

# Circular Economy in Kenya



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## 1 Introduction

A circular economy is a system based on economic and industrial concepts that advocates reusing of products and raw materials so as to maximize the restorative capacity of natural resources. The circular economy attempts to minimize value destruction in the overall system and to maximize value creation in each link in the system. The main benefit of this kind of economy is the reduction of environmental pressure through minimizing emissions of harmful products such as carbon dioxide, nitrogen oxides, and methane among others thus resulting into a cleaner world without rising temperatures and other corresponding negative consequences. The earth is currently facing severe environmental challenges as vital ecosystems such as forests, woodlands, grasslands, and wetlands are facing extreme depletion due to unsustainable human activities. It is estimated that almost half of the world's rivers have been depleted thus accelerating the impacts of global warming. Environmental degradation has led to migration of more than 50 million people from their homes to urban areas where majority reside in urban informal settlements. The planet will continue to face the ever-increasing challenges unless countries shift to more sustainable ways of living and development. Countries and global community must adopt and implement circular economy strategies that seek to reduce environmental damages while maximizing on sustainable development.

In Kenya, many people especially those residing in urban informal settlements and rural areas have started to practice circular economy activities such as the establishment of biogas digesters and reusing of plastic bottles. The country has also banned the use of plastic bags thus creating opportunities for its citizens to reuse and recycle materials such as sisal woolen bags. The establishment of biogas digesters

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in Kenyan rural areas and slums has led to generation of power to light up homesteads and also made cooking easier and safer. Biogas establishment in many parts of Kenya has led to sustainable management of solid waste and municipal wastewater. Recycling and reusing of solid waste from households and municipal wastewater in Kenya has helped the country improve sanitation conditions of most slums. In 2017, the Kenyan government in collaboration with Africa Development Bank (AFDB) under Sustainable Energy Fund for Africa (SEFA) came into an agreement to establish 100 megawatts (MW) waste to energy electricity plant in Dandora dumpsite. Dandora dumpsite is the largest dumpsite in the country that receives waste from most part of Nairobi City County. Asticom Kenya Limited has already been granted permits by the Kenyan government to undertake the task of building this 100 MW municipal waste to energy (WTE) plant. The WTE project in Kenya will have significant benefits to the health, socio-economic, and environmental dimensions of the country. According to AFDB, the project will be receiving an approximate of 1,000 tonnes of municipal solid waste from Kibera slums.

In 2018, Kenyan Association of Manufacturers introduced a plastic bottle recycling initiative to mark the celebrations of World Environment Day. The plastic bottle initiative by KAM led to the establishment of polyethylene terephthalate (PET) recycling company known as PETCO Kenya that will ensure sustainable management of plastic materials through recycling and reusing in the country. All private manufacturers in the country will be represented in PETCO thus ensuring that the initiative gains popularity across the country. PETCO Kenya aims to achieve recovery and recycling of PET materials at a rate of 25 pc in 2018 and 70 pc by 2030, (Rutten 2018). Recycling and reusing of plastic bottles in Kenya has led to emergence of business initiatives. Urban dwellers in Kenya especially those living in informal settlements are reusing plastic bottles to set up small kitchen gardens. Crops such as onions, broccoli, cabbage, kales, bullet chilies, garlic, and ginger are planted in large plastic bottles filled with soil and manure from domestic animals mostly cows and donkeys. According to Kumar, a Nairobi resident in Parklands, they buy 10 L plastic bottles from companies within the city at Kshs 50 each in order to set up a kitchen garden of about 1,000 plastic bottles (Kilonzo 2014).

Kenya has also implemented the use of renewable energy as a means of promoting circular economy concepts. Kenya Electricity Generating Company (KENGEN) has already set up three plants to generate geothermal resource in the country. These geothermal plants include Olkaria I which generates 195 MW, Olkaria II generating 105 MW, and Olkaria IV which generates 140. Geothermal electricity will help to reduce the country relying on Hydroelectric Power (HEP), (Ochieng 2017). Private investors across the country have also invested in small-scale solar and wind electricity generation plants. World Bank-funded rural electrification program commonly referred to as Last Mile Main Grid Connectivity in Kenya seeks to establish the largest solar power in East and Central Africa in Garissa on 85 ha piece of land. Kenya investment in renewable energy is one of the strategies to reduce its carbon emissions by 64,190 tonnes per year. In order to ensure success in promotion of

circular economy concepts, the country has set up organizations like Kenya National Cleaner Production Center (KNCPC), Kenya Nuclear Electricity Board (KNEB), and National Environment Management Authority (NEMA).

## **2 Legislative framework supporting Circular Economy in Kenya**

In Kenya, there are several legislation and legal frameworks to enhance sustainable implementation of circular economy strategies. CE legislations in Kenya include parliament Acts, bills, by-laws, and legal publications in most governmental parastatals and lead agencies. The new Kenyan constitution 2010 mainly Chapter 5 Part 2 on land and environment mainly states all the obligations of its citizens to ensure sustainable exploitation of natural resources and sustainable management and protection of the environment. Chapter 5 Part 2 of the constitution environment and natural resources is helping the country achieve green growth and sustainable development which is a key step toward implementation of a circular economy. The circular economy concepts in Kenya started to gain recognition since the development and implementation of Environmental Management and Coordination Act (EMCA) of 1999. EMCA 1999 is a legal framework law on environmental management and conservation in Kenya. EMCA 1999 has led to the establishment of the following institutions to help the country achieve environmental sustainability; National Environment Management Authority (NEMA), Public Complaints Committee (PCC), National Environment Tribunal (NET), National Environment Action Plan Committees (NEAP), and County Environment Committees.

The National Environment Management Authority (NEMA) was established as the principal instrument of government charged with the implementation of all policies relating to the environment and to exercise general supervision and coordination over all matters relating to the environment. In consultation with the lead agencies, NEMA is empowered to develop regulations, prescribe measures and standards, and issue guidelines for the management and conservation of natural resources and the environment. EMCA 1999 also led to the formulation and adoption of Environmental Impact Assessment (EIA), Environmental Audit (EA) and monitoring, environmental restoration orders, conservation orders, and easements. The incorporation of EIA and EA in development concerns in the country has helped to promote cleaner production and sustainable development which is a major step toward realizing achievement of circular economy. All development projects in the country are required by law to undertake EIA to ensure all the potential impacts are identified and sustainable mitigation measures are developed. Regular monitoring of ongoing development projects in the country is also carried out to ensure that all developers and projects comply with the set of environmental regulations.

In June 10 2008, the then President Mwai Kibaki launched Vision 2030, a long-term blueprint toward the achievement of sustainable development in the country by

2030. Vision 2030 has also played a key role toward the promotion of CE in the country. The blueprint advocates for adoption of industrial ecology, cleaner production principles, and other sustainable practices to ensure that the country achieves a green growth that reduces environmental harm while at the same time maximizing on the economic gains. The country is also a signatory to several regional conventions such as the Africa Vision 2063, Bamako Convention, Convention of the African Energy Commission, and the Revised African Convention on the Conservation of Nature and Natural Resources. The country has also adopted international sustainable development goals (SDG) to guide sustainable implementation of developmental issues that promote circular economy.

### 3 Research Models

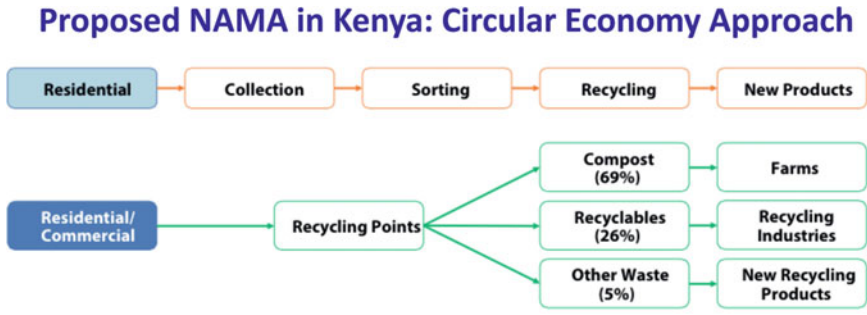
In 2016, the Ministry of Environment and Natural Resources in collaboration with UNDP developed a circular economy research model on solid waste management in urban areas. The Research model adopted is known as Low Emission Capacity Building (LECB) Program under funding from the European Commission (EC), the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB), and the Australian Government. LECB's main aim is to ensure partnership among the public sector, private sector, industries, and relevant national and international organizations in order to ensure development of low emission approaches. National counterparts are supported to strengthen technical and institutional capacities to identify and formulate Nationally Appropriate Mitigation Actions (NAMAs) and Low Emission Development Strategies (LEDS) in the public and private sectors, and to strengthen the underlying greenhouse gas inventory management and Measurement, Reporting and Verification (MRV) systems. The LECB Program runs through 2016 and is active in 25 countries: Argentina, Bhutan, Chile, China, Colombia, Costa Rica, the Democratic Republic of Congo (DRC), Ecuador, Egypt, Ghana, Indonesia, Kenya, Lebanon, Malaysia, Mexico, Moldova, Morocco, Peru, Philippines, Tanzania, Thailand, Trinidad and Tobago, Uganda, Vietnam, and Zambia. LECB program is being implemented in the country through NAMAs. The NAMAs circular Economy Municipal Solid Waste Management Approach for urban areas aims to transform Nairobi's waste sector from a disposal-driven one to one of recycling and composting.

NAMAs circular Economy Municipal Solid Waste Management Approach will have the following benefits to the country; affordable waste collection services to all income areas, increase in the amount of waste collected and recycle, improved health at household levels, reduction in GHG emissions, direct and indirect job creation, and increase in the application of compost to improve agricultural soil fertility. The NAMA circular economy model seeks to propose that 90% of all the waste collected in Kenya must be recycled thus making the country among the highest ranking globally in terms of recycling. In comparison, developed nations like Italy and USA have recycling rates of 36 and 34.5%, respectively. NAMA model states that waste

from households and companies in Kenya will be collected by waste collection companies. Waste collection companies will then transport the waste into a central waste recycling point instead of disposing it at Dandora dumpsite. At the central waste recycling point, sorting out of the waste into different fractions will be carried out. 30% of the recyclable materials recovered at the central recycling point will be sold to recycling industries while 60% of the total waste that is mainly organic will be transported to composting plants for manure manufacturing. The remaining percent of the waste will be disposed with a small research pilot activity undertaken to generate energy through cement kiln method.

The figure below shows the operational flow of the circular economy approach of the NAMA. Revenues come from three sources:

- Waste collection fees (earned by collectors)
- Sales of recyclable materials and tipping fees (earned by recycling points)
- Sales of compost (by composting businesses)
- Sales of new products (by recycling industries).



Source Nema (2016)

## 4 Case Studies of CE Implementation

### 4.1 Safi Organics

Safi Organics is a rice processing company based in Mwea Kenya. The company was founded in 2015 and boasts of annual turnover of 42,000 USD. The company is an eco-inclusive enterprise that aims at reversing the declining agricultural production while creating job opportunities for the youth in Kenya. Rice farmers in Mwea face the challenges of disposing off rice husk which they burn thus polluting the air around the area. Safi Organics has developed technologies to collect the rice husk and transform it into organic fertilizer. Waste rice husk is collected from farmers and

processed into biochar, the biochar is then stored, processed, and a local enzyme is added to enable microbial growth. The fertiliser and soil treatments are sold back to the farmers directly or through agents. Safi Organics has created a local circular economy that enables farmers to exploit the value of their waste in an environmentally friendly manner, as well as gain access to cheaper fertilisers and soils treatments. Safi Organics also employs a number of local youths, providing them with an income stream and access to valuable training and experience. Safi Organics is collaborating with Kenya Agricultural and Livestock Research Organization (KALRO) to increase opportunities in organic farming among rice farmers in Mwea. Safi Organics' main environmental objective is to reverse declining soil fertility and reduce the burden of chemical fertiliser on the local environment. Safi Organics contributes to enhanced soil conditions by encouraging local farmers to use rice husks for soil maintenance. Prior to their involvement with Safi Organics, local farmers were unaware of this sustainable, local alternative to chemical fertilisers.

## ***4.2 EcoPost Limited***

EcoPost is a social enterprise that addresses the challenges of urban waste management especially plastic pollution, youth unemployment, deforestation, and impacts of climate change in Kenya. EcoPost is involved in recycling plastic waste in order to manufacture eco-friendly plastic products such as outdoor furniture and fencing materials. The enterprise is making huge contributions toward minimizing plastic pollution in informal settlements. The enterprise aims to recycle 20.9 million kgs in the next 10 years. EcoPost Limited is working closely with Safaricom Foundation, Ministry of Youth Affairs, Enablis East Africa, and BiD Network from Netherlands to ensure it achieves and its objectives.

## ***4.3 Sanergy Kenya***

Sanergy Kenya is an organization that aims at improving the sanitation condition of most urban slums such as Mukuru in Nairobi. Urban slums in Kenya are faced by challenges such as high population that exacerbates the poor sanitation conditions in these informal settlements. An approximate of 8 million slum dwellers in Kenya are forced to use unsanitary options such as “flying toilets” that involves mainly defecating in available plastic bags that are later disposed on the streets. The ban of plastic bags is likely to make the conditions worse as most slum dwellers may start to defecate in the open. Sanergy Kenya is now providing Fresh Life Toilets that are designed to be used 80–100 per day. The waste from the toilets is collected regularly in sealed cartridges and taken to a central processing facility. In the central processing facility, the waste is stored in special bio-digesters where it breaks down and releases

methane that is used as a fuel in biogas generating plants in the slum. The biodigesters also help in removing disease-causing pathogens thus making the leftover matter safe to use as fertilizer. According to Sanergy Kenya, one tonne of human waste produces about 0.6 m<sup>3</sup> of biogas. Sanergy has already collected 2,700 metric tonnes of waste from Mukuru slums. Once the Sanergy's biogas plant is completed, it will generate 250 kW of electricity that will help to light up the slums and also sell to the national grid. Poo-to-power initiatives are already at work in some Kenyan slums as well as several schools, but projects such as Sanergy's with bigger funding and wider aspirations hope to bring the benefits to more of the population.

#### ***4.4 Coca-Cola Kenya***

Coca-Cola Company has launched a global plan "World Without Waste" that will help in recycling of plastic waste. The company aims to reshape its packaging and a new global goal that aims at recycling almost 100% of its packaging by 2030. The companies "World Without waste" initiative will be guided mainly by the three R's scheme: Reduce, Reuse, and Recycle. The company has reduced its dependence on fossil fuels by introducing the Plant Bottle Packaging, which is the first fully recyclable polyethylene terephthalate (PET) plastic bottle made with up to 30% plant-based material. Together with partners, the company has invested in two bottle-to-bottle recycling facilities at Extrupet and MPact, to create recycled PET for use in the beverage industry. 45,000 tonnes of PET bottles are diverted from landfills each year to be reused in the beverage industry. Coca-Cola, together also with its bottling partners and other members of the PET value chain, has helped to set up a recycling company, PETCO, which in 2016, achieved a recovery and recycling rate of 58% of post-consumer PET bottles—one of the highest rates in the world.

#### ***4.5 TakaTaka Solutions***

TakaTaka Solutions is a small-scale waste recycling enterprise that mainly operates with Nairobi City County. The enterprise claims that it is capable of recycling up to 95% of the waste it collects. Waste collected by TakaTaka Solutions is separated into two fractions mainly organic and inorganic at the initial stage. Organic waste which accounts for a high amount of an approximate 60% is then transported to the enterprise's central facility for production of compost. The compost produced is popularly known as the TakaTaka Solution Biobooster. Recyclable materials from the waste collected such as plastic containers, cardboards, and metals are then sold to recycling industries across Nairobi. TakaTaka Solutions is also involved in manufacturing of wine glasses and tumblers from recycled glass bottles.

## 5 Discussion and Analysis

There is a strong relationship between CE and environmental sustainability as they both aim at improvement of the social, economic, health, and environmental dimensions in a society. Humanity must learn to sustainably utilize the available resources to improve their well-being while at the same time learn how to modify waste generated to create more products. In Kenya, the number of industrial plants engaging themselves in Resource Efficient Cleaner Production (RECP), the 3Rs programs—reduce, reuse, and recycle, and Industrial Ecology (IE) is on the rise. Some technologies in RECP, 3Rs, and IE, are very expensive to adopt especially among the small-scale manufacturing industries thus the government should offer monetary support. The process of “greening” the Special Economic Zones (SEZs) has greatly helped Kenya attract green Foreign Direct Investments (FDIs). In Kenya, over the years, there has been an emerging international consensus that the country is exploiting its natural resources in an unsustainable manner. This has led to implementation of interventions such as Industrial Ecology, EIA, EA, and cleaner production strategies in order to reduce pressure on the existing ecological resources. In the past, manufacturing industries in Athi River SEZ have been operating in a linear approach where they extract raw materials from the environment to produce products and then dumping the waste in landfills. The adoption of a circular economy in the country coupled with Resource Efficient Cleaner Production (RECP) and industrial symbiosis will improve resource security of the SEZs, reduce associated ecological impacts associated with waste disposal, and offer new opportunities for economic growth and wealth creation. The adoption of CE in Kenya is likely to encounter barriers such as inadequate awareness of the benefits of adopting CE concepts and strategies. The policy makers in the country also are likely to encounter challenges inaccurate production and manufacturing data that can be relied upon to make informed decisions.

The over reliance on out-dated production regulations that do not prioritize CE concepts and efficient harnessing of ecological resources, limited research in CE should serve as learning points for policy makers in Kenya to improve the country’s production and manufacturing sector. Adoption of a circular economy requires an incentive approach as demonstrated in European and Asian countries. An incentive approach will allow manufacturing industries to seal loopholes in use of raw materials and energy use so as to minimize disposing large amounts of wastes in landfills. Kenya aims to achieve a Gross Domestic Product (GDP) growth rate of 10% by 2030. The country aims to promote Foreign Direct Investment (FDIs) through implementation of several flagship projects over the Vision 2030 period. In the first Medium Term Plan (MTP) of Vision 2030 (2008–2012), the countries implemented the following flagship projects: creation of Small Scale Enterprise (SMEs) parks, development of SEZs, creation of industrial parks, industrial and manufacturing zoning, inputs cost reduction, value addition and market access development, and development of livestock Disease Free Zones (LDFZ) for production of premium quality beef and other livestock products. The implementation of these flagship projects during the first Medium Term Plan was slow as some of the projects were never realized. During



the first MTP (2008–2012), five SMEs industrial parks were to be developed in Eldoret, Kisumu, Nakuru, Mombasa, and Nairobi, but they have not been established since.

### ***5.1 Current Status of Waste Management in Kenya***

In Kenya, there is increased urbanization coupled with rapid growth of human population mostly in the urban areas. Increased trends of urbanization and rapid population growth have led to increased rate of waste generation and challenges in waste flow. Despite existence of regulations and policies that guides on waste management, weak implementation, and unsustainable individual practices have led to accumulation of waste in most urban centers in Kenya. Poor waste management has led to outbreak of waterborne disease and dengue fever especially in Mombasa and parts of North Eastern counties. The plates below show examples of poor waste management in Kenya.



*Illegal waste dumping on the streets*



*Uncontrolled open dumpsite*

In Kenya, most urban centers have inefficient waste collection and disposal systems. The table below shows a summary of waste generation, collection, and recovery status in major towns.

Name of town	Estimated waste generated (tons/day)	Waste collected	waste recovery	Uncollected waste
Nairobi	2400	80%	45%	20%
Nakuru	250	45%	18%	37%
Kisumu	400	20%	Unknown	Unknown
Thika	140	60%	30%	40%
Mombasa	2200	65%	40%	35%
Eldoret	600	55%	15%	45%

*Source* Ministry of Environment and Natural Resources (2010)

Waste is mainly transported in Kenya using open trucks, donkey carts, handcarts, and buckets that lead to massive pollution and contamination of the environmental resources.

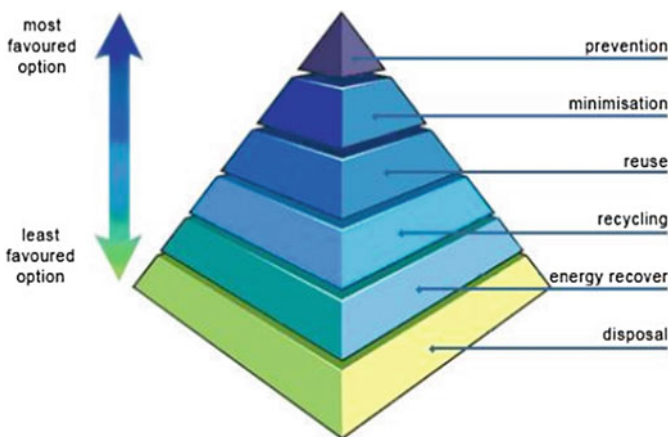
### 5.2 Type of Waste and Management Method in Kenya

Type of waste	Disposal method
Organic (vegetable and fruit remains)	Fed to animals, disposed to landfills or dumpsite
Food remains	Fed to animals, taken to dumpsite
Debris from construction	Deposited in open dumpsite, recycled
Plastics	Reused, recycled, dropped on the environment, taken to dumpsite
Sludge	Discharged to water bodies–rivers, streams
Bio-medical	Burying, burning
Sawdust	Reused in toilets, fuel
Old fabrics	Recycled

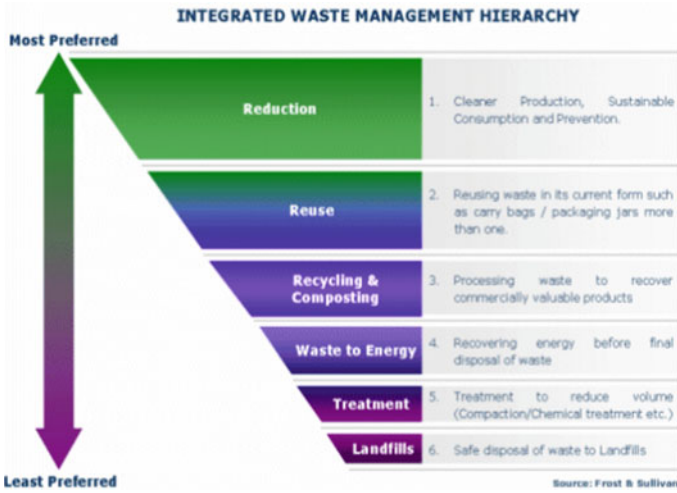
Source Kilonzo (2014)

### 5.3 The Preferred State of Waste Management in Kenya: Integrated Solid Waste Management

Integrated Solid Waste Management (ISWM) hierarchy is an integrated approach that aims at protection and conservation of the environment through implementation of various approaches of sustainable waste management. ISWM establishes the preferred order of solid waste management alternatives as follows: waste reduction, reuse, recycling, resource recovery, incineration, and landfilling. The figures below represent ISWM Hierarchy.

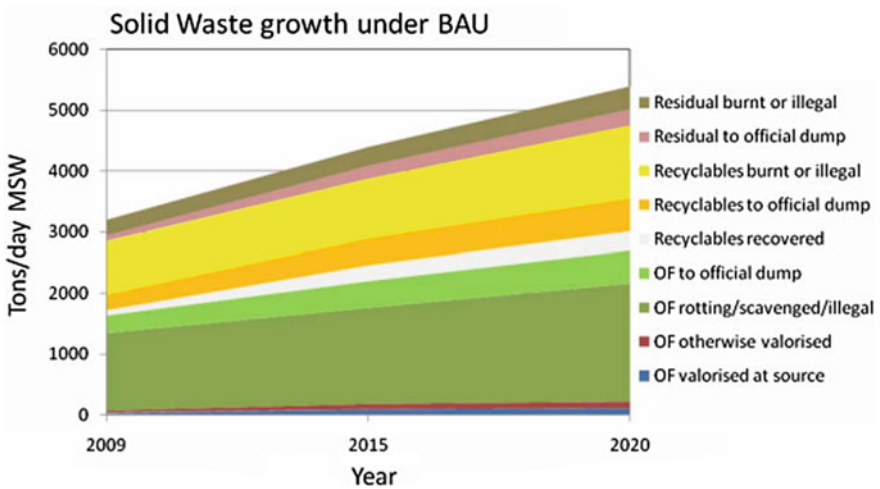


Source KIPPRA (2013)

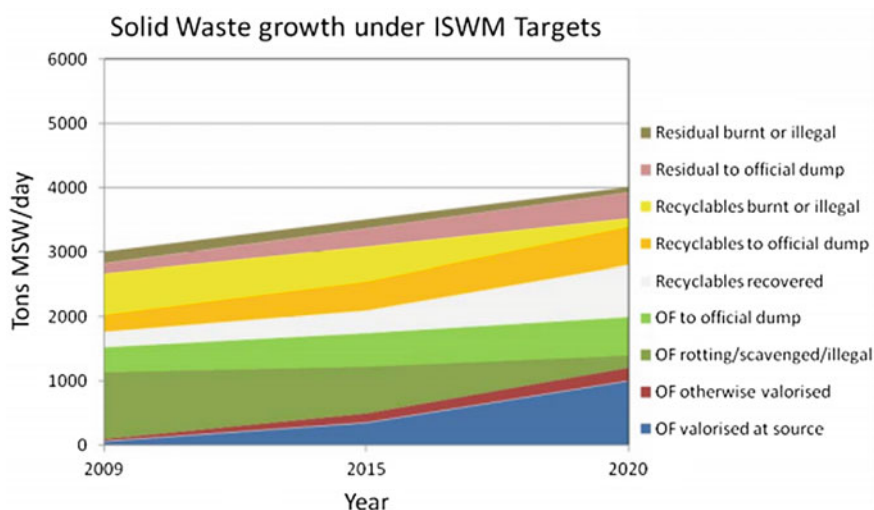


Source KIPPRA (2013)

ISWM plan targets to transform waste collected into different fractions. The possible future scenarios for solid waste management in Nairobi city are illustrated in the figures below for business as usual under ISWM targets.



Source Muthoni (2014)



The following table summarizes an estimate of waste volumes in 2009 and predictions with and without the ISWM plan for 2015 and 2020 (Table 1).

**Table 1** Status quo and possible futures for solid waste volumes in Nairobi

Year	Quantities in tons/day					
	2009		2015		2020	
	Best	Worst	ISWM	BAU	ISWM	BAU
Total generated	3000	3200	3500	4400	4000	5400
Organic Fraction valorised at source	2%	1%	10%	2%	25%	2%
Organic Fraction otherwise valorised	1%	1%	4%	2%	5%	2%
Of rotting/scavenged/illegal	35%	40%	21%	36%	5%	36%
Organic Fraction to official dump	13%	9%	15%	10%	15%	10%
Recyclables recovered	8%	3%	10%	6%	20%	6%
Recyclables to official dump	9%	8%	13%	10%	15%	10%
Recyclables burnt or illegally dumped	21%	27%	15%	22%	3%	22%
Residual waste to official dump	5%	3%	8%	5%	10%	5%
Residual burnt of illegally dumped	6%	8%	4%	7%	2%	7%
Total	100%	100%	100%	100%	100%	100%
Total to dump	30%	18%	36%	25%	40%	25%
Total valorised	8%	5%	24%	10%	50%	10%
Total illegal	62%	77%	40%	65%	10%	65%

*OF*—Organic Fraction; *BAU*—Business As Usual

It is estimated that Nairobi City County receives at least 50% of waste collection services while half of Nairobi residents do not completely receive waste collection services. This equates to an approximate of about 1560 tonnes that remain uncollected per day. Based on April 2009 CCN records, average CCN collection levels at present are approximately 430 tons/day out of an average of 567 tons/day received at Dandora in 2009. Weighbridge records at the Dandora dumpsite over the period 2006—end 2008 indicated an average 830 tons/day were disposed there prior to 2009. In Nairobi, there is an active and well-documented material recovery and recycling sectors operating thus creating employment opportunities, especially among the youth. Material recovery and recycling sector accounts for a large amount of the generated but remains limited to about 300 tonnes per day that can be broken down as follows: 100 t/day of paper (~18% of paper waste), 100 t/day of plastic (~20% of plastic waste), 62 tonnes per day of metal (Most Valuable Metal is recovered), and 2.4 tonnes of organics are composted (<1% of organic waste). It is unknown how much organic waste is recovered for livestock feeding. Recycled glass volumes appear to be on the decline at approximately 50 tonnes per day.

## 6 Impact of CE on GDP

In any given economy, an emergence of a business opportunity is greatly considered as a chance to accelerate the economic growth. Circular economy is presenting numerous opportunities to the Kenyan economy through improvement of its production and consumption patterns, cost savings, and creation of employment and room for technological advancement through innovation. Economic growth is the ability of economy to produce products and services for society and measured in terms of Gross Domestic Product (GDP) and Gross National Product (GNP) indicators. According to . . . , it is estimated that the Kenyan economy will achieve a double digit growth by shifting from linear economy to circular economy. The country's transition to GE will bring about huge benefits such as industrial innovation, changes in production and manufacturing processes, and other industrial technological advancement. Industrial technological advancement may ring up to 3% of economic productivity per year in the country. The circular economy will lead to less exploitation of natural resources and increase opportunities in waste recycling and reusing. Recycling and reusing waste will increase household savings and minimize the expense due to availability to transform waste into more desirable products thus boosting the GDP.

In the near future, it is estimated that unemployment in developing nations will significantly decrease. Studies reveal that the implementation of circular economy strategies by developing nations will result in creation of several job opportunities. Implementation of circular economy concepts by developing nations will also change the production and consumption patterns of both small- and large-scale enterprise through the adoption of new technologies of production and resource conservation. Adoption of sustainable production and consumption patterns by manufacturing industries will lead to creation of high-quality products thus also raising their

consumption levels through creation of new markets. Foreign investors and international financial lending institutions will be attracted to invest in developing countries that have adopted circular economy concepts thus boosting their economic growth. According to Ellen MacArthur Foundation, industries with fast-moving consumer goods, the net material cost savings might be about 700 billion dollars globally. Innovations by replacing usual, one-way goods with those, that are “circular by design” and creating the logistical facilities for circular network systems can give extra possibilities for economies and companies to use new ideas at their businesses and, thus, generate new channels of revenues. The advantages may include such aspects as higher labor and energy effectiveness, better technological development, redesigned materials, and bigger profits opportunities. Besides economical and business opportunities, the circular economy gives the possibility to improve the environment. The circular economy promises to reduce carbon dioxide emissions by 48% by 2030 and by 83% by 2050 in Europe and also reduces 7.4 million tonnes of greenhouse gas emissions by not letting organic waste permeate into landfills.

A circular economy development path could result in a reduction of primary material consumption (measured by car and construction materials, real estate land, synthetic fertiliser, pesticides, agricultural water use, fuels, and non-renewable electricity) by 32% by 2030 and 53% by 2050, compared with today (SUN Institute 2015). In addition, primary material consumption could be reduced by 32% by 2030 and by 53% by 2050 compared with today’s indexes. Primary materials may include construction materials, pesticides, fuel, real estate land, and others. Moreover, we have to take into consideration the land degradation and that it costs billions of dollars annually. By moving more biological materials with composting, the circular economy will make the necessity for replenishment with additional nutrients much more less. Organic waste, which is used systematically, can help regenerate the soil and reduce the use of chemical fertilizers to 2–7 times comparing with today. The households could reduce the costs by 16% by 2030, as circular economy is controlling the externalities, which involve pollution of water and air, climate change, land use, and the release of toxic substances, (Ellen MacArthur Foundation 2015). Circular Economy Opportunities in Business Profitability is one of the main goals of the companies.

The circular economy could help individual businesses achieve the lower rates of input costs in their production and open the new profit streams. There are some ways on how to do it: Beer production demands input costs as water, grains, yeast, and energy. Usually, the used materials are thrown away, but what if the company starts to sell the used brewer’s grains. It can help to gain USD 1.90 per hectoliter of beer which was produced, which leads to capturing the millions as a profit. Another example could be the reduction of costs of mobile phones remanufacturing. Remanufacturing expenses can be less in 50%. In this case, the mobile industry needs to offer the motivation to return the phones and to improve the reverse cycle. The high-end washing machines could be leased to consumers instead of selling it. Then washing machines will be affordable for most households; customers would save about third per wash cycle, and the producers would earn a third more in profits, but gaining money for leasing. The circular economy concept is also applicable to clothes

industry. Clothes manufacturers can collect worn pieces of clothes to produce new items, which reduce the costs of input. Such concept is already used by many companies. The circular economy can give companies the opportunity to be independent of changeable raw material prices, as the transition to circular path involves the usage of more remanufactured materials and less virgin, which eliminates the raw material price dependency and makes the enterprise more stable. Besides this, producers will be less dependent from natural disasters or geopolitical situations, as decentralized providers offer alternative sources of materials. Consequently, manufacturers are confident in their supplies, and there is a lower risk of bankruptcy, (Timmermans 2015).

The green economy will also create the demand for new business services. With the new system of doing economy, there would be needed such services as collection and reverse logistics organizations, that would support products to enter the new system, sales platforms, that will improve the utilization of the goods, remanufacturing, and repairing companies, and that would give the new life to products. Customers will be engaged in new ways. The circular economy gives the solutions to firms how to interact with clients on the longer terms. As the life-time of the products is increased, there will be more touch points with the customers, which will bring the better satisfaction both to clients and companies, (Ellen MacArthur Foundation 2015). Further, the circular business models will be studied and discussed, which will help to get the full understanding of circular economy adoption for the company level.

## 7 Conclusions

Currently, across the globe, the concept of circular economy is gaining recognition and several countries have developed policies to ensure its successful implementation. Many countries are aiming to replace the “end-of-life” concept with circular economy which is a more sustainable means of development. The circular economy aims at encouraging reusing, recycling, and recovering of materials in the production process assumed to be waste and then use them as raw materials to create new products, by-products, and services. The circular economy will help to reduce environmental pollution and damage by ensuring sustainable management of waste. The circular economy operates at micro-levels of raw materials extraction and production with the objective of enhancing the accomplishment sustainable development. The circular economy will help to improve environmental quality while simultaneously enhancing economic prosperity and social equity to the current and future generations. Government, policy makers, business leaders, and consumers must realize that in order to ensure there is continued wealth creation and economic growth, new industrial models that depend less on primary energy and inputs must be adopted. The circular economy concepts must act as drivers of the twenty-first century industrial revolution by promoting innovations and industrial technological advancements.



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