are employed in the waste sector (Gupta, 2001). Potentially, a number of otherwise would be unemployed people can gainfully engage in the process of sorting and collecting especially recyclable waste materials either on a private individual (informal) basis or at (formal) company level. In so doing, financial gains would permeate to those who engage in sustainable waste management practices and thus encouraging sustained participation in the developing countries by exporting second-hand items (Bournay, E, 2006).

It is very clear that without household community support and involvement at least at sorting stage (which has to be done at the source before waste collection), even recycling may be very costly to undertake (Nzeadibe, 2009). Here, the community manifests as a very important stakeholder in solid waste management and the level of their participation counts on the success of recycling in particular and solid waste management in general. Notably, the costs of collection, transportation and land for landfills, are high; however, engaging the community serves to reduce such costs. In a way, this proves to be a sustainable mode of waste management. For example, in Dhaka where community-based solid waste management and composting projects have been implemented, a lot of such costs have been reduced. The projects have been able to save the municipalities from the costs of collection while at the same time reducing the need for landfills (Bournay, E, 2006). Diversion of costs from the municipalities allows them to invest in other services that benefit the community.

Wastes of value such as plastics, cardboards and scrap metals are separated starting at source, at transfer points and at disposal sites. Some of the separated wastes are sold to artisans and women groups who convert them into goods such as hats, bags, necklaces, baskets, door rugs, mats and seedling cups that are sold to the community as crafts (Achankeng, 2003). This is only possible for waste pickers if organised in formal groups that can be legally registered, monitored and supervised as reported in studies by Mbeng et al. (2009) and Nzeadibe (2009).

For years, recycling has been hampered by the belief that by doing that, it should generate money. That may be true for some recyclables, but not for everything. Rather, recycling should be as much as possible a cost-effective management option. It usually requires fewer government subsidies than land filling or incineration. It saves natural resources and helps to protect the environment. Lower taxes, energy savings and a cleaner environment are some of the “bottom lines” in favour of recycling (Achankeng, 2003). All of those fit as well on what Circular Economy promotes.

2.3.3 Challenges faced by households and other actors participating in sustainable waste management

The process of household participation in solid waste management is challenged by several factors, depending on the method chosen for this purpose as well as the characteristics of the household in a particular location (Tsai , 2007). It is noted for example that attitudes towards recycling are influenced by appropriate opportunities, facilities, knowledge and convenience (Achankeng, 2003). People are diverse in terms of the knowledge base they possess as well as in what they feel is convenient for them. This automatically makes their attitudes to differ. As mentioned under section 2.2, the Chennai Corporation, in spite of having high waste collection rates, does not have a proper workable plan for solid waste management (Sivaraman , 2013). It also lacks technical expertise and sufficient manpower. The daily waste generated in the city is disposed of in dumpsites without following internationally accepted scientific procedures (Troop, 2013). It is very difficult to operate in an efficient manner without cooperation from municipalities as they are not only responsible for disposing of the left-over waste, but also for supporting waste collection in other ways such as allocating space for composting. Unsatisfactory or below par performance of municipal staff can create challenges for household interventions (Ramkumar, 1996). Some people look at community-based organization work as an extra voluntary task to which they are not prepared to fully commit. When such an attitude prevails, systems usually collapse without anyone to run and monitor them on a full-time basis (Crown , 2012).

The other factor has to do with information, knowledge and awareness gaps among the members of the public which make their participation a challenging option. In their study on waste minimisation in local governments in the United Kingdom, Read et al (1998) found out that there was low awareness about the best practices in waste minimisation across different administrative areas/local governments. For household participation to yield optimum benefit, narrowing the knowledge and awareness gaps have to be done. Involving the public

with their knowledge gaps may only lead to a challenging process of participation in solid waste management. Inadequate or limited awareness and appreciation of best practices for environmentally sound management of wastes is a major constraint and a paradigm shift among the communities and society at large is needed (USEPA, 1998). Solid waste management is a matter influenced by policy. Ideally, policy acts as an engine that gives direction and impetus to the solid waste management system. The analysis, however, shows that due to the absence of clear public policies as well as the economic inevitability of investments in municipal waste segregation and recycling, such activities have not thrived in most parts of the developing world (Joardar & Souro, 2000). To effectively involve the households in solid waste management within a structure that does not provide clear public policies becomes very cumbersome.

There has also been a tendency to localise the nature of the waste concern and thus looking at it as a mere nuisance rather than a health and environmental hazard (Joardar & Souro, 2000). This has translated into low political will and the reluctance of the households to respond to the problem. The absence of clear and specifically outlined legislation and mandate makes it difficult to achieve quality solid waste management practices. This is because it deprives local bodies of transparent tools to regulate activities of individuals, firms, or organisations towards effective solid waste management (Joardar & Souro, 2000). The participation of the private sector in solid waste management also most of the times concentrates on municipal contracting-out of secondary waste collectors in form of transferring the waste to disposal sites (Joardar & Souro, 2000). The participation of the households as individuals is still virgin and provides a lot of potential for doing more about solid waste management. This therefore calls for strategies that will help to enlist the participation of the entire public for their attention to sustainable solid waste management practices.

There are also the negative factors of attitude and culture that have prevented in some cases the very important element of household participation as noted by some authors (Kaseva & Mbulungwe, 2005) and (Rotich, et al., 2006). The low standard of living (*poor pay*), education (*high illiteracy levels*) and the economy (*low GDP per capita*) are influencing factors that cause low levels of willingness to participate in public management matters. Therefore, there should be some public policy put in place to address such barriers to enable household participation to deploy its intrinsic benefits on waste management as it was presented in section 2.2.2.

There is no national policy for reduction of generated waste at source. Although councils have by-laws, the thrust of these laws has remained focused on collection and disposal of waste, with little official attention being paid to other waste management activities such as recycling and composting. Nonetheless, enforcement of these laws still remains a big challenge as countries in Africa still lack a national Waste Management Policy. There is a serious gap in awareness creation as the process is considered expensive with no immediate returns. No local authority has adequate budgetary provision to support awareness rising (Achankeng, 2003).

Waste management in African countries, is still ranked low in comparison with other competing national development needs. More human resources and updated equipment have to be availed in solid waste management in African countries. People are generally reluctant to pay the fees of collecting off their municipal wastes (Borongon & Okumura, 2010). Cost of borrowing for purchase of waste equipment is high. This has inhibited the active private sector participation in waste management hence there are a few players in the sector to provide the service. Most institutions lack infrastructure and resources to enforce laws under their jurisdiction (Rotich, et al., 2006). As discussed above, the work which the institutions are doing is not up to acceptable standards because of constraints. The constraints include poor funding, poor administration, lack of transport, lack of equipment, and inadequate remuneration for qualified staff and there is generally inadequate human and financial capacity for the local authority to manage waste.

In African countries, there is generally low scale of separation of waste at source, there is absence of national policies for reducing the amount of waste generated at source, mixing of other waste streams (hazardous waste with domestic) is a common practice. There is generally limited usage and utilization of materials that could be recycled, inefficiency in the recycling processes specially for organic waste, lack of technical support to upgrade waste recycling factories, lack of market for some recycled products, lack of institutions which recover and recycle hazardous wastes and empty containers (Ellen MacArthur Foundation, 2015). In the next section, the specific situation in Zambia takes the attention in order to distinguish the specific challenges and opportunities to develop circular economy whilst managing the solid waste sustainably through household participation.

2.4 Situation of solid waste management in Zambia

The management of solid waste in Zambia is the responsibility of the local authority. Generally, the current waste management situation leaves much to be desired. Wastes generated from all the sectors of the economy are currently not well managed. Disposal sites in almost all the districts are either not there or they are poorly managed (Ministry of Local Government and Housing, 2010). Taking the Lusaka situation as a reference point, less than 15 % of the waste generated in the urban centres finds its way to the disposal sites (Mulenga, 2001). In addition, there is generally inadequate data for other waste streams especially for areas outside Lusaka and Copperbelt.

The management of various types of waste has over the years been a very difficult and challenging issue. This difficulty has manifested itself in the perennial outbreak of diseases (e.g. cholera, dysentery among others), pollution (water resources, air and soil), proliferation of pests and vermin, and the loss of aesthetic beauty (Mulenga, 2001).

Improvements are desired in waste management covering aspects of minimisation of waste generation, collection, reuse, recycling, treatment and disposal. In this regard, the Government of the Republic of Zambia (GRZ) enacted legislation such as the Environmental Protection and Pollution Control Act (EPPCA) amended in 1999, Cap 204 of the Laws of Zambia, which established the Environmental Council of Zambia (ECZ) now called the Zambia Environmental Management Agency (ZEMA) to provide for the control of activities related to environmental protection. Because of the new and emerging issues including for example, climate change, pollution from persistent organic pollutants and electronic waste, the government through ZEMA, to address these new challenges as well as enhance the control and management of the existing ones, a new Act, the Environmental Management Act (EMA) No. 12 of 2011 has been enacted.

The Lusaka City Council (LCC), like most municipalities in the country, has not been able to adequately deliver services to its residents due to the liquidity problems it has experienced for a long time. The poor performance of such local authority is largely due to the centralisation of resources by the government (Ministry of Local Government and Housing, 2010). At the moment, however, LCC faces serious financial problems mainly due to a narrow resource base, untapped potential for income generation and out-dated policies. These constraints confine it to being an implementer as opposed to being a regulator in issues such as determination of certain levies within its area of jurisdiction (LCC, 1999).

Throughout the years, waste management in Lusaka has been totally inadequate for a large city. Due to lack of funding and no sustainable waste management system, only the central business district (CBD), hospitals, markets, and governmental and commercial institutions have been serviced on a regular basis in the immediate past (Ministry of Local Government and Housing, 2010). In Lusaka, only an estimated 15% of the municipal solid waste generated is collected, resulting in build-up of waste in open spaces and along streets in or around the city (LCC, 1999). The Lusaka City Council is implementing a new waste management system in order to ensure that the city's inhabitants have access to affordable waste management services. The system was developed in 2003 and is being implemented by the Waste Management Unit of the council, in partnership with the private sector. The council has contracts with a number of waste management companies for the collection of waste. Each company collects waste in a part of the city and is also being responsible for the collection of fees (Ministry of Local Government and Housing, 2010).

The Waste Management Unit of the LCC is responsible for waste collection in the CBD and some surrounding areas, including peri-urban areas, where fees are collected by Waste Management Committees that operate as community-based enterprises or community based organizations (LCC, 1999). In the latter case, the Waste Management Committee works under the umbrella of either the Resident Development Committees or Neighbourhood Health Committee. LCC municipal solid waste bylaws support the new waste management system. The council has constructed an engineered landfill site with support from the Danish government (Mulenga, 2001).

Zambia has recognised the need for a strengthened legal framework to the management of solid waste. In this regard, the EPPCA, which is a result of the recommendation of the NCS to have legislation that encompasses all environmental aspects, forms the basis of the framework. Within this framework, all the stakeholders will have a role to play with local authority playing a key role in the formulation of by-laws and regulations in their areas of jurisdiction. The 'polluter-pays-principle' and similar such principles shall guide this process. This framework reflects the National Environmental Action Plan's (NEAP) fundamental principles of the right of the citizens to a clean environment, the participation of local communities and the private sector in natural resources management, and obligatory Environmental Impact Assessment (EIA) of major development projects in all sectors (Ministry of Local Government and Housing, 2010).

As mentioned earlier, this study is carried out in Kabwe town and below is the map showing the relative location of the town and its residential areas.

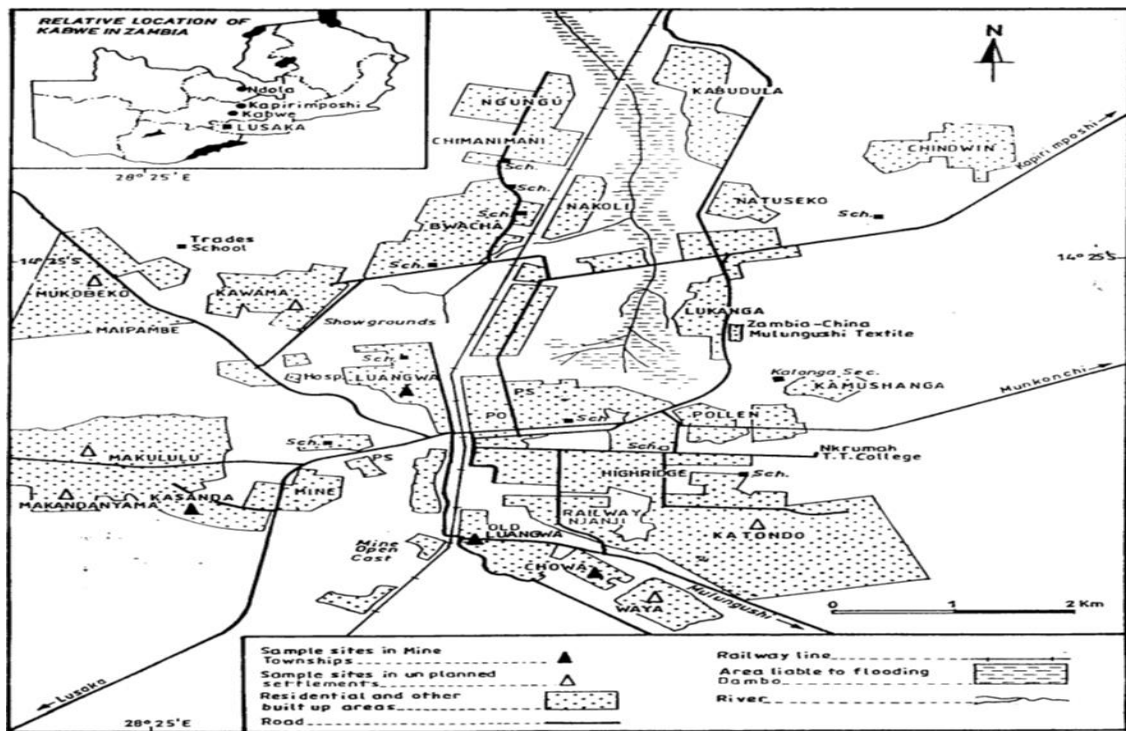


Figure 3: Relative location of Kabwe Town and its residential areas (CSO, 2011)



Figure 4: Map of Zambia showing the relative position of Kabwe town (CSO, 2010)

CHAPTER 3: RESEARCH DESIGN

The research design is the organisation of collection and analysis of significant data for the purpose of the research. The study in Kabwe town, Central Province of Zambia will be designed to use quantitative method of study. It therefore draws on the cross-sectional study design as explained by Bryman (2004) and also on aspects of a phenomenological research design as discussed by Blanche et al. (2006). This design was chosen because of the nature of data that is needed for the study. Qualitative research methods of study are concerned with expressing the quality of a phenomenon under investigation.

3.1 Research Framework

This is the schematic and highly visualised representation of the steps required to achieve the research objective (Verschuren & Doorewaard, 2010). The research framework is developed through a list of steps (activities) that are used to achieve the research objectives and the steps are as shown below:

Step 1: Characterizing briefly the objective of the research project

The objective of the study was to investigate household participation in solid waste management under CE tenets towards sustainability. Two aspects made part of this research: the identification of the current level of household participation and the identification of other possible households' contribution to their own solid waste management.

Step 2: Determining the research object

The research object was the solid waste management, in Kabwe Town Central Province of Zambia.

Step 3: Establishing the nature of research perspective

The research perspective is basically a conceptual model to determine the practice and analyse the participation of the households in solid waste management. With the purpose to give recommendations, several sources of information were considered to be integrated in such a way that a cross validation could be ensured. Desk research and in-depth interviews were considered in this design. Hence, the research was inclined towards problem analysis to provide recommendations to the local authority.

Step 4: Determining the sources of the research perspective

The research used scientific literature to develop the conceptual model as shown below in table 1.

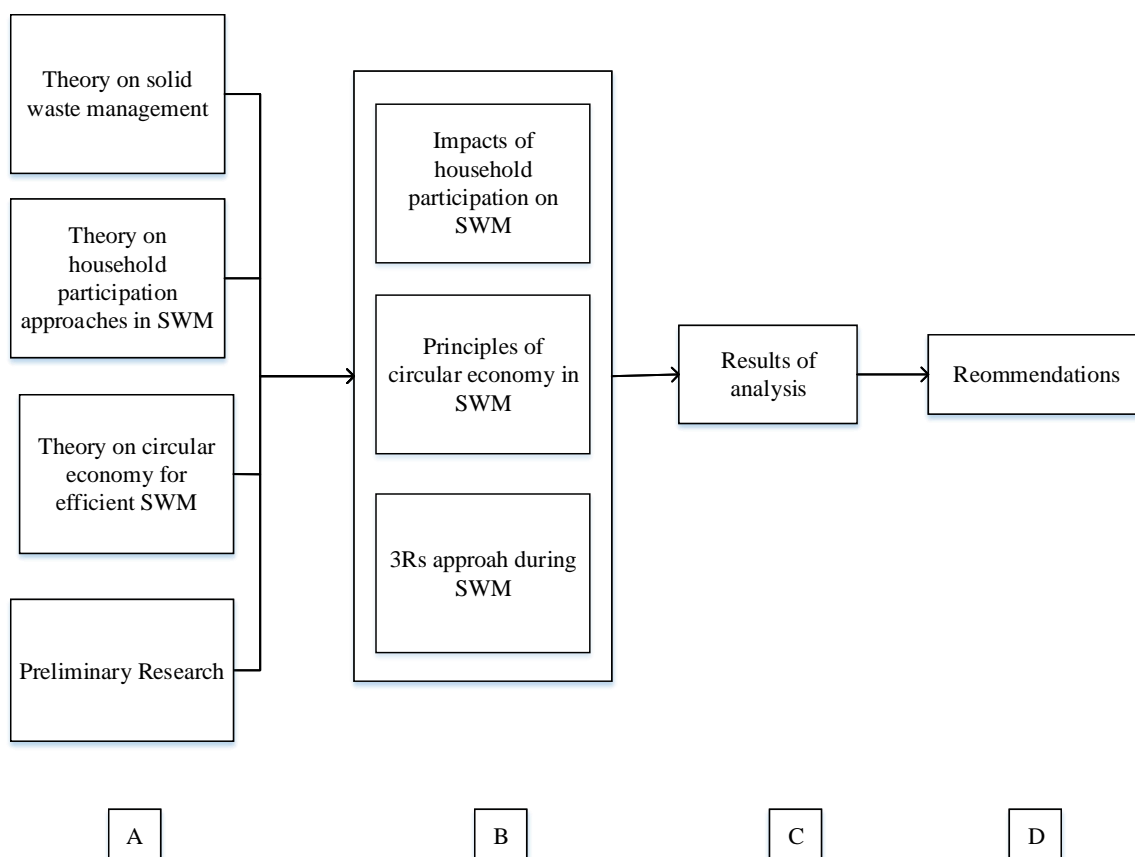
Table 1 Sources of the research perspective

Key concepts	Theories and Documents
Household/stakeholder participation	Theories on waste management
	Theory on solid waste management
The 3Rs approach during SWM	Theory of household participation
Circular economy	Theory on circular economy

Step 5: Making a schematic presentation of the research framework

The research framework is presented below in figure 3.

Figure 5 Schematic representation of research framework



Step 6: The steps that were taken during the execution of the research project are here formulated;

- (a) The study of theories on waste management, particularly solid waste management, household participation approaches, and circular economy concepts were studied

- (b) Based on step A, analysis of impacts of household participation on SWM, including 3Rs' approach and the circular economy aspects were done.
- (c) Analysis of the results obtained in step B was done to give recommendations
- (d) Recommendations/suggestions for future improvement of SWM in the Kabwe Town.

Step 7: Checking whether the model requires any change

In this research, there was no reason of changing the research model of the research project

3.2 Research questions.

Main research question

What is existing situation on solid waste management in Kabwe Town, Central Province of Zambia? How can the existing situation be improved?

Sub research questions

The study seeks to answer the following research questions;

1. What are the impacts of household participation in sustainable solid waste management?
2. What is the current situation on household participation in sustainable solid waste management?
3. What challenges do households and other actors involved in solid waste management face?
4. How households' participation in the Kabwe Town can enable sustainable solid waste management by using the circular economy model involving the 3Rs?

3.3 Defining key concepts

This step of defining and elaborating key concepts is needed because key concepts do not only have influence on the progress of the research projects but also on the steering capacity of the research questions (Verschuren & Doorewaard, 2010). Key concepts can be defined in so many ways but for the purpose of this research the following key concepts were defined;

Waste: any material that is no longer wanted or material leftover from a useful process (Chalmin & Gaillochet , 2009).

Solid Waste: any material that is no longer wanted or material leftover from a useful process which is not in liquid or gaseous form (ADB, 2002).

Sustainable Management: any practice or activity capable of maintaining resources without exhausting them or causing any damage to the environment (Mbeng , et al., 2009).

Circular Economy: is an economic concept which emphasizes on maintaining the value of materials throughout the life cycle of a product by a well-planned design (Ellen MacArthur Foundation, 2015).

Household: people who live together in a group in a house (Colon & Fawcett , 2006).

Participation: is an act of involvement of people in community projects to solve their own problems (UNCHS, 1986).

3.4 Types of Data

Data needed for the study was obtained from both primary and secondary sources. According to Bless and Higson (1995), primary data is the data which the researcher himself or herself collects and are thus original in character. This data is first hand because they are usually collected from respondents using questionnaires, interviews, surveys, direct observations, and experiments. Primary data in this case was obtained from the local people in Kabwe District. Secondary data on the other hand includes the data that has already been collected and compiled by someone else and are available for use by the researcher (Denzin & Lincoln, 2000). This data may not be original in nature, but it was used to supplement primary data and to validate it. Secondary data was from books, magazines, journals and the internet.

3.5 Research Strategy

A research strategy is a coherent body of decisions regarding the way in which the researcher is going to carry out the research itself. It is the most significant step a researcher has to make when developing a research design which includes the approach to be taken (Verschuren & Doorewaard, 2010).

3.5.1 Research Unit

The research unit for this case study was Kabwe Town, Central Province of Zambia. Solid waste management situation at household level in the town was analysed.

3.5.2 Selection of research units

As Verschuren and Doorewaard (2010) explained, the selection of informants and respondents for data and information collection is arranged in the following ways:

Informant: Someone who provides data about other people, situations, objects or processes

Respondent: A person who supplies information about himself or herself

Households: They serve as both informants and respondents. They are assumed to give the real (practical) image of solid waste management on the ground and can explain complaints that they have on the management system that can serve as an input data for this case study. The interview gets into detail until satisfactory data and information is gained that can help to assess the solid waste management of the town.

Local municipal council/Ministry of Water Sanitation and Environmental Protection/Zambia Environmental Management Agency (ZEMA)/Solid Technology Systems and Zinc, Aluminium, Lead and Copper Ore (ZALCO): They can serve as both informants and respondents. They can explain challenges related to solid waste management practices and the general situation of waste management in the town. The interview will include senior and middle management based on how strong the data and information they can provide to this case study.

The Town Clerk: He/she can also serve as both respondent and informant. He/she can explain both technical and management details of the problems based on the questions (interviews) he/she is asked.

3.5.3 Sampling Methodology

Since it is difficult to conduct interviews based on the whole population of the town, *purposive or judgemental* type of sampling technique was used in this case study. This type of sampling technique was based on selecting the most useful or representative group or sample that could give useful data and information for the case study. The selected group or sample was assumed to be representative of the whole population (Babbie, 2004).

This form of sampling is often used when working with very small samples such as in case study research and when one wishes to select cases that are particularly informative. The logic on which the researcher bases his strategy for selecting cases for a purposive sample should be dependent on the research questions and objectives (Saunders, et al., 2000). The sample group to be targeted as a source of data for this case study from households of Kabwe town were from three residential areas; one a high, medium and low cost respectively in terms of income levels of the households involved.

The methodology that was adopted in collecting the data included questionnaires and formal interviews with the indigenous people and the local authority department and other stakeholders involved in solid waste management in order to obtain data on household participation in the management of solid waste, the impacts, challenges faced and the possibility to enable CE. With the consent of the respondents, photographs were taken during observations of the study. The information collected was verified by cross checking from other knowledgeable persons of the study area and key informants regarding the involvement of households in management of solid waste.

3.5.4 Research Boundary

The research boundary is used to demarcate the research so that it will be conducted in a given time frame and also meet the objective by answering research questions. There might be complaints from local people especially such as availability of solid waste disposal equipment, technologies and resources allocation problems and further inquiries from management bodies that will fall beyond the scope of this research. So, issues which need advanced research were not included in this study. Only issues concerning present solid waste management specifically based on this case study questions were targeted.

Sample size

Out of the total population 202,914 in Kabwe CSO (2011), 100 people were talked to through questionnaire, 30 from each of the 3 residential areas that were sampled out and 10 respondents from others such as Municipal council workers and other institutions involved in the management of solid waste such as the Local municipal council, Ministry of Water Sanitation and Environmental Protection, Zambia Environmental Management Agency (ZEMA), Solid Technology Systems and Zinc, Aluminium, Lead and Copper Ore (ZALCO). This was representative enough to generalise results with other situations and other people in Kabwe District.

3.6 Research Materials and accessing Methods

Research material and accessing method is the way of organizing and defining where are data and information that a researcher needs to answer research questions. Which source should be analysed, and how to get them are all planning and designing of the way to attain the research objective (Verschuren and Doorewaard, 2010) .

In this research, data sources were people, documents, media and reality (from observation). The strategic way of using these sources were by interview (individual face to face), analyzing documents and observing the reality on the ground. Analysis of document included the existing solid waste management system in the town, if the concept of circular economy exists or not, and achievements they made so far including future perspective of solid waste management of the town. During the interview, people talked about whatever they felt like concerning the target of questions they were asked.

3.6.1 Data Collection Methods

The sources of data, types of information needed and their accessing method in this research were identified through the set of sub-research question as shown in the table below;

Table 2 Types of data or/and information needed, Data sources, and Accessing method

Research questions	Types of information needed	Data Sources	Accessing method
1. How is the participation of households in sustainable solid waste management organised?	<ul style="list-style-type: none"> - Existing solid waste management in the town - The waste disposal methods - Awareness 	Primary data <ul style="list-style-type: none"> - Individual households - Municipality council 	<ul style="list-style-type: none"> - Individual interview (face-face) - Observation
		Secondary data <ul style="list-style-type: none"> - Documents 	Document review
2. What are the impacts of household participation in sustainable solid waste management?	<ul style="list-style-type: none"> - Change of behaviour/attitude over time in the community - The results of households participating in SWM 	Primary data <ul style="list-style-type: none"> - Individual households - Municipality council - The Town Clerk - Reality (true situation that exists) 	<ul style="list-style-type: none"> - Individual interview (face-face) - Observation
		Secondary data <ul style="list-style-type: none"> - Document - Media 	Document review

<p>3. What challenges do households involved in sustainable solid waste management face?</p>	<p>From the perspective of:</p> <ul style="list-style-type: none"> - Availability of waste collection materials - Economic situation - Awareness level 	<p>Primary data</p> <ul style="list-style-type: none"> - Individual households - Municipality council - The Town Clerk - Reality (true situation that exists) 	<ul style="list-style-type: none"> - Individual interview (face-face) - Observation
<p>4. How households' participation in the Kabwe Town can enable sustainable solid waste management by using some of the circular economy models?</p>	<ul style="list-style-type: none"> - Level of awareness concerning circular economy at household level - Feasibility of circular economy in terms of economic status of the households 	<p>Primary data</p> <ul style="list-style-type: none"> - Individual households - Municipality council - The Town Clerk 	<ul style="list-style-type: none"> - Individual interview (face-face) - Observation
		<p>Secondary data</p> <ul style="list-style-type: none"> - Documents 	<p>Document review</p>

3.6.2 Data analysis method

The information that was obtained from the study was analysed using qualitative method in order to come up with necessary information for the study and the qualitative data was transcribed and processed in themes and presented and discussed in the light of the objectives of the study. After collecting data and information, the method of analysing them to get certain result was described in table 4 below;

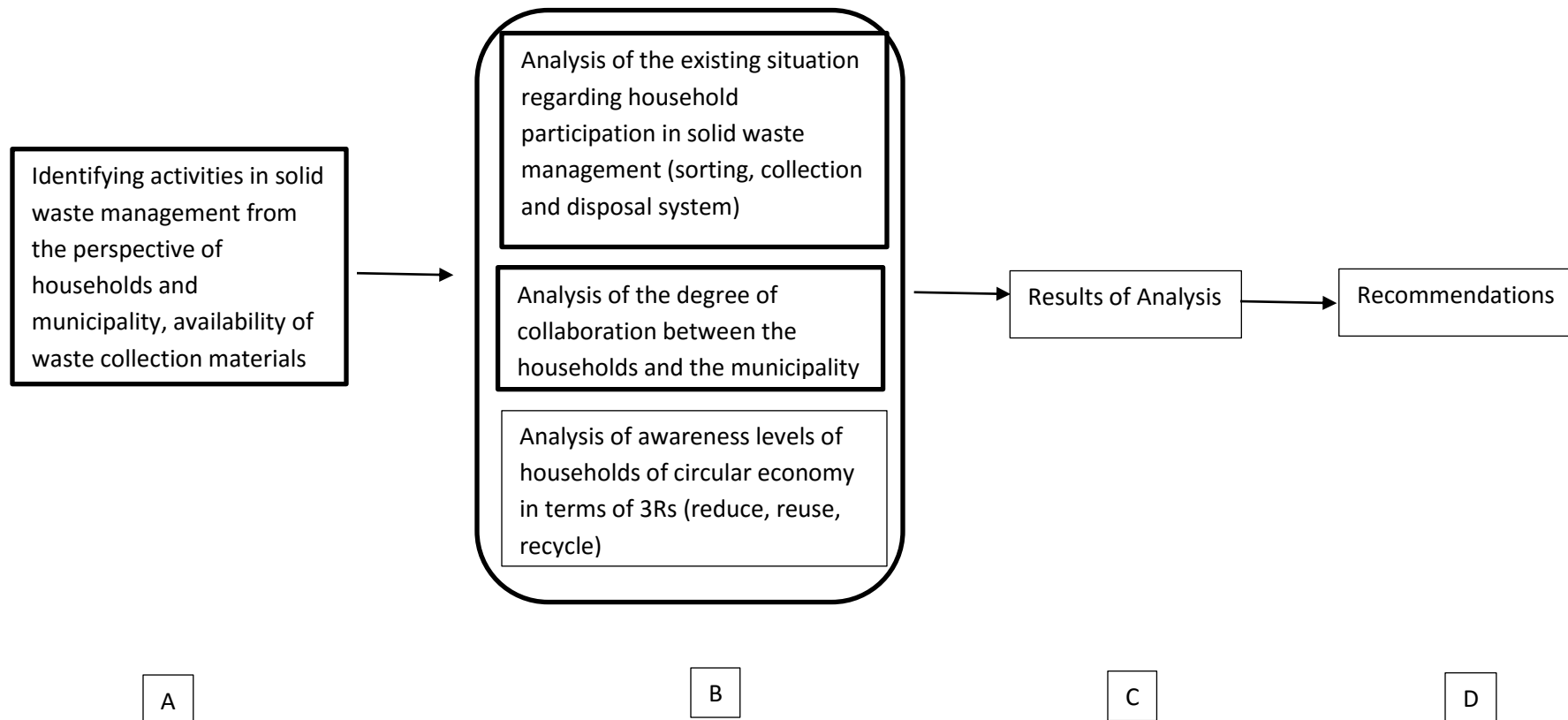
Table 3 Data and information to be collected and respective method of analysis

Data and information to be collected	Method of analysis
<ul style="list-style-type: none"> - Existing solid waste management in the town - The waste disposal methods - Awareness levels 	<p><u>Qualitative method:</u> Analysis of existing solid waste management, the waste disposal methods and level of awareness</p>
<ul style="list-style-type: none"> - Change of behaviour/attitude over time in the community - The results of households participating in SWM 	<p><u>Qualitative method:</u> Analysis of the change in attitude among the households and also the outcomes of the participation by households</p>
<p>From perspective of:</p> <ul style="list-style-type: none"> - Availability of waste collection materials - Households economic situation - Awareness level 	<p><u>Qualitative method:</u> Analysis of support from local authority in terms of waste collection materials. Analysis of awareness level of households and their living style</p>
<ul style="list-style-type: none"> - Level of awareness concerning circular economy at household level - Feasibility of circular economy in terms of economic status of the households 	<p><u>Qualitative method:</u> Analysis of levels of awareness concerning circular economy concepts among households. Analysis of the capacity of households to embrace circular economy based on the living style of households</p>

3.6.3 Analytical Framework

The analytical framework of the case study is shown schematically in figure 5 below.

Figure 6 Schematic representation of Analytical Framework



Data analysis was conducted by the following procedure:

- a. Firstly, the study identified the activities in solid waste management from the perspective of the households and the municipality. Also, the analysis of impacts of household participation was done. In this analysis step, research sub-questions number 1 and 2 were answered including some descriptions as a steppingstone to the rest of the questions that led to answers in the next analysis.
- b. Secondly, Analysis of the existing situation in line with the concepts of circular economy, the presence of waste collection materials and programs as well as the economic situation among households and their awareness levels was done. This was done by data collected from interviews, documents, and reality based on observation. The analysis of awareness levels of households and their economic status was used as the basis to enable circular economy. Under this analysis step, research sub-questions number 3 and 4 were answered.
- c. Thirdly, by combining results of analysis from first and second step, summary of results (answers) concerning all research sub-questions was organized and presented. This step helped to answer the main research question by ensuring that all research sub-questions were answered.
- d. Finally, based on the answers of sub-research questions in the previous steps and the summary of result of analysis in the third step, recommendations were given to implied authorities in the town that were responsible for SWM.

Chapter 4: Findings

This section presents the findings of the data that was collected through investigations related to household participation in solid waste management towards a circular economy of the town of Kabwe. Most of the primary data came from the questionnaires that were prepared to find out about household participation and also from direct observations of what the households, the municipality and other actors were doing.

4.1 Impacts of households' participation in SWM

Household participation in solid waste management in Kabwe town has resulted in the waste being collected from households for disposal from designated places. According to the KMC this collection has created a clean environment hence reduced disease burden which has resulted in reduced medical costs for both government and the general public. The primary objectives of solid waste management are to protect human life from disease acquired due to poor sanitation and pollution of water and air, and to protect the environment and natural resources. In line with these objectives, Mrs Rebecca Mtonga Museteka reviewed in an interview that due to an outbreak of dysentery in the military residential area, Chindwin Barracks with 1,200 households, her company was contracted to collect solid waste. The information collected through interviews with both the KMC and Mabaleka Enterprises pointed out that only 5850 households were actively participating in SWM while the rest of the households (33,819 households) were not participating. These participating households have seen the benefits of participating and are more responsive to the activities of solid waste management in the town. Activities such as illegal collection, transportation and dumping have been reported in time by alert households participating in SWM.

In the areas where waste is collected, the residents have not been affected by foul smell of waste since their participation has led to effective waste collection. Due to participation by the few households, there has been successful recycling with reduced costs in the recycling process which has ended up creating more jobs (being created as households participate in sorting out waste) than jobs from landfilling or dumping in the case of the KMC.

The collection of revenue in form of taxes and licenses by the KMC has resulted from household participation and companies or franchise contractors involved in waste collection have been able to collect revenue from households as an act their financial participation.

4.2 Current situation of SWM from the perspective of the households, municipality and other actors

The current situation regarding solid waste management in the Kabwe town is such that the municipality collects wastes from only less than 100 households (600 people)¹ out of the total population of 202, 914 CSO, (2010) of Kabwe town. The KMC reviewed that the collection of waste is on request from the households who later pay K30 per month². A franchise contractor, Mabaleka Enterprises collects wastes from 3,030 housing units from different residential areas broken down as, Chindwin Barracks (1,200), Kohima Barracks (500), Lukanga Township (1,200), Luangwa Township (30), Highridge (40), Zambia Railways (30) and Pollen (30) and other companies collect waste from 2,720 households giving a total of 5750 households. Mabaleka Enterprises collects waste from the households four times a month (an average of once a week) and the waste collection fees for the franchise contractors are determined by the KMC and are such that the low cost residential areas pay K20, medium pay K30 and high cost pay K50 per month. However, the waste collected from these households is not sorted out at the source, it is rather mixed. The majority of the households are not willing to sort the waste claiming it's involving without them being paid anything. Almost all the households have landfills in their backyards or burn wastes as a way of disposing it. The other important aspect that is conspicuously missing in the waste management is the sensitization of the households on proper waste management by the KMC and the majority of the households reviewed that they didn't even know what was happening in the town regarding SWM.

In an attempt to improve SWM in the town, the municipality has procured 90kg sacks (bag) which have a plastic lining inside for different waste streams to be supplied to the households at a fee of K12 per sack as shown in appendix 2. The sacks are branded as follows;

- Green for organic waste
- Orange for plastic
- Blue for paper waste
- Red for glass bottles
- Brown for metal waste

¹ An average household in Kabwe town consists of 6 people (CSO, 2010)

² \$1 is equivalent to approximately K9.3 as at 26/06/2017(Zanaco Bank, 2017)

The collection of waste by the KMC is done twice a week while in the CBD waste is collected on a daily basis although there is also indiscriminate throwing of solid waste before it can be collected. As far as legalities are concerned, the local authorities (KMC), ZEMA and the Ministry of Water Sanitation and Environmental Protection reviewed that there was no legal framework to compel households to participation in solid waste management. Most of them doing it were doing so just as a civic duty or because they felt a sense of responsibility to do so. Mr Chiinda and Ms Mtonga said although households want to have their waste collected they were not willing to pay the waste collection fees for effective waste management. According to a study conducted by the KMC, only 17.3% of the waste generated was collected by the waste collection companies and that 82.7% of the waste remains uncollected (level of participation stands at 17.3%).

The KMC had also divided the town into 10 zones for the purpose of bringing in franchise contractor so that households can be brought on board. As regards recycling, Mr Chiinda said that KMC was not involved in any form of recycling instead, there was general dumping of the waste at the dump site. Scavengers at the dump site sort the waste as a business and later sell to recycling companies within and outside the town. The KMC has entered into contracts with three companies (Mabaleka Enterprises, Shuffle Ltd and Anger Ltd) for the collection of waste on trial basis from June to December of 2013 for free of the dumping fees and there after start paying the dumping fees. Mr Sikaundi Gift said that Franchise contractors in waste collection get their own licences from ZEMA to operate regarding the collection of waste from the households as required by law.

Recycling in the town is done on a smaller scale and in this regard a company ZALCO was recycling waste paper into craft paper and tissue paper for carton box making and tissue making respectively. ZALCO is also recycling aluminium and lead metal from aluminium and lead scrap metals into various products such as pots and batteries as shown in appendix 3. Another recycling company Solid Technology Systems was recycling waste plastic into various products such as plastic desks and chairs for schools, curtain rails, paving tiles, manholes covers, benches for business, plastic planks, plastic gears for industries instead of metallic ones, shoes for chairs, plastic doors, plastic poly twine from old polypropylene bags to make thread for farmers as shown in appendix 4.

One other factor worth noting besides the absence of a legal framework is that there is no system for the waste collection fees from the households. Households can pay whenever they felt like and anytime. All the actors involved in waste collection use refuse trucks for waste collection which are not containerized as it can be seen in appendix 6. One of the responsibilities of the KMC is to manage the dump site; however, the dump site is not well managed and not fenced to secure the wastes as can be seen in appendix 5.

4.3 Challenges faced in SWM activities by various actors

Various stakeholders in SWM face diverse challenges such as the lack of trained/skilled manpower in SWM and lack of financial resources (Rotich, et al, 2006). These challenges are not exceptional in the management of SW in the town of Kabwe by all players involved. Mr Chiinda of the KMC and Ms Mtonga of ME highlighted the lack of infrastructure such refuse collection trucks. The KMC has only three sub-standard trucks for waste collection for the whole town. Regarding the waste collection fees, the households complained that the amount of money (K20) that the local authorities and other waste collection companies were asking for was too high for them to afford.

Mr Goldwin Gondwe, who is the Director of Environment at the Ministry of Water Sanitation and Environmental Protection, was quick to mention the insufficient capacity for recovery and recycling of various waste streams as a challenge. He said there was inadequate awareness on sound management of wastes and their impact on human health and the environment. He also bemoaned the low participation by households in waste management and poor data management including low investment in the waste sector.

The lack of legal framework to enable household participation in SWM has been mentioned earlier in 4.2 among the aspects of the current situation in the town and it comes up here as a challenge inhibiting the involvement of households. There is also failure by companies that collect waste from households to pay the dumping fees to the KMC for various purposes especially for the management of the dump site. There is also no legal framework to advocate for household participation through the payment of a fee.

The attitude and waste culture among the households was seen in the way they throw wastes in the open spaces and in the burning of waste at night with a lot of landfilling activities which go unpunished. The local authorities are not doing enough to sensitize the households

on proper solid waste management practices. Mercy Zulu, the Communications Officer at ZEMA said they were raising awareness also through participation in the commemoration of such important activities such as the Environmental Day, Earth Hour, Water Day, and through press statements.

The other challenge is the lack of enforcement of the laws that are contained in the Environmental Management Act No 12 of 2011. The number of recycling companies is so low in the town despite the call in the same Act encouraging recycling and reuse of waste and there is a complete absence of organic waste recycling causing an accumulation of organic waste to alarming levels.

There are many good laws provided for in the Environmental Management Act (EMA) No. 12 of 2011, for example the law that forbids landfilling and burning of waste by households but the enforcement is lacking. The waste collection fees by households are low making the waste collection companies to use unsuitable equipment because the modern and appropriate equipment is expensive for them to buy from the low fees collected.

4.4 Possibility of how to enable circular economy in the town

It was found that households were not willing to sort the waste as stated earlier in section 4.2 as they believed the process was cumbersome and involving to do for free. There also are very few recycling companies in the town (only three) to deal with the waste if it were sorted by households and a complete absence of companies dealing with recycling of organic waste.

Mr Godwin Gondwe said there was a National Solid Waste Management Strategy of 2004 which proposes the integrated approaches to address the problem of poor solid waste management. This strategy aims at minimising the generation of wastes, maximise waste collection efficiency, reduce the volumes of wastes requiring disposal and maximise the economic value of waste and adopt environmentally sound treatment and disposal facilities/practices. He also added that there was also an Extended Producer Responsibility (EPR) meant to promote minimization, recovery, re-use or recycling of wastes meant to reduce the potential impacts on the environment.

There is no legal framework on household participation in SWM to make them feel legally bound to do so unlike the households thinking it's voluntary as stated in section 4.3. When

asked if there was a legal framework provision regarding participation of households, the KMC, ZEMA and Ministry officials said there was no direct legal provision compelling the households to participate in solid waste management. What was interesting also to note during the interview with Mr Sikaundi Gift of ZEMA was that the policy instrument or legal framework on SWM based on circular economy concepts was still in its draft form. He added that once this framework was in effect, it would compel many manufacturers to either reduce certain packaging materials that were polluting the environment or promote recycling of such materials and thereby removing them from the environment. However, document search reviewed that there was an act that said that the Agency may, upon application, issue a waste management licence to a person to allow the person to reclaim, re-use, recover or recycle waste. The Act also says that the local authority shall take all practical measures to promote and support the minimisation of waste and the recovery of waste, particularly at the point at which it is produced.

It was found out from the interview that some of the households are already practicing the principles of circular economy without knowing it. They were reusing cooking oil containers to store drinking water and peanut butter containers were reused for storing sugar. Most of the household are low-income households and mostly poor and not in formal employment; they earn a living by selling at the market or working as maids and garden boys.

There are also too many less durable but cheap products such as clothes, shoes and electronic products which increase waste because this is what most of the households can afford to buy given their income levels. The presence landfills by households and presence of dump sites by the KMC is another common place. The education levels among most of the households are low and the level of awareness regarding circular economy concepts is very poor. Most of the households have an 'I don't care' kind of attitude towards SWM as was seen from their unwillingness to sort the wastes and pay the fees.

Chapter 5: Discussion

This section presents the analysis of the data that was collected through the interviews with the here above mentioned organizations in relationship to household participation in solid waste management towards a circular economy in the town of Kabwe.

5.1 Impacts of household participation in SWM activities

As a result of participation of the few households (5,850) in Kabwe by putting waste in the designated places, waste ended up being collected by the KMC and other waste collection companies (franchise contractors) involved in the management of solid waste. The implication is that if all the households (33,819) participated in SWM, the impacts would be much bigger, meaning that all the waste generated by all households would be collected and disposed of in a proper manner as prescribed by the law.

The primary objectives of solid waste management are to protect human life from disease acquired due to poor sanitation and pollution of water and air, and to protect the environment and natural resources. The collection as a result of participation has ended up creating a clean environment for these households and hence a reduced disease burden which has eventually resulted in reduced medical bills for both the general public and the government as provider of health facilities as mentioned in section 4.1. The problem of house flies and scavenging dogs which were transmitting infectious diseases are now a past problem. These animals are responsible of transmission of various diseases among the households such as typhoid fever, cholera, dysentery, rabies, hookworm, dog tapeworm etcetera. In line with the objectives of SWM, participation of households has helped to deal with the situation of dysentery in the military residential area showing that household participation is key in dealing with effective SWM. In the same vain, due to household participation, it was easier to track down the illegal collection, transportation and dumping of wastes in town. These illegal actives were robbing the local authorities the opportunity to collect revenue both from the households and the dumping fees from these franchise contractors in waste collection. This participation, however small, has brought responsibility among these households regarding attitudes towards solid waste and the environment. Although there was no legal provision on household involvement, there has been great improvement in waste management through improved collection and handling, increased recycling and re-use of wastes due to participation by a few households. Collection and handling, increased recycling and reuse are only possible when there is effective participation and it can only be effective if everyone is

participating unlike the current situation where very few are involved. The Ministry of Water Sanitation and Environmental Protection is the mother body of all stakeholders in the management of waste. If there were legal provisions in place on household participation right from the mother body, it would be easier to bring all the households on board in the management of solid waste. As the situation stands, without legal provisions to bind households to participate, it remains a voluntary activity where households can choose to participate or not to. Organic waste, which only takes a few days to decompose forms over 50% of the wastes generated by the households in Kabwe town. If the entire population of over 200,000 people (33,819 households) participated compared to only 35,100 people (5,850 households), wastes will already be reduced to less than half the waste that goes to the dump site. If the households were allowed to fully participate in SWM, there was going to be successful recycling as this would lead to reduced costs in the recycling business as waste will come in sorted from the source and clean as stated in the literature by Nzeadibe (2009).

Putting recyclable waste of economic value in a common bin makes the quality of waste to deteriorate once it gets soiled by the by wet waste. Regarding waste separation, the Ellen MacArthur Foundation (2015) says the composition of waste will not be known and planning, designing and implementation of waste management systems will not be possible. Waste separation is therefore a key activity in any successful implementation of the 3R initiative. A lot of financial resources were being channelled into paying labourers for sorting and cleaning of the waste received by recycling companies due to absence of sorting to those that were participating. If there is household participation, there can be a lot of recycling activities which can lead to creation of many jobs as opposed to dumping of waste at the dumpsite in line with what was stated in the literature by the EPA (2002) and by Gupta (2001). Dumping does not create jobs as shown by the current situation in Kabwe town where there was only one person supervising the dumping of wastes at the dump site by various actors as opposed to recycling which would employ more people for various activities. The participation of households would enhance the collection of the much needed revenue through taxes and license fees to ease the operations of the local authorities who were affected by the lack of financial resources.

The participation of the few households has helped the KMC and other waste collection companies to collect the revenue as a way of their participation both financially and physically making the solid waste management effective as this ensured that the waste was collected at all times. Household participation has also helped provide employment to the local community and provide help to the local authorities inform of refuse collection tracks for free as an act of corporate social responsibility (CSR). Here the households manifest as very important stakeholders in the solid waste management as generators of waste and the level of their participation accounts for the success of recycling in particular and solid waste management in general. The costs of collection, transportation and land for dump sites are high, however engaging the households in this way proves to be a sustainable mode of waste management as it serves to reduce such costs. If households are fully involved and there is sorting at the source, there will be a lot of recycling activities and as a result the need for a lot of land for dumpsites will reduce as most of the waste will be recycled and very little or nothing at all will end up at the dump site. Not all recycling should generate money, rather recycling should be considered as a cost-effective management option as it required less resources compared to dumping. Recycling can save the depletion of natural resources and can help save the environment as there would be no need of using new raw materials, for example at ZALCO, during the process of recycling there has been a lot of savings made from the energy recovered and other material recoveries like water, aluminium and lead to save as raw materials for other products and processes.

The key element of participation is the involvement of households in various phases of the project as stated in the Participatory Action Research (PAR) Theory such as planning, implementation, operations and evaluation. It is reported that the means for building political support for environmental improvement is public (household) participation in environmental management activities (World Bank, 1994).

5.2 Current situation in SWM from the perspective of households, municipality and other actors

The current operational system of the solid waste management by the KMC and other waste collection companies is linear based (take, make and dispose) where resources are converted to products and are ultimately discarded as waste. This scenario is unsuitable and unsustainable solid waste collection and management practices results in the loss of resources

and energy, which could be recycled and produced from a large part of the solid waste (Ellen MacArthur Foundation, 2015). Similarly, linear economy basically involves, mass exploitation, mass consumption and mass waste. If the current consumption rate of resources and discarding rate of waste continues, it would not take long to completely wipe the resources off the country due to limited recycling.

According to the KMC and the CSO (2011), the majority of the households are made up of between 6-10 members where each member generates 0.41kg of waste per day for a high class residential area (high income). Taking the lower limit of 6 members, 2.46kg of waste per day or 73.8kg of waste per month are generated. For a family of 10 members, 4.1 kg of waste per day or 123kg of waste per month are generated. This data shows clearly that the larger the family, the larger the solid waste generated. Therefore the absence of solid waste collection can result in accumulation of solid waste and hence the need to have in place, a sound SWM system in Kabwe town. Out of the total population of 202,914 (33,819 households) in Kabwe town CSO (2011), the KMC collects waste from less than 100 households which also is done on request from these households who could have relocated from towns where it was normal for them to have their waste collected at a fee of K30 per month. This number of households participating shows a low level of participation and this is due to the absence of a direct legal framework for household participation in solid waste management. The percentage of participation stands at 17.3% and this participation accounts for the collection of only 14,391kg (14.4 tonnes) of waste generated pay day compared to the total waste generated of 83,194.74kg (83.2 tonnes) per day. It is clear from this information that was given that 72,002kg (72 tonnes) of wastes remains uncollected per day and this is a huge amount of waste to leave unattended to. It means over time there will be a lot of waste generated and uncollected because the number of households participating was far too small.

The waste collection fees for the companies (franchise contractors) are determined by the KMC and are such that the low cost residential areas pay K20, medium pay K30 and high cost pay K50 per month. These fees are sufficient for the waste collection companies to run smoothly if all households were participating in SWM and paying the fees and CE requires that participation levels are sufficient enough to guarantee collection of sorted wastes for recycling. The failure by the private companies to pay the dumping fees at the expiry of the trial contract affects negatively the sooth operations of the local authority. This non-payment

of these dumping fees is due to absence of sufficient participation by households which has resulted in the failure by the KMC to manage and fence the dump site to safe guard it from scavenging. The fencing can ensure order at the dump site and collection of the dumping fees.

The waste that was collected from the households is not sorted as mentioned earlier and households use sacks for their waste which is collected eight times and four times a month respectively while in the CBD of the town the KMC collected on a daily basis. The sacks are not hygienic; however, given the income levels of the majority of the households, they cannot afford to purchase proper refuse containers. To sort out the waste, it requires that households pay for several proper refuse containers for sorting purposes which is again not affordable to them making the aspect of sorting the waste unattainable. CE requires that there should be sufficient sorting of wastes of all streams for recycling and reuse and this in the end would ensure reduction of waste. Security of these same proper refuse containers would be another issue of concern as they would end up stolen. There is also indiscriminate heaping of waste in undesignated places in CBD before it can be collected by the KMC as a result of the insufficient of mobile litter receptacles. This has been caused by lack of sensitisation by the KMC making waste to accumulate for a long time in the CBD. In trying to improve the solid waste management in the town, the municipality has procured 90kg sacks (bag) branded as follows;

- Green for organic waste,
- Orange for plastic waste,
- Blue for paper waste,
- Red for glass bottles waste and
- Brown for metal waste.

Some of the branded bags for different waste streams are shown in appendix 5.

However, the waste separation plan by the KMC had not taken off due to inability by households to buy these waste collection sacks which they claimed were expensive for them. Most of the households are poor and this is because they are employed in low paying jobs and as a result they are not able to pay for these bags which may need replacement from time to time due to lack of durability. The lack of financial resources by households resulting from low paying jobs is the cause of poor standard of living as stated by (Rotich, et at, 2006) and low level of willingness to participate in waste management activities. The other reason why

the plan has not taken off was the lack of sensitization activities by the local authorities as alluded to by majority of the households. The waste collection companies were also selling sacks for waste collection at a fee of K6, cheaper than the KMC however the households are still not willing to buy as the majority of them felt they were expensive and it was the duty of the local municipality to provide them with waste collection materials for free in line with the what Bournay E, 2006 said in the literature review. The households want their waste collected but are not willing to pay the waste collection fees and this attitude by households is also because there is no legal framework to compel households to participate in solid waste management through payment of the waste collection fees and otherwise. Sometimes the waste collection companies go to collect waste even from households that had not paid the waste collection fees. This they do for fear of 'sunk costs' which would result as they collect from affiliated households because it would be required of them to return to the same areas assigned to them to collect from those that defaulted. The division of the town into 10 zones for the purpose of bringing in more franchise contractors so that more households can be brought on board has not been effected. The delay of this initiative to take off has contributed low level of participation by households. This initiative would have helped to increase the number of actors in SWM because the number of current actors in solid waste collection is still very small. The KMC is not involved in any form of recycling instead there is general dumping of the waste at the dump site where scavengers sorted out waste as a business and sell to recycling companies both within and outside the town. If the KMC as implementers of SWM programs in the town were involved in recycling, the wastes would not end up at the dump site, instead it would be recycled thereby reducing the volumes of waste in line with the Zero Waste principle in the management of waste.

On the other hand, the majority of the households are not involved in solid waste management activities and were not making any contribution to the existing SWM organised by the KMC because they were not aware of such programs. This as mentioned earlier, shows a serious lack of awareness programs which has led to poor levels of participation. Some households are neither serviced by the KMC nor any franchise contractors and since waste is not collected the households have resorted to landfilling and burning of wastes which is forbidden by the Act. When it came to the aspect of sorting wastes, the majority of the households said they were not willing to sort out the waste as the process would be so involving and time consuming for them to do for free without any form of payment or

incentive as stated earlier. They felt it was easier for them to put all the waste streams in one waste collection bag and if the local authorities desired them to sort the wastes for free, then they should pay them or trade in with the collection of waste for free. This lack of sorting the waste is making recycling a costly and difficulty undertaking in line with what was stated earlier in the literature by the Ellen MacArthur Foundation (2015). This attitude towards sorting of waste is making a lot of waste to end up at the dump site where scavengers scatter it as they try to sort it for business. The majority of the households were landfilling and burning the waste in their back yards. Land filling and burning are other sources of pollution which must be discouraged at all times as they pollute both the water under ground by leaching of the contaminants and the air people breathe from the smoke produced respectively.

To help the local authorities in the management of solid waste, ZALCO is recycling waste paper into craft paper and tissue paper for carton box making and tissue making respectively. The craft paper is also used for making files and envelopes and these activities are helping to reduce the volumes of paper waste. ZALCO was also recycling aluminium and lead metal from aluminium and lead scrap metals into various products like pots and batteries.

Solid Technology Systems was another SME involved in recycling of plastic waste as a way of reducing waste into various products such as plastic desks and chairs for schools and curtain rails. Other products are paving tiles, manholes covers, benches for business, plastic planks, plastic gears for industries instead of metallic ones, shoes for chairs, plastic doors, plastic poly twine from old polypropylene bags to make thread for farmers. These SMEs have heeded to the call in section 55 (1) of the Act No. 12 of 2011 for various actors to come on board and engage in activities to do with reclaiming, re-use or recycling of waste. However, many of them are not into this aspect of waste management to protect and save the environment, but for income generation and job creation. Despite the absence of legal a frame work to involve households, there was a National Solid Waste Management Strategy of 2004 which proposes the integrated approaches to address the problem of poor solid waste management. This strategy aimed at minimising the generation of wastes, maximise waste collection efficiency, reduce the volumes of wastes requiring disposal and maximise the economic value of waste and adopt environmentally sound treatment and disposal facilities/practices. This strategy however, is just on paper and suffers from a lack of

implementation throwing the whole management of solid waste into disarray. There is also an Extended Producer Responsibility (EPR) meant to promote minimization, recovery, re-use or recycling of wastes meant to reduce the potential impacts on the environment. The EPR is meant to build engineered landfills which would lead to reduced air and ground water pollution arising from wastes. The construction of engineered landfills, if implemented can help reduce the alarming levels of pollution in the town as opposed to dump site facilities.

Despite the franchise contractors involved in waste collection getting their own licences from the ZEMA regarding the collection and disposal of waste from the households, there was no system for collection of fees from households making the collection of fees both tedious and elusive. The current system of collecting waste is very difficult to manage as it allows a lot of households to default and hamper the operations of franchise contractors as well as those of the local authority.

The refuse trucks used for waste collection by all the actors are not containerized causing the waste again to fly all over the places during collection and transportation from the households to the dump site. These non-containerized refuse trucks also produce foul smell posing a health hazard to the people which should not be the case.

The waste collection companies dispose waste by dumping at the dump site which is not well managed and not fenced. If the dumpsite was fenced it was going to be easy to maintain order as stated earlier in the manner the waste is dumped and waste dumping fees would be collected as part of the revenue for the KMC. Dump sites are not just aesthetic disaster but also provide a breeding ground for disease carrying organisms such as rats, cockroaches and flies. The solid waste management practices in Kabwe town are not in line with the principles of solid waste management especially the one called Best Available Technology (BAT) Principle which advocates for better technology to reduce waste. The BAT principle says that poor technical solutions are no excuse for pollution if better technology is available. The better technology in this case is recycling of waste so that little or no waste ends up at the dump site. According to a study conducted by the KMC, only 17.3% of the waste generated was collected by the waste collection companies and that 82.7% of the waste remains uncollected. This implies that more wastes end up landfilled or burnt by the households as opposed to proper waste disposal due to low level of participation by households. If there is

adequate participation, this scenario could be reversed so that we end up with more waste collected than the one not collected.

5.3 Challenges faced by households and various actors in SWM activities

The process of household participation in solid waste management is challenged by several factors, depending on the method chosen for this purpose as well as the characteristics of the household in a particular location (Tsai , 2007).

The challenges indeed have been characterized by several factors which include a lack of a legal framework for household participation and collection of waste fees by both the KMC and SMEs involved in waste collection. The payment of fees and taking waste to the designated places is a crucial aspect of household participation and can go a long way in making the SWM sustainable. There are no direct legal provisions as the Act on participation only says that “a local authority shall, within its area of jurisdiction collect and dispose of, or arrange for the collection and disposal of, all household waste in accordance with the Act.” This weakness in the Act makes it very difficult to ensure effective solid waste management in that the very generators of waste are not legally bound to either pay or participate in the management process. According to the Theory of Participation known as the Participatory Action Research (PAR), households are recognised as a unit of identity sharing common need and fate, and advocates for the participation of households in every phase to identify the problem and address it (World Bank, 1994). According to this theory, participation enhances humanistic approach through household engagement in solving social issues. In line with this theory, participation of households would bridge the gap in the management of solid waste especially that they are the actors at the source. Participation would ensure the reflection of household priorities and needs in the planned activities and would motivate them into maintaining and operating the planned activities. Participation can increase capabilities at the level of the households and encourages cost sharing of project activities.

While ZEMA was conducting awareness campaigns on the need and importance to have a clean environment free of waste at national level, the local authorities were passive and doing nothing concerning this important exercise. ZEMA sensitizing the households through environmental clubs in schools using quizzes which were aired on National Television targeted at raising awareness not only for participants but also for viewers. Other methods

which can be used to raise awareness involve the production of materials and brochures, social media, events like road shows etcetera. Sensitizing the households on new tenets of waste management would result in waste not going to the dump site as waste would be sorted by the households and passed to the recycling companies for recycling into various products thereby reducing waste a great deal. Planned sensitization would result into educating and informing the households about the evils of throwing of waste in the open spaces and burning of waste as well as land filling as the practice was for many households.

The attitude and culture by households has exerted negative influenced on the process of solid waste management in the town in line with the literature review by Kaseva & Mbulingwe (2005) and Crown (2012) & Achankeng (2003). Many households look at waste management as a duty of the local authorities in which they have no role to play themselves as stated in section 5.2. Even when the households were interviewed regarding the aspect of sorting the wastes, it was very clear they were not willing to take part in the SWM process. The households could not sort waste for free while paying the fees and they did not see the benefits of sorting the waste, some went to an extent of not seeing the benefits of taking part in SWM as a humanistic duty on their part. This 'I don't care' type of attitude has hampered the management of solid waste by the KMC and other actors and the process of behavioural change among the households. Unless the households are willing and committed to change their attitude, even the education awareness they are advocating for may not have much effect and it's incumbent upon the KMC to develop strategies that can bring about change of attitude among the households regarding the environment. Some of the households from the high cost residential areas complained that there were no incentives or recognition of households taking part in upholding the good practices of solid waste management. If there are no incentives or recognition, the households will not do the right thing and may lose interest in the process. People are only interested when their efforts are being recognised and sooner or later when they see that their efforts go unnoticed they develop a negative attitude towards that activity and may prove difficulty to win them back.

Lack of financial resources and infrastructure was another challenge faced by several actors. The municipality was facing a lot of difficulties in the area of finance in order to buy waste collection equipment such as refuse trucks due to poor funding. The KMC was depending on the three open refuse trucks which were not enough to cater for the population of more than

33,819 households. This goes to explain why the KMC is collecting waste from only less than 100 households. If the local authority was well funded they would buy enough refuse trucks and employ more people who everywhere in the town to collect waste from all households not just a few. The poor collection of waste is attributed to poor funding by the Central Government. The major source of revenue for the KMC was land rates whose revenue was not only channelled to waste management but shared with other departments in need of finances. Rentals from housing units and water provision used to be other sources of income; however, this major source of revenue was lost when the housing units were sold to sitting tenants and the privatization of water supply. For this reason, the municipality is unable to collect all the wastes from households in the town. But waste has to be collected before it accumulates to alarming levels. One of the principles of waste management called the Critical Load Principle (CLP) refers to the amount of pollution that the natural environment can withstand without becoming permanently damaged (World Bank, 1994). This critical load must not be exceeded; waste should be collected from the households before it becomes a danger to the environment and to human life. Given the amount of wastes that remain uncollected as stated in section 4.2 due to low level participation, there will be more wastes than the environment can withstand over time. This low level of participation is making the solid waste management so poor and causing the town fail to attain the status of a city due to lack of cleanliness as it was one of the parameters used to gain a city status. The households do not fully participate as they cannot afford the waste collection fees. The households want to have their waste collected but were not able to pay the waste collection fees as they were beyond what they could afford. On the part of the waste collection companies, the fees were described as being low. These low fees were making it very difficult for them to meet their day to day maintenance and running costs of their companies. These low fees could not afford them proper and modern waste equipment which was too expensive for them with the little financial resources. The recycling companies were lacking the financial resources to purchase all plastic wastes that were brought by the suppliers.

The other challenge was the presence of few recycling companies and the absence of those dealing in recycling of organic waste. Of the three recycling companies in Kabwe, none of them was recycling organic waste. Organic waste can be recycled to make organic compost which can be very useful in the agriculture sector as this kind of manure has no impact on the environment and it would go a long way in reducing waste of organic nature. With proper

knowledge, the households can also use organic waste as compost in their back yard gardens as a way of reducing and reusing waste. Recycling of organic waste can also serve as a source of cheap and clean energy for other processes. Recycling of organic waste can also reduce the consumption of fresh raw materials (Ellen MacArthur Foundations, 2015) and reduce the need for conventional waste disposal.

For proper waste management, there has to be high co-operation and support among all stakeholders at national, regional and local levels to enhance the management of waste. The KMC would like to maintain the dump site however, waste collection companies were not paying dumping fees. After the trial contract of June to December of 2013 with the three waste collection companies, they were supposed to start paying the dumping fees but they were not paying. This has resulted in a poorly managed dumpsite without a fence to secure the waste from the scavengers who scavenge without control or abating littering.

There is a complete lack of enforcement of the good laws that were contained in the Act such as the law forbidding a person to dispose of waste in such a manner that it became litter or was likely to become litter, forbidding of burning and land filling by households. This is one of the greatest weaknesses in the management of waste-enforcement of laws. Document search showed that there were so many good laws and by-laws both in the Act as well as by the local authorities but were not being enforced to enhance waste management by bringing law breakers to book. The local authorities can in accordance with the law move from one household to another checking on those that have landfills and implement a fine as prescribed in the Act to deter would be perpetrators or law breakers.

5.4 Possibility of how to enable circular economy in the town

The analysis of the current operational system of solid waste management by the KMC, the households and the waste collection companies shows that it is linear based (take, make and dispose) where resources are converted to products and are ultimately discarded as waste. And this is unsuitable solid waste collection and management. Such practices result in the loss of resources and energy, which could be recycled and produced from a large part of the solid waste (Ellen MacArthur Foundation, 2015). Similarly, linear economy basically involves, mass exploitation, mass consumption and mass waste. If the current consumption

rate of resources and discarding rate of waste continues, it would not take long to completely wipe the resources off the country.

To enable circular economy as an efficient and effective option in the management of solid waste, there are key driving principles to consider and the Ellen MacArthur Foundation lists these key principles as follows;

1. Design out waste.
2. Understand that everything within the economy has value.
3. Design and disassembly and reuse in mind, with minimal changes required to reuse components of the products.
4. Differentiate between consumable and durable components. Biological materials going back into nature: durable, or technological, materials stay in use for as long as possible.
5. Find ways to reuse materials across the value chain.
6. Eliminate toxic chemicals, making it easier to reuse components without risk of contamination.
7. Adjust prices to reflect the true cost of the effort required to produce a product.
8. Fuel the system with renewable energy.
9. Build resilience through diversity.
10. Think in systems, taking into account how one action will impact the whole.

To achieve an efficient solid waste management based on circular economy principles, there has to be legal frame work provisions for household participation. This legal backing is very crucial to the enabling of solid waste management towards circular economy in that participation will help achieve some of the principles of CE such as sorting at the source. When dealing with the possibilities of how to enable circular economy there are certain parameters that must be fulfilled. One of the aspects is that waste must be separated but in the case of Kabwe town waste is not separated at the source. When the households sort the wastes there will be sufficient recycling companies to deal with the sorted wastes. Participation like mentioned before can either be in form of paying the fees or physically sorting and taking the waste to the designated places but in the case of Kabwe the households are not willing to pay waste collection fees but they want their waste to be collected. Sorting of wastes is a crucial component in the successful implementation of CE as sorting could help

find ways of reusing materials across the value chain. If the wastes are not separated, the subsequent activities of recycling to reduce and reuse the waste will be hampered. Participation is one such visible gap in the management of solid waste towards a circular economy in the town of Kabwe. Participation enhances understanding of cost sharing (Colon & Fawcett, 2006) and also increases awareness and give people to initiate strategies to improve their own situation. This can involve organising households in clean-up activities and awareness raising campaigns.

Circular economy incorporates the aspects of reuse, recycling and recovery and to achieve these, there has to be where wastes of different streams can go after sorting and collection. The findings show that there were very few (only three) recycling companies to use the wastes compared to the waste generated by a population of over 33,819 households and if the authorities and other stakeholders were collecting waste from all the households as opposed to only the current 5,850 households, there would be need for more recycling companies to use up all the wastes and hence managing the solid waste in an efficient manner. This scenario needs to change if the town is to embrace circular economy as an option for effective solid waste management.

The finding that some of the households, without knowing, were already practicing some concepts of circular economy by reusing cooking oil containers to store water for drinking as well as reusing peanut butter containers as sugar bowls (to store sugar) should be a step in the right direction. In certain cases, there was reuse of old clothes and sacks with bottle tops which would have ended up as waste to make door mats thereby reducing and reusing waste as demanded by circular economy. According to a study done in Uganda, the situation is not different except the households go a little further and sort the wastes considered of value such as vegetables and food leftovers for animal feeds (Lin, et al., 2008). The local authorities can take advantage of this natural instinct among the households to introduce the management of SW via circular economy. This implies that if there was a top down initiative to sensitize and create awareness among the households in the management of solid waste using CE, it would be easier to convince the households who already are appreciating reuse of waste as a concept of CE.

The majority of the households as reviewed from the interviews were low-income and as stated earlier in this chapter, this paradigm shift in solid waste management requires financial resources for CE to be enabled. The financial resources are needed to supply the households with proper refuse collection materials such as bins for different waste streams as opposed to unsustainable practice of using sacks to store wastes. The availability of finances will also enable the households buy durable products which will last longer thereby reducing the amount of waste due to obsolescence of products especially the cheap products the households are able to afford due to low income levels. Low income is the cause of landfilling and burning by households who are not able to pay the waste collection fees to the local authorities and other players in SWM. The households have resorted to land filling and burning because of lack of income thereby polluting the very environment due to burying of non-biodegradable products and burning of waste which produces harmful substances. For an efficient SWM system, the basic constraints such as lack of financial resources, shortage of recycling facilities, poor behavioural pattern etcetera should be taken into consideration. Hence, the strategies that need to be adopted should be centred to address some of the existing waste management issues.

The owning of a dump site by the KMC is another aspect that shows that the local authority is not ambitious or determined to embrace circular economy despite its enshrinement in the Environmental Management Act (EMA) No. 12 of 2011. Enabling circular economy can go a long way in reducing the need for landfills by households and dumpsites by the local authorities. This is so because the waste that is supposed to end up at the dump site, due to participation by households will be sorted and not go to the land fill but be collected and delivered for recycling.

Chapter 6: Conclusions and Recommendations

This chapter sums up the whole report and gives suggestions and improvements that can help address some of the challenges related to solid waste management in the town of Kabwe.

6.1 Conclusion

In conclusion, it has been observed that the critical issues for solid waste management are waste generation, collection and disposal, institutional and infrastructure capacity for the management of wastes in the town and participation is key for successful management of SWM. The rationale of effective household participation is clearly based on the fact that everyone generates waste and can be affected directly and indirectly if waste is not well managed (Squires, 2006). Therefore, the utilization of non-professionals through citizen involvement mechanisms to address social problems has become more common place (Kaufman and Poulin, 1996). Participation develops the capacity to contribute to one's and community development. Participation comes in with a number of benefits; participants increase knowledge, opinion and understanding of the major issues that affect them. Those that participate are able to set objectives and targets that will be locally acceptable, meaningful and implementable. Household participation gives greater political credibility that for strategies that are drawn by technocrats and bureaucrats who use the top down approach in dealing with community concerns (World Bank, 1994). Willingness to support and participate in any activity largely depends on the understanding of the benefits one would obtain and the attitude of an individual concerned towards solid waste management. A promising approach to improve SWM system is the introduction of household-based management schemes involving them in proper waste storage, collection, segregation, and recycling activities (Pfammatter & Schertenleib, 1996). Once this has been achieved, there can be a possibility of enabling circular economy in the town of Kabwe.

If waste was collected from all the households (33,819) in the Kabwe town, the impacts of participation would even double if not triple. There would be an increase in jobs created in addition to those that are already there as a result of the few (5,850) that were participating, a lot more of natural resources would be saved as there would be enough raw materials in the waste that was generated and collected. In addition the local authority would collect more revenue to run the municipality programs as a result of compulsory participation by households.

A circular economy has important potential benefits that are operational as well as strategic. Embracing circular economy is a trillion dollar opportunity with huge potential for innovation, job creation, substantial net material saving, economic growth and a huge potential for fostering wealth against the backdrop of resource constraints. It also creates more value from each unit of resource than the traditional linear economy of the “take-make dispose” model. According to the Ellen MacArthur Foundation (2015) a circular economy has benefits that are operational as well as strategic, on both a micro- and macroeconomic level. Eliminating waste from the waste management system by redesigning the products, recycling and reusing the materials to the maximum extent possible, promises production cost savings and less resource dependence. Circular economy forms the basis for the spur of new ideas and innovation and more so, it is likely that a circular economy would bring greater local employment thus addressing a serious issue of unemployment in the economies of a developing country like Zambia.

Once the management of waste based on circular economy concepts is in effect, a number of benefits or impacts mentioned earlier in section 4.1 will begin to show on a large scale. The households who were complaining that they didn’t see their benefits of sorting out the wastes other than just helping the local authority and other players in waste management will begin to appreciate.

6.2 Recommendations

The recommendations are based on the findings of the current practices, the impacts of household participation and the challenges faced in SWM in the Kabwe town towards CE.

The following are the recommendations arising from the above mentioned aspects;

6.2.1 Impacts of household participation in sustainable solid waste management?

There is need for sensitization of the households by the KMC to create awareness on the importance of separating waste into different streams to enable recycling and also the importance of paying for the services. This awareness would change the mind-set and the attitudes of the households. Educating and sensitizing can be done in schools through the environmental based clubs on the importance of waste management and separation of waste at the source. This can be done also through the introduction of waste management in the school curriculum by the Ministry of General Education so that right from the early stage, awareness is created.

6.2.2 The current situation on household participation in sustainable solid waste management?

The government or local authority needs find a way of reducing the use of plastic to reduce or reuse plastic waste as it was non-biodegradable. There can be a law that prohibits the provision of free plastic bags to the shoppers as opposed to the current practice and add a cost so that those willing to have a plastic bag should pay for it and this would reduce the amount of plastic waste. The reduction of plastic waste can also be done by asking the households to sort out plastic waste which they can later sell to earn a living.

Authorities to design a legal framework on household participation to allow the local authority and waste collection companies compel the households to pay for the services. The absence of such a legal provision makes it very difficult for the local authority and waste collection companies to take legal action against the households in an event that they don't pay the waste collection fees. The legal provision would also instil fear and a sense of responsibility among the households when they know the consequences of none compliance. The local authority cannot alone achieve success in waste management without corresponding positive collaboration of the public (households) and the private sector. If the residents or households are properly organized and educated, they can be mobilized to team up to improve the process of waste management. For an effective urban waste management, it demands multi-pronged approach in which all segments of the society must be brought together and made to function like a team (Uwadiogwu B.O. et al, 2013).

There must be a system of waste collection fees for example, through utility bills like water and electricity. This will ensure that most if not all the revenue is collected to help the local authority and the franchise contractors provide good services and manage the waste efficiently. If this is not done, the number of defaulters will continue to increase and revenue will continue to be lost.

6.2.3 Challenges households and other actors involved in solid waste management face?

The local authority should enforce the law that forbids burring or burning of wastes by households so that all waste can be collected thereby reducing pollution from burning and leaching as a result of landfilling. Charging huge penalties of more than the waste collection fees to households with landfills can help to deter perpetrators. This can ensure compliance

and a sense of responsibility among the households for fear of being liable to unaffordable fines. In the same vain, enforcement of the law so that the waste collection companies can pay the dumping fees should be done in order that the dump site can be managed with those funds as most of the companies were not paying the fees. In line with this recommendation, there must be a regulation regarding the refuse trucks which do not meet the standards. The current situation is that the refuse trucks used by various actors are open and hence leaving a lot of foul smell affecting the health of the people and litter behind which flies off these trucks.

The Ministry of Local Government, through the local authority should bring on board more actors in waste management like NGOs concerned with health e.g. CARE, to avoid lapses in the collection. This idea can be combined with the formation of Resident Development Committees (RDCs) who can collaborate with the NGOs, KMC and other stakeholders on issues to deal with solid waste management.

6.2.4 How households' participation in the Kabwe Town can enable sustainable solid waste management by using the circular economy model involving the 3Rs. The local authority should supply waste collection bins for different waste streams and as opposed to the sacks and at an affordable fee to households to enable sorting of wastes at the source which can eventually begin to enable the process of circular economy. Proper waste collection bins will ensure that there is no further pollution coming from the foul smell produced by the decomposing organic waste which may not be the case with the sacks.

Waste should be collected from all households (33,819) not just some households (5,850). Participation by households should be compulsory and backed with a legal framework in the current Act; strategies to reach out to households that are unreachable due to poor road network should be designed in order that wastes from these households could be collected as well. This therefore means every household should participate in SWM.

The establishment of waste recovery and recycling facilities should be facilitated to reduce waste at the dump site and ensure value addition to waste through material recovery. Recycling of organic waste which forms more than 50% of the waste generated should be started as this would reduce the amount of waste generated by more than half. This would

reduce the volume of waste requiring disposal and maximize the economic value of waste. If possible, there must be a deliberate move by the authorities that be, to attract investors in the industry of recycling and recovery of solid waste.

CE should be considered by the local authority as an effective strategy in the management of solid waste in addition to the existing ones. In the face of resource constraint, it is time now to shift the paradigm from linear municipal approach to a sustainable production and consumption pattern. This could enable the reduction and recovery of resources. Hence, taking into account the limited raw materials, financial and environmental cost of their extraction, a circular economy can be considered as a fundamental revolution to realize the sustainable development strategy, and a closed cycled feedback process of “Resources Products Renewable Resources-Renewable Products” (Zeng Z., et al, 2012) and ultimately phase out the waste from the process of waste management. In addition, the local authority should develop and adopt environmentally sound treatment and disposal methods/practices including recycling and engineered landfills. This can include a regulation compelling waste collection companies to take their waste to the recycling companies as opposed to dumping.

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APPENDICES

Appendix 1: Photos showing the current situation of SWM in the CBD of Kabwe town



Source: Field work, 2017

Appendix 2: Photos showing the initiative by the KMC to improve the SWM in the town

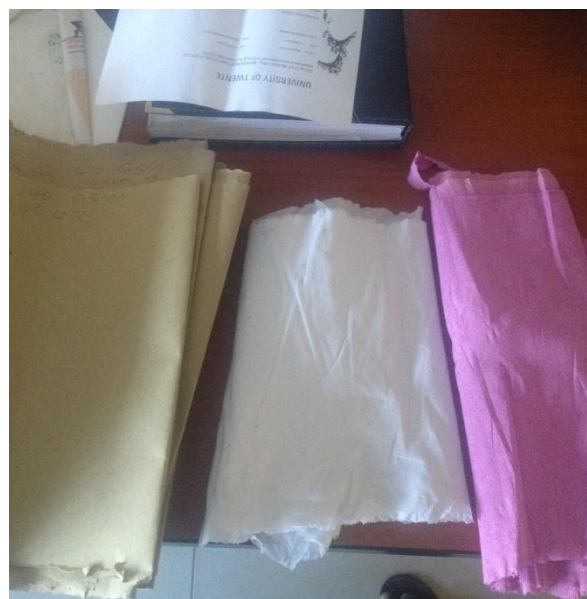


Source: Filed work, 2017

Appendix 3: Photos showing some of the products of recycling of paper, aluminium and lead waste by ZALCO



Source: Filed work, 2017

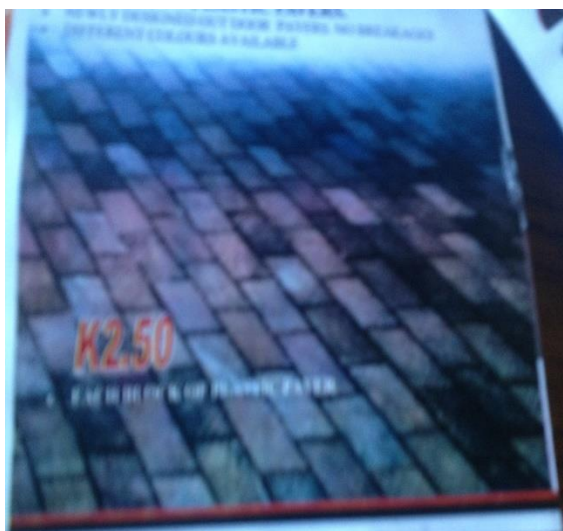


Source: Filed work, 2017

Appendix 4: Photos showing the various products of plastic recycling, interview sessions, sources of plastic wastes and the recycling process at Solid Technology Systems (STS)



Source: Field work, 2017



Source: Filed work, 2017



Source: Filed work, 2017



Source: Filed work, 2017



Source: Filed work, 2017



Source: Filed work, 2017

Appendix 5: Photos showing the current situation at the dump site with scavenging activities



Source: Filed work, 2017

Appendix 6: Photos showing the refuse trucks used by Mabaleka Enterprising and an interview session with Sole Proprietor, Mrs Museteka



Source: Filed work, 2017



Source: Filed work, 2017

UNIVERSITY OF TWENTE.

FACULTY OF BEHAVIOURAL, MANAGEMENT AND SOCIAL SCIENCES Department of Governance and Technology
for Sustainability (CSTM)

Questionnaire on SWM towards Circular Economy

(a) Households

1. Are you aware of what is called solid waste and management issues?
2. Are you involved in solid waste management, if so how and if not why?
3. What is your contribution to the existing solid waste management which is mainly organized by the local authority?
4. In what ways you think that existing solid waste management can be improved by local authority? What do you think that you can do to improve it?
5. Are you aware of the concept of recycling as a means to reduce waste?
6. What initiatives/activities are you doing/involved in that are meant to reduce waste?
7. Do you have several waste collection bins at your home for the purpose of sorting them out?
8. Do you separate (sort) the waste if into what waste streams do you do so?
9. Does the local authority come to collect waste from your home? How often?
10. How do you dispose of your waste at your home?
11. From your income, are you able to pay fees and taxes towards waste management by the municipality or any other such companies dealing with waste? How much?
12. Are you willing to pay a fee towards the collection of waste and the waste collection materials if asked to do so for the purpose of effective solid waste management? If not, why?
13. What challenges do you face to participate in the management of solid waste and what do you think could be the benefits of your participation?

(a) Local Municipal Council- Mr Paul Mukuka, Director Public Health/Mr Chiinza Evans, Senior Health Inspector

1. Is there any policy instrument on the involvement of households in solid waste management and what does it say?
2. What is the existing solid waste management situation, do you collect waste from the households, if so how and if not why?
3. To what extent are the households involved in solid waste management?
4. How many waste streams do you collect and what do you do with each one of them?
5. Are you engaged in any form of recycling of waste as a means to reduce and reuse waste? If not, are there any other organizations involved in recycling of solid waste that you work with?
6. What are the waste disposal methods that you are using in the management of solid waste?
7. Are there any stakeholders you are working with in the management of solid waste? And who are they?
8. What strategies can be adopted to improve the waste management services?
9. Does the Municipality consider circular economy for effective waste management, if yes how?
10. What are the strategies do you use to improve the waste management services that can instil the sense of responsibility in the minds of households?
11. What educational awareness programs do you conduct to make the households realize the importance of reducing, reusing and recycling of waste?
12. What are the challenges/opportunities in involving the households in the management of solid waste?
13. What incentives can the households receive as a result of their participation in the management of solid waste?

(b) Recycling Company-Solid Tech Systems-Mr Zulu Phillip, Chief Executive Officer

1. Are you aware of the concept of circular economy (the 3Rs) as a way to manage waste effectively?
2. What has motivated your company into recycling of waste?
3. How do you collect waste?
4. From whom do you collect the waste?
5. Does the waste you receive come in already separated (sorted)? What would be the benefits to you receiving already sorted waste?
6. Is the waste that you receive free of charge or do you buy it?
7. Into what products do you recycle your wastes and from which category of solid waste?

8. Who are your clients in this recycling business?
9. What challenges do you face as a private waste management and recycling firm?

**(c) Recycling Company-Zinc Aluminium Lead Copper Ore Ltd (ZALCO) Mr Goldwin
Muyunda, Public Relations Manager**

1. Are you aware of the concept of circular economy (the 3Rs) as a way to manage waste effectively?
2. What has motivated your company into recycling of waste?
3. How do you collect waste?
4. From whom do you collect the waste?
5. Does the waste you receive come in already separated (sorted)? What would be the benefits to you receiving already sorted waste?
6. Is the waste that you receive free of charge or do you buy it?
7. Into what products do you recycle your wastes and from which category of solid waste?
8. Who are your clients in this recycling business?
9. What challenges do you face as a private waste management and recycling firm?

**(d) Waste Collection Company-Mabaleka Enterprises (Waste Management Wing)-Ms
Rebecca Mtonga Museteka, Chief Executive Officer**

1. How much do you charge the households for waste collection?
2. Do the households manage to pay the waste collection fees?
3. How frequent do you collect the waste from the households?
4. Are there sufficient waste collection materials among the households?
5. Is the waste you collect from the households separated (sorted)?
6. How do you dispose of the waste you collect from the households?
7. What are the benefits of your involvement in solid waste management?
8. Is there any contract you have signed with the municipality and for how long?
9. Is your company also involved in recycling of waste as a way to manage solid waste?
10. What challenges/opportunities of your involvement in the management of solid waste?
11. What could be the benefits of your involvement in the management of solid waste?

(e) Zambia Environmental Management Agency (ZEMA)-Mr Gift Sikaundi/Ms Mercy Zulu

1. Is there any policy instrument on solid waste management based on tenets of circular economy and could you explain how you strive to promote circular economy in the city?
2. Is there any policy instrument on the involvement of households in solid waste management and what does it say? Has it been implemented?
3. What are your operational structures through which you implement your programs in solid waste management?
4. What strategies do you have in place to promote the reduction of waste for effective SWM?
5. What educational awareness programs do you conduct to make the households realize the importance of reducing, reusing and recycling of waste?
6. Do you see households as critical partners in SWM and to what extent can they be involved?
7. What are the challenges you face in the management of solid waste to protect the environment?
8. What could be the beneficial effects of the participation by households?

(f) Ministry of Water Development, Sanitation and Environmental Protection- Mr Godwin Gondwe, Director Environmental Department

1. Is there any policy instrument on solid waste management using circular economy tenets?
2. Is there any policy instrument on the involvement of households in solid waste management and what does it say?
3. What are your operational structures through which you implement your programs in solid waste management?
4. What strategies do you have in place to promote reduction of waste for effective SWM?
5. What is your collaborative role among the different actors from the waste generation till the different ways to manage the waste streams towards circular economy?

6. What strategies can be adopted to improve the waste management services and instil the sense of responsibility in the minds of households?
7. What educational awareness programs do you conduct to make the households realize the importance of reducing, reusing and recycling of waste?
8. Do you see households as critical partners in SWM and to what extent can they be involved? What is their position in SWM?
9. What could be the beneficial effects of the participation by households?
10. Are there any organizations that you work with to implement your programs? Name the organizations and explain how you work together?
11. Are there challenges you face in the management of solid waste to protect the environment?
12. Do you do any clean up campaigns and how often?