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Chapter

Circular Economy: An Antidote to Municipal Solid Waste Challenges in Zambia

*Kachikoti Banda, Erastus M. Mwanaumo
and Bupe Getrude Mwanza*

Abstract

Zambia is one of the fastest developing countries in Africa. It is land linked and has one of the most urbanizing cities, the capital, Lusaka. The country is now grappling with serious challenges of managing municipal solid waste that is generated from its growing population and increased economic activity. Circular economy ensures that all the negativities of linear economy are reduced or prevented by ensuring reduced generation of waste at source, reuse of the generated waste and if these cannot be implemented, recycling of the generated waste follows. This results into environmental benefits such as clean and safe air and water. Land degradation or pollution is prevented. Therefore, there is need to implement circular economy as an antidote to the current municipal solid waste challenges. Municipal solid waste management is a critical public good that provides a barometer for the effectiveness of any governance system around the world. Successive governments should embed the waste management issue in all the policies developed for to ensure sustainability. In today's world of material scarcity and a call to action toward climate change action, it cannot be over emphasized that circular economy is the antidote to municipal solid waste challenges Zambia is facing.

Keywords: circular economy, municipal, solid waste, antidote, linear economy

1. Introduction

Rising populations and increased economic activities across the world have given rise to the generation of municipal solid waste. While developed countries have made tremendous slides to cope with this increased generation, developing countries especially in southern Africa are still grappling with the challenge. Developing countries are making efforts to improve the well-being of their people, grow the economy and ensure the much-needed development is delivered especially when it comes to political, promises. While they focus is on the former, municipal solid waste generation rates continue to rise and are not met with sustainable municipal solid waste management systems. This paper focuses on municipal solid waste management in Zambia,

a southern African country and how circular economy could be used as an antidote or solution to many challenges the country is facing.

Zambia is a vast African country and one of the fastest developing countries in Africa and has one of the most urbanizing cities, the capital, Lusaka. National records indicate that the country covers 752,614 square kilometers and the World Bank projects the 2021 population to be at 18.9 million. According to www.cia.gov, the rate of urbanization in Zambia is estimated at 4.2% for the period 2020 to 2025 with the urban population accounting for 46% as at the year 2022. The country applies democratic governance system with its 2016 Republican Constitution providing exclusive functions for local authorities among which is municipal solid waste management (Article 147). Rising populations and the rural urban drift due to improved economy have given rise to the daunting challenge in the management of municipal solid waste in the country. Once known as the Garden City of Africa, the country is now grappling with serious challenges of managing municipal solid waste that is generated from its growing population and increased economic activity. This is exacerbated by collapsed waste management systems, lack of financing and bad behavioral attitudes. Successive governments have tried several efforts to ensure that municipal solid waste is effectively managed to ultimately protect public health and the environment [1, 2]. While this is just an example of the challenge in the capital city, the situation is similar across the country especially cosmopolitan towns along the line of rail. Lack of financing, poor behavior attitudes couple with lack of equipment and uncontrolled unplanned settlement has led to a serious challenge to Local Authorities. The situation poses a threat to public health, environment, socio-economic and to a larger extent political sector. Further, contributions from Balasubramanian [3], indicate that social, economic and health issues are some of the effects of uncollected waste. While effects of poor waste management are innumerable as they affect all sectors of human, environmental and socio-economic development, the use of linear economy focuses only on municipal solid waste systems that recognize generation, collection, transportation and disposal only. Such linear economy as revealed by Glaser et al. [4], has been in existence since the industrial revolution and has achieved economic growth. Linear economy systems have several negative impacts on the public health and the environment as they are primarily focused on economic growth in their non-holistic approach.

Sustainable municipal solid waste management is a potential tool for socio-economic development despite its primary focus on public health and environment. As the world and Zambia as member of the global village propagates then achievement of sustainable development goals, the implementation of circular economy is an urgent matter. The call for circular economy across the world is now louder and more apparent than before. This would not only ensure a clean and safe environment but also, create the much-needed jobs with more than 60% population being the youths. As opposed to linear economy, circular economy is more productive and healthier with raw materials are maintained in the production cycle and recycled [5].

2. Municipal solid waste management in Zambia

Zambia attained independence in 1964 on October 24th. During that period and a few years post-independence, municipal solid waste ably managed by the colonial government and new independent Zambia. This was made possible through the public health act and other related legislation. As the country embarked on liberalizing

the economy, the Environmental Council of Zambia was created to attend to environmental challenges in the country especially those coming from the mining sector which is the main revenue base for the country. This led to formulation of the waste management regulations. A few years before that, the national conservation strategy of 1985 was developed to provide policy guidance on the use of natural resources and environmental preservation. These two categories of documents formulated the basis of legal and policy framework that government municipal solid waste management in Zambia.

As the country progressed on its economic reforms, the economy was liberalized leading the country into a free market economy. Increased population growth, a booming economy coupled with the rural urban drift along the cosmopolitan towns of the line of rail led to increased population growth. It is worth noting that the colonial government and the subsequent Zambian governments after independence used a tariff bundling system for collection of waste management fees. This system collapsed in the mid-1990s when economic reforms took place, the resultant effect was piles of uncollected waste lying in the streets because municipalities could not effectively collect waste mainly because of failure to maintain the fleet and also low subscription rates from the citizens. The situation was exacerbated with low research and funding for the waste management sector leading to outbreak of diseases such as cholera especially in major cities like Lusaka the capital.

According to the constitution of Zambia, municipal solid waste management is an exclusive function of local authorities. Therefore, as the responsibility grew, the Zambia Environmental Management Agency (ZEMA), an institution created with the enactment of the environmental management act of 2011 was regulating local authorities in the management of municipal solid waste. However, in December of 2018, the government of Zambia enacted the first ever stand-alone act of parliament, the Solid Waste Regulation and Management Act of 2018. The act recognizes waste as resources and provides for formulation of utility companies to be by local authorities to manage waste on their behalf. Further, the country does not have a new waste management strategic plan and is currently using the national solid waste management strategy of 2004. Apparently, only the Lusaka City Council from the capital Lusaka has developed a waste management plan. Local authorities in the country are visibly struggling to manage municipal solid waste. Some of the reasons attributed to the glaring problems are; lack of revenue, low or no investments or incentives in the sector by government, extremely low levels of awareness among the citizens leading to illegal dumping, burning and burying of waste etc. While the law is in place and few convictions have been secured especially in Lusaka, many towns and cities across the country are doing very little to combat this environmental and public health threat. What is more threatening and appalling, not all the 116 municipalities in the country have engineered landfills for safe disposal of their waste. This means the whole country is using crude dumping clearly polluting the atmosphere, land and water, both surface and underground, the eminent public health threat to the immediate communities living around these dumpsites cannot be over emphasized. Further, very little landfill diversion strategies are being done to enhance recycling and waste to energy process in a bid to promote circular economy. From the highlighted enormous challenges, it is time the country embraced circular economy for an assured sustainable future. This calls for enhanced recycling of municipal solid waste to ensure a sustained supply of material to the industry for production. The model would reduce the stress on landfills and eventually lead to manageable levels of costs for final disposal sites.

3. Current generation rates, streams and sources

Municipal solid waste management in Zambia is a constitutional mandate for Local Authorities. The Ministry of Local Government and Rural Development and other agencies like the Zambia Environmental Management Agency provide an oversight role to the management of solid waste in the country. The implementation of circular economy models are based on the fact that waste generated from any activity, is used as raw material for the production of other items thereby avoiding the use of virgin materials. As discussed earlier, the implementation of the 3R systems is the blueprint of this model. However, it is important to know generation rates to determine the quantities of raw materials for production. For example, waste to energy systems are one the innovative technologies that use waste as a raw material for the generation of heat and energy. In world affected by climate change, the scarcity of water for hydroelectricity generation is real. Further, generation of heat and electricity from fossil fuels is a serious threat to climate change. Therefore, use of municipal solid waste for this purpose is the alternative. Zambia currently has had no empirical survey to determine generation rates, waste streams and sources which produces what kind of waste. Expert opinion, experience and physical characterization of waste informs that for the city of Lusaka in Zambia, 60% of waste produced is comprised of plastic and paper. This could be similar for other cosmopolitan towns and cities but notably different for rural districts, which have agricultural activities and lack of manufacturing industries, low commercial activities and low production more than these towns. This implies that there is huge potential for recycling. Metal is heavily recycled in the currently because of a lucrative market for scrap metal. Glass, garments and organic waste are rarely recycled. It is therefore important that before any circular economy model is implemented, these studies be conducted to inform decision and devise strategies.

4. Circular economy and municipal solid waste management

According to Zhang et al. [6], Circular Economy is an economic development model consisting of resources-products-renewable resources and repeated circulation of materials based on the principles of reduce, reuse and recycle. Natural resource depletion and increased waste generation have contributed to the emergence of the concept of a “circular economy” as a new paradigm opposed to the standard “linear economy” [7]. While there are other schools of thoughts that have more than 3Rs, the scope of this paper is just the 3Rs. This means that the waste generation is reduced at source from every day economic, domestic and commercial activities. Reduction of generation of waste is a conscious-based activity at individual level and also system-based at industrial or commercial level. This means that individuals, residents, or the citizenry is well aware that they have to reduce the generation of more waste by employing technics at individual level that could help in reducing waste generation. For example, an individual or a family could use a reusable shopping bag other than purchasing more plastic bags as they conduct their shopping. Another example at commercial or industrial levels is implementation of systems that reduce more generation of waste are employed. For example, when an organization is conducting a workshop, the institutional policy to reduce the generation of waste from purchase of individual water drinking bottles could clearly be spelt such that all workshop participants could come with their own reusable water bottles and drink from the

common water dispenser or reusable cups could be used for the participants. Clearly, these technics could help reduce the generation of waste that affecting the first R for reduce. The unavoidable waste that is generated could then be disposed of in separate bins according to waste streams or indeed taken to sorting centers for separation at communal sorting stations. This leads us to the second R. However, the effectiveness of this is mainly based on the mindset of the population [8] and effectiveness of the implementation of institutional or work policies aimed at reducing the generation of municipal solid waste.

When waste is generated, there are certain streams or types of waste that could be reused without any physical or chemical change in this case recycling. The reusing of such waste is based on the primary status of its physical, chemical or biological properties. For example, waste from vegetable cuttings or food premises could be used as they are for manure or compost in the backyard gardens for growing of vegetables, this would contribute to the reduction of expenditure on fertilizers, especially if it is conducted at large scale. The world has seen the rise of proponents or enthusiasts of organic farming leading to some becoming vegetarians to save the animals. The growing of such organic food is based on the reuse and recycling of organic waste or waste that can decompose and provide that much needed nutrients to plants or animals. Reduce and Reuse of waste helps in diverting the waste from final disposal sites and thus contribute to the lifespan of the landfill. This is a closed loop systems. Plastics are the other stream of waste that can be reused in its form for several purposes. This leads us to the final R; Recycling. Recycling is the manufacture or production of goods or items by use of material that has performed a primary function and not virgin material. This implies that the raw material used in the production line is waste disposed off in another activity. Recycling of waste could save millions of money needed to purchase, transport and use of virgin material in production systems. Environmental conservation and protection is at the core of the implementation of this R because of the potential of prevention of pollution, conserves the earth and ensuring a safer and cleaner environment. Recycling is thus a game changer in industrial production, job creation, public health and environmental protection. Circular economy if well implemented could be an antidote the currently challenges the country is facing in managing its waste in most of its cosmopolitan towns and cities. This is affirmed by the work of Allevi et al. [8] who propose a waste management model in a circular economy framework.

5. Environmental and socio-economic value of circular economy

While the implementation of circular economy as opposed to linear economy is being encouraged and considered, it is worth noting that the circular economy has numerable environmental and socio-economic value to the implementing agent, institution, city or indeed country. Linear economy involves the use of raw materials to make new products and the waste generated is disposed off. This implies that there is no diversion from the final disposal systems, for recycling let alone, reduction and reuse. This cause pollution landfills, over consumption of natural resources thereby depleting the much-needed resources for future development, clearly going against the concept of sustainable development. Continued hauling of waste from generation to disposal sites and management of disposal sites consume a lot of fuel thereby affecting budgets of municipalities across the country. The threat of climate change, pollution and contamination of air land water cannot be overemphasized. However, circular

economy ensures that all the negativities of linear economy are reduced or prevented by ensuring reduced generation of waste are source, reuse of the generated waste and if these two cannot be implemented, recycling of the generated waste. This yields innumerable environmental benefits among which are clean and safe air and water. Land degradation or pollution is prevented.

On the other hand, agents, institutions or industries and indeed municipalities are bale to record significant savings on their financials in circular economy is implemented. For example, the cost of running landfills is significantly reduced if waste is diverted to recycling plants as opposed to just being disposed of at landfills. This is true also at domestic or industrial level as evidenced by significant savings on the cost of virgin raw material needed for production. Individuals of agents can save at personal or domestic level if the 3Rs are implemented as circular economy principles.

6. Circular economy and vision 2030

Zambia seeks to grow its economy to achieve a middle-income prosperous nation by the year 2030. This aspiration has led to the development and implementation of the Zambia Vision 2030 policy that would spur the country to the desired status by the year 2030. Implementation of circular economy through the 3R system can greatly contribute to the achievement of these visions by the year 2030. Concerning waste management, the Vision 2030 clearly seeks to *achieve and sustain efficiency and effectiveness in the delivery of Public Services; and also attract and retain quality technical, professional and managerial staff in the Public Service*. This implies that as an antidote to the current municipal solid waste challenges the country is facing, there is need to ensure that there is effectiveness and efficiency in the implementation of the 3R system to realize the accrued benefits. Further, these results cannot be achieved if the country does not produce through its universities and colleges, technical and professional staff to undertake this important program. Often times, countries or municipalities especially in developing countries do not have experts in waste management leading to the sector being managed or handled by all sorts of people thereby causing chaos and disjointed activities whose results and impacts cannot be measured. Therefore, circular economy, through the implementation of the 3R system in Zambia can greatly contribute to the achievement of the Government's vision for a middle-income prosperous nation by the year 2030.

7. Strategies for Zambia to achieve a circular economy

Zambia is party to international organizations and treaties among the notable ones being the sustainable development goals. It is therefore important that the country migrate to a fully-fledged circular economy in order to contribute to the achievement of the vision 2030 and actualize the sustainable development goals. Therefore, the following are proposed strategies to be implemented in an effort to implement circular economy as an antidote to the currently municipal solid waste challenges;

There is need for government to immediately provide incentives the waste management sector so that it becomes economically viable to reduce, reuse and recycle including waste to energy projects. Currently, there is no incentive in the waste management sector making infrastructure, equipment and collection systems economically and unattractive. The second strategy is to ensure that domestic and

institutional policies are developed and enforced aimed at implementing the 3R system. Thirdly, there is need to streamline flow of all waste materials to industries and track the recycling rates for purposes of measuring progress and impacts. The last strategy is to ensure application of technology in all process so as to crate the closes loop systems for monitoring and evaluation from generation, collection, transportation, intermediate treatment, and final disposal i.e. Waste to energy plant.

8. Conclusion

Municipal solid waste management is a critical public good that provides a barometer for the effectiveness of any governance system around the world. Waste management is always a political issue as much as it is an environmental and public health issue. It is therefore important that successive governments should embed the waste management issue in all the policies developed for development. Further, the education and financial system should supplement enforcement and operational solutions in the sector. In today's world of material scarcity and a call to action towards climate change, it cannot be over emphasized that circular economy is the antidote to municipal solid waste challenges Zambia is facing. Environmental, social and governance factors need to be critically considered in devising waste management systems in order to combat climate change caused by municipal solid waste management [9].

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Author details


Kachikoti Banda^{1*}, Erastus M. Mwanaumo¹ and Bupe Getrude Mwanza²

1 Department of Civil and Environmental Engineering, University of Zambia, Lusaka, Zambia

2 Graduate School of Business, University of Zambia, Lusaka, Zambia

*Address all correspondence to: billkachikoti@gmail.com

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