

Review

Waste Disposal; An Environmental Tragedy of the Future Commons, Kenya

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Abstract

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Waste is an eternal burden and is a necessary evil, a tragedy of the commons in waiting. Waste production increase with increase in world global population resulting to serious environmental problems when poorly treated and disposed. Inevitable consequences of the practice of solid waste disposal in landfills are gas and leachate generation due primarily to microbial decomposition; climatic conditions refuse characteristics and land filling operations. The migration of gas and leachate away from the landfill boundaries and their release into the surrounding environment present serious environmental concerns at both existing and new facilities. The surface garbage disposal known as dumpsite method is risk to human population and other biodiversity. In Kenya, most of the wastes are left unattended hence is an environmental risk. Besides potential health hazards, these concerns include, and are not limited to, fires and explosions, vegetation damage, unpleasant odours, landfill settlement, ground water pollution, air pollution and global warming. This paper seeks to address the dangerous situation waste generation and its disposal methods present environmental disintegration and future loss of biodiversity. The objective of this research is to sound caution and find sustainable ways of disposing waste in Kenya. The information was obtained from various sources including visits to the disposal site observation and recording, interviews with key informers, desktop research, Archives, and county officials dealing with waste disposals. The results were discussed and recommendations made.

Keywords: Waste disposal methods, tragedies, waste production, environmental problem

INTRODUCTION

It is estimated that, 11.2 billion tons of solid waste are collected worldwide every year. This poses a serious risk to ecosystems and human health due to the increasing volume and complexity of waste associated with the modern economy and rapid urbanization. Waste has become eternal burden of modern life and a necessary evil particularly in Kenya. Africa is the most rapidly urbanizing continent globally with projections showing

that more than half of its population will live in urban settings in the next few decades. With 15% to 20% of the human population living in urban environments, waste management is already a problem (Mercy, 2018). Rapid urbanization comes with several challenges including high generation of solid waste. Management of this solid waste is a complex and costly process, especially for developing African countries of which Kenya is one.

Today, solid-waste management (SWM) conditions in the developing world are often quite dire and reminiscent of those found in the developed world several generations ago. The impact of inadequate SWM practices on natural and human environments is now being acknowledged (Mercy, 2018). One of the most worrying global environmental problems currently, is the amount of waste generation and disposal systems. Out of 90% of waste generated, 80% is non-biodegradable which if not checked is mostly likely affect the earth's because most of the wastes are harmful to life (Alice, 2018). The major environmental challenges associated with waste generation are inadequate waste collection, transport, treatment and disposal methods. Current systems cannot cope with the volumes of waste generated by an increasing urban population, and these negatively impacts on the environment and public health. The challenges and barriers are significant, but so are the opportunities (14). Dumpsite method is one of the most common, widely used waste management techniques in Kenya. The ever increasing of solid waste has made the role of dumpsite and landfills become prominent despite the negative impacts that they cause unavoidable. The public and government regulations are getting more aware with the negative impacts that could be brought by the waste disposal towards the community. However, current urban planning tends to emphasize more on the environmental aspect instead of social and economic aspects (Kadir, 2017).

Literature Review

Other research studies indicate that, tragedy of the commons manifests themselves everywhere in the world and waste disposal is one of the tragedies of the commons mainly in urban environments in Kenya (Aarni, 2017). To give an example, the amount of waste moving into the oceans is overwhelming and oceanic life is in danger of extinction. The waste debris come from off-shore dumping and river pollution and is carried and trapped in the middle of the Ocean waters. This behaviour of the tragedy of the commons is called "dominant strategy" of each individual. Proper waste disposal is expensive and can pose a significant cost to an individual or industrial company. Assumption is that, a factory can get away with illegally dumping trash into a river or can either pay for waste disposal, or throw the waste into a river. Throwing the waste into the river poses a negligible cost to the factory. Obviously, using the river is the dominant strategy (Aarni, 2017). If the concept of competition is introduced, and other factories are dumping waste in the river, any individual factory will have a dominant strategy of dumping waste into the river (Aarni, 2017). As a result of this behaviour, enormous patches of garbage are now floating in the ocean waters. Individuals act in their best interest, ignoring the small,

but not negligible cost to the environment or others. When many individuals exhibit this behaviour, the tragedy of the commons occurs. This phenomenon is actually quite common. Each acting unit, be it a person, company, or factory, receives one hundred per cent of the benefits of easy disposal of waste into air, land, or bodies of water but only incurs a fraction of the negative effects of the pollution (Mercy, 2018).

There are many ways of waste disposal and one of them is landfills. Creation of landfills are better way of disposing of waste but gas and leachate generated from them due to primarily microbial decomposition, climatic conditions, refuse characteristics and land filling operations pose serious danger to the environmental health through the migration of gas and leachate away from the landfill boundaries and their release into the surrounding. Besides potential health hazards, these concerns include, and are not limited to, fires and explosions, vegetation damage, unpleasant odours, landfill settlement, ground water pollution, air pollution and global warming (James et al., 2017). As the modern world produces more than 3.5 million tons of garbage a day and as the figure grows, landfills have been seen as the ultimate solution for storing ever increasingly waste generation at lowest cost by all institutional and urban environmental practices. Before human civilization and population increase, waste disposal was not an environmental issue but with the increase of human population, consumption and generation of waste, it follows that there was need to find a solution to dispose of waste to prevent pollution of the environment. It is now scientifically a well-known fact that such waste deposits have related implications such as long-term methane emissions, local pollution concerns, settling issues and limitations on urban development (African Population and Health Research Center, 2017). Waste disposal through various methods such as landfills only address immediate problems but overlook their long term effect on future environments.

OBJECTIVES

- i. To evaluate the extent of waste disposal and its effects on the environment in Kenya
- ii. To make recommendations to the National and county governments on sustainable waste disposal methods

METHODOLOGY

The study adopted desk top research, personal observation through visiting the disposal sites, key informants and focus group discussions. Other secondary information was obtained from NEMA, National environmental department and county governments from eight counties as representatives of others 47 counties.

RESULTS AND DISCUSSIONS

Waste Disposal Methods and Impacts on biodiversity

The study found that, different countries have different problems regarding effects of wastes on the environment due to disposal methods. In Athens (500 B.C.) each household was responsible for garbage collection to the disposal site located at a minimum of 1.5 kilometres from the city walls. With the Roman Empire, came the first garbage collection service. Before this, people threw their refuse into the streets from where it was transported to an open pit, often located within the community, by horse-pulled carts (Linda and Suzan, 2017). Centuries later, there were still no organized waste collection methods. In the early days, the population was small and plenty of land hence garbage was simply dumped in convenient places and forgotten. By the 1700s, increased waste production had become a major problem: It took another 150 years before scientific reports linking disease to filthy environmental conditions finally helped launch the 'age of sanitation' (Linda and Suzan, 2017). In the United States, the modern concept of solid waste management first emerged in the 1890s. By the turn of the 20th century, a growing number of American cities provided at least a rudimentary level of solid waste collection and disposal, and around 1930 virtually all cities offered garbage collection services. From urban centres, wastes were disposed of in a variety of ways, including landfills, incineration, water and, ocean disposal. The latter was outlawed in 1933; however industrial and commercial wastes were exempted (Linda and Suzan, 2017). During World War II era there was significant escalation of the waste management problem for two reasons: over-consumption and the rise of the chemical age, which, together, resulted in dramatic changes in waste volumes, composition and toxicity. The 1950s the so-called Sanitary Landfill, typically defined as an engineered method of disposing solid wastes on land by spreading the waste in thin layers, compacting it to the smallest practical volume and covering it with soil at the end of each working day. But despite the new terminology, it remained in essence an earth moving operation. In 1970s and 1980s, it was realised that, landfills were causing significant contamination of groundwater. The problem was compounded by the fact that once groundwater becomes contaminated it is exceedingly difficult to remediate. As a result, a number of features like bottom liners made of clays or synthetic materials with impermeable high-density polyethylene were introduced to stop leachate from leaving the landfill. Monitoring of groundwater, surface water, and gas emissions became a routine part of landfill operations. For long, landfills have been a child of convenience and it is now time to develop and implement waste management systems that do not impair our environment, use up valuable resources, or place

limitations on future resources (Recycle Co, 2015).

Composition of Urban Wastes

The study found that there are more waste management problems in urban areas than in rural settings. This is due to the concentrated high population in municipal areas, industrial wastes and high consumption of resources. Urban consists of hazardous substances including cleaning products (acids, alkalis, and solvents), batteries (heavy metals, e.g., lead, nickel, cadmium, and mercury), pharmaceuticals, pesticides and biocides, oils and fats, paints (solvents and fungicides), wood preservatives (e.g., creosote, tributyltin, and copper chrome arsenate), metal food containers (usually coated with Bisphenol A, an endocrine disruptor), and electrical and electronic equipment (e.g., mercury in fluorescent tubes, heavy metals, chlorofluorocarbons, and brominated flame retardants in plastics). While there are numerous studies exploring leachate composition, few studies have looked at contaminant concentrations in solid waste materials (Recycle Co, 2015). Studies of historic waste tend to have examined metals in matrix materials, often focusing on the potential of the sites for 'landfill mining' and therefore overlooking metals contained in other waste materials and potential contaminants that have no recycling value such as organics or asbestos. The magnitude of contamination may pose significant environmental risks to surrounding coastal and estuarine environments; however, there have been few studies determining the potential impact upon sediment quality, and flora and fauna should the waste be released to the coastal zone. The significant variability of contaminant concentrations, and the shortage of data relating to operational periods, waste categories, and material types present in historic landfills, makes the meaningful assessment of the environmental risks of historic landfills challenging (Recycle Co, 2015).

Amount of Wastes produced and Disposal methods

With a sharp increase in the world population and many economies growing, the world is producing more waste than ever. In Europe and the United States our trash is largely invisible once it's tossed; in other parts of the world it is more obvious, in the form of waste dumps, sometimes in the middle of cities (James et al., 2017). Every country has used various waste disposal methods such as dumpsites, landfills, incineration, burning. Dumpsites are a problem because they release methane, a potent greenhouse gas that traps heat in the atmosphere. Burning trash outdoors is also harmful, to the environment and people's health. Landfills and waste dumps are quickly filling up with many of the largest receiving on average 10,000 tons of waste per day

(James et al., 2017). As a country becomes richer, the composition of its waste changes more packaging, electronic components, broken toys and appliances, and relatively less organic material. On average, a person in the United States or Western Europe uses about 220 pounds of plastic per year, according to the World Watch Institute, a research organization.

Waste Management in Kenya

The study found that, 45 per cent of waste goes uncollected in six major towns across the country, a report by the National Environmental Complaints Committee has revealed. Nairobi, Kisumu, Thika, Nakuru, Mombasa and Eldoret towns generate an estimated 6,000 tonnes of waste daily (NEMA, 2017). Kisumu County leads in those with the least effort being made to collect daily generated garbage. Only 20 per cent is collected, according to the report, leaving 80 tonnes uncollected. Nairobi tops the list in active waste collection - 80 per cent of the daily generated garbage is collected. However, 240 tonnes of waste still goes uncollected. 26% of urban community complain of waste uncollected. The report reveals that 24 million plastic bags are used monthly in Kenya, a situation that has constrained county governments financially.

Waste disposal and management is the biggest headache of all times in Kenya. With the increase in urban population, county governments are strained to effectively collect and manage waste. According to a report by Japan International Cooperation Agency (JICA) in 2015, only 33% of the waste produced was collected and dumped at Dandora dumpsite. In most upmarket residential areas, garbage is collected twice a week while in middle income housing estates it is done once. The study has found that, in some urban areas, there is hardly any strategy in waste collections (Sourav, 2015). In the informal settlements, the county government collects garbage from designated dumping areas but most inhabitants opt to throw garbage in nearby rivers, drainages, road-sides and other undesignated areas. This careless, unconcerned attitude in waste disposal presents a tragedy in the waiting. The Nationally Appropriate Mitigation Action (NAMA) on a circular on economy solid waste management approach for urban areas in Kenya, states that poor waste management contributes to emissions of greenhouse gasses globally. With this in mind, Kenya is failing in its role of ensuring that its people live in a clean and healthy environment as envisioned in the constitution. In an attempt to achieve transformation in waste management, a number of entrepreneurs are making their contributions in recycling waste in various sectors ranging from energy, agribusiness, water including solid waste (Sourav, 2015).

The rising tide of garbage is threatening a very fundamental right for every Kenyan to a clean and

healthy environment. It is in this context that the Vision 2030 recognized that efficient and sustainable waste management systems are required as the country develops into a newly industrialized state by 2030. In this regard, the Vision 2030 set flagship projects for the five cities namely; Mombasa, Kisumu, Eldoret, Nakuru and Thika to have fully functional and compliant waste management systems by developing strategies towards achieving sustainable waste management and a clean healthy environment for all. According to the Nairobi City County Solid Management bill 2014, solid waste management means the activities, administrative and operational that are used in the handling, packaging, treatment, conditioning, reducing, recycling, re-use, storage and disposal of solid waste so as to protect the environment against the possible resultant adverse effect. Waste management is one of the agenda under climate change. The Clean Development Mechanism (CDM) and the Joint Implementation (JI) of the Kyoto Protocol have stated that the emission of methane could be reduced significantly by the reduction of waste in landfills. This is with the understanding that emissions from landfills account for up to 5% of the total greenhouse gas emission and 12% of the world's emissions is methane. This goes to show waste management cannot be ignored in the climate change agenda (Sourav, 2015). In the study, it was observed that, Nairobi is currently choking with garbage. A walk down any street will give you a clear picture of the mess the city is in. When the current county government came into power last year, top on their agenda was having a cleaner city. The research has found out that, nearly urban environments are littered with wastes. This means that the National and county governments have not succeeded in enforcing laws regarding waste management. Article 42 of the Kenyan Constitution states that, each person has the right to a clean and healthy environment.

New Development in waste management in Kenya

On 28th August, 2017, the government imposed a ban on all paper bags in Kenya. Five months later, drainages are still clogged polythene bags which remain an eye sore on land and in water. On the other hand the bans on plastic wastes have yielded some good results and a lot of efforts are needed to completely control the waste generation. In the sanitation sector, Sanitation which makes briquettes from human waste is making its contribution in managing waste especially for households that are not connected to sewer lines or using shared latrines. These are some of the start ups in the clean tech space which are making their mark in the improvement and management of solid waste. If the right incentives are provided and the public and private sector works together to maintain proper waste collection and

disposal, the country will have moved in great strides in reducing green house gas emissions and protecting the environment (Sourav, 2015). A clean environment is essential to human health; however, cleaning operations generate waste that can adversely affect human rights if inappropriately disposed. While the poor are responsible for a small fraction of waste generated in the city, they are the greatest burden of effects. Absence of a functional waste management system in Nairobi has resulted in indiscriminate dumping of waste in Dandora, one of the poorest neighbourhoods in the city. Evidence from these neighbourhoods demonstrates that contamination from the dumpsite has adversely affected human health, particularly through respiratory diseases, endocrine complications and cancer. At least half the children in surrounding neighbourhoods have heavy metal concentrations in their blood that exceed the maximum level set by the World Health Organization. Towns which are affected by poor waste management are; Nakuru, Kakamega, Nyeri, Mombasa, Kisumu, Kisii, among others. Despite these risks, between 6,000 and 10,000 people eke a living from on dumpsite, while over 200,000 people have indirect economic and social links to it. Consequently, many around the dumpsite do not want it removed for fear of losing its benefits (Jia et al., 2017).

With each person producing an estimated 600 grams of solid waste daily, at least 850 tonnes are deposited in Dandora Nairobi each day. What was once an abandoned limestone pit is now a mountain of decaying domestic, industrial, medical and agricultural refuse. The waste has polluted the soil, water and air directly affecting more than 200,000 people in surrounding settlements of Korogocho, Babadogo, lucky Summer, and Dandora. These poor communities, while contributing the least to the problem, are bearing the burden of an environmental catastrophe. The most affected are between 6,000 and 10,000 persons who scavenge at the site. These men, women and children, commonly referred to as 'Chokora', brave the dangers of the dumpsite to escape the ravages of extreme poverty. Scavenging involves sorting and recovery of food and recyclable or reusable materials for sale. At least 15,000 tonnes of recoverable waste is produced from the city each day, however, as the city lacks sorting facilities, it is all dumped at the site. Recovery is done manually through laborious processes involving poorly equipped and protected individuals working in small groups. These workers make meagre income at great expense to their health (Jia et al., 2017).

Food Toxicity and Waste Management Systems

The study revealed that, food grown in toxic waste environment of any type if not well handled ends up on a table and finally in human stomach including other

biological species. The plants and animals we feed on feed on toxic waste which becomes part of our meal. This means that, in life cycle dangerous wastes kill lives. Recently, there has been public outcry in Maragua where locals want assurance that Sh1.2 billion landfill to be relocated from Nairobi to Muranga County will present safe environment and will not harm for both human and other biodiversity. The municipal councils in Kenya have found it a challenge in dealing with huge tonnes of waste generated each day. Nairobi city one of the fastest growing urban environment is already facing landfill sites problems. The current sites are already full and there is no space for expansion and this has caused the authority to look for new landfill site away from the city. The residents of Maragua have already voiced that, the National Environment Management Authority release the impact assessment report to help them make a decision on the project (Crystal and Bernhard, 2017). The landfill will be used to treat 500 tonnes of waste from Nairobi, Kajiado, Machakos, Murang'a, and Kiambu counties daily. The residents, said majority of them will only support the project, which will be set up in a 50-acre piece of land, if it is approved by environmental experts.

Studies reveal that Nairobi's waste and recycling communities can become self-sustaining and even profitable, but they need the help of national and local government to introduce effective waste management systems. Improvements in infrastructure and processes are urgently needed to support entrepreneurial waste collection enterprises and reduce the pressures of rural-urban migration (Hardin, 1998). Waste collection has to operate like clockwork or risk cascading into a series of massive disruptions. For example, the breakdown of a single truck can delay collection by a day, not only leading to upset citizens but a ripple effect across the entire management ecosystem. At the same time waste management outfits are under pressure to cut operational costs, so there may simply not be another truck to deploy (20). Yet even if there was an available vehicle, how can operations identify the problem in an actionable time frame, all while managing the disruption over other areas? In some scenarios, such as a worker strike, the delays can become catastrophic, requiring weeks even months to recover all the overflow waste and align schedules back to normal (20). There are three core problems that affect waste management systems: no end to end control processes and information trapped in silos, and an inability to respond and plan in real-time to scenarios.

In recent years a lot of noise has been made around the concept of Smart Cities. Waste management groups cannot be blamed for rolling their eyes when hearing about yet another futuristic 'solution' to a complicated set of challenges. Yet in some cases hype and reality do meet up. By integrating tried and tested waste management solutions with an Enterprise Resource Planning (ERP) culture, the ambition of a real-time, end-

to-end approach to reducing garbage is very attainable. SAP has partnered with waste management company PROLOGA, to address many of the challenges around this industry: from route planning, real-time equipment oversight, staff management and citizen services to meeting regulatory benchmarks and forward-planning through data collection and predictive analytics.

SAP waste management technology solutions have many possibilities that are developing from day to day. Amongst others, they are currently also playing a role in helping manage issues related to infectious disease outbreaks in Africa, such as cholera and Ebola. In another example, the central African nation of Gabon is growing its appeal as a tourism destination by tackling the waste problems of its capital Libreville. The city's inhabitants also quickly cottoned onto the benefits of a cleaner environment, resulting in less littering and proactive beautification of the area (Hardin, 1998).

Smart technologies are slowly expanding into modern urban environments, fuelled by the growth of high speed fibre and mobile networks. Seoul in South Korea is one of several cities trailing smart garbage bins: these will send notifications when they need to be emptied, thus saving unnecessary trips and enabling a proactive approach to waste disposal. The project projects a 20 percent reduction in waste removal trips (Hardin, 1998). Alternatively, waste can simply be shoved into walls, as the Romans did by breaking down pots that imported olive oil from Spain and insulating their homes with the shards. Whatever was left formed massive garbage piles that today are the happy playgrounds of archaeologists. Sadly or fortunately, the nature and scale of today's waste makes that idea impractical.

Future Problems of Landfill

Study discussed that, although landfill can contain most types of municipal solid wastes and one of the most widely used method in the managing of municipal solid wastes in Malaysia, nonetheless, the impacts that brought by landfill is undeniable (Linda and Suzan, 2017). In terms of environmental aspects, landfill can cause pollution towards soil, water and air (Taras Oceanographic Foundation, 2014). Accordingly, the biogas that releases from the landfill site will cause global warming and it is dangerous to human health. In terms of economic aspect, the land depreciation is getting higher as it is nearer to the landfill site. The land value is being impacted by the noise and air pollution generated from the landfill site.

Besides that, the landfill site has caused the surrounding area aesthetically unattractive (Leah Oyake-Ombis, 2017). Also, it is getting tougher in siting a landfill in an urban area as the land is scarce while it requires high cost in acquiring land for landfill (Kadir, 2017). On the other hand, due to the landfill site that is affecting the

visual effect on a landscape and unpleasant smell released from the collected municipal solid wastes, it directly affects the people who stay near to the landfill site (Erica, 2016). It makes the residents over there highly uncomfortable. All these three aspects, namely, environmental, economic and social impacts generated from the landfill site has indeed caused the siting of landfill harder. These three aspects are known as the principle of sustainable and it is important to be evaluated during the urban planning for the siting of a landfill site (Kadir, 2017).

Think Wisely in Handling Waste

Each time you throw something as garbage, think of where it will finally end up. Whether it is a plastic glass, your broken cell phone or the used up battery cells from your portable CD/MP3 player, they all contribute in some way to environmental pollution and are also hazardous to life. Not only are they biodegradable, but also disposing of them has their own risks as they release harmful toxins into the air and surrounding soil and ground water. Apart from solid natural waste, there are other types of man-made wastes that are more hazardous to the environment. Cell phone, for instance is made of lead, mercury and plastic and so many millions of them get thrown as garbage. This kind of electronic garbage creates environmental problems.

Electronic waste is fast becoming a big threat to our environment. Another problem is the fact that disposing of the junk is hazardous. For example, mercury will leach when certain electronic devices, such as circuit breakers are destroyed. Batteries are an environmental hazard. The acid leaches not only into the soil but also goes into the ground water. Disposing of them also creates their own problems as the lead is likely to remain in the ash and be released in the air. As the problem of waste accumulation reaches threatening proportions, a worldwide effort is on to control waste and to manage it. Many countries and individual towns are making an effort in their own way to manage waste.

Future solutions if any

Levels of recycling have improved substantially with the UK now recycling around 45% of household waste and an estimated 59% of commercial and industrial waste. At these levels, the UK is one of the top ten performing countries in Europe. Nearly 14 million tonnes of waste per year is now sent to a multitude of different energy from waste facilities where long term, sustainable energy is produced (Sharifah et al., 2013) (Jeff Rhodes and Mike Thair, Biff, 2017). For 20 years, the U.S. Environmental Protection Agency has required some landfill operators (generally those with larger facilities) to control methane

emissions by installing gas collection systems. To capture it, operators insert vertical wells into the waste and use vacuum pressure to suck up the gas. After capture, the gas can be processed and used in different ways. Because methane is the main component of natural gas, it can be captured and burned for energy with a much lower climate impact than letting it seep out (Jeff and Mike, 2017). Putting a price on Trash policy is one way to get people to produce less garbage and charge them for it. So-called pay-as-you-throw programs in which municipalities bill residents for their garbage have been around for decades but are becoming more widespread. And they work: since beginning a pay-as-you-throw program in 1993, Worcester, Massachusetts, has seen a 53 percent drop in waste, from 43,000 tons a year to 20,000. “It really does change behavior,” says Mark Dancy, the president of Waste Zero, a company that runs similar programs in hundreds of municipalities. “Now that people are aware that trash has a cost, they begin looking for all the alternatives to putting things in a trash can (Erica, 2016).

Technology akin to facial recognition software could further automate sorting by helping machines distinguish, say, a peanut-butter sandwich from a peanut-butter jar and send them along for composting and recycling, respectively (Erica, 2016). It is proposed that, crushing trash and molding it into Tetris-esque blocks that we could use to build islands and skyscrapers. Joachim’s firm has created architectural plans for a 53-story tower made with the waste New Yorkers produce in 24 hours. A group in Guatemala called Pura Vida is already working on a low-tech version of the same idea; it promotes the use of a building material it calls an “eco-block” just a plastic bottle stuffed with trash, that it says makes for excellent insulation and is safe in earthquakes prone areas (Erica, 2016).

Food accounts for about one-fifth of what goes into municipal landfills, and companies are looking for new ways to repurpose what we don’t eat. Some farmers use leftovers to feed their animals, and companies in California and Ireland are turning edible trash into pet food. Better systems to collect and distribute excess food from grocery stores and restaurants could help feed the hungry. Such food recycling is difficult and labor-intensive because it has to be done very quickly, but as droughts challenge agricultural production around the world, it could become more common (Erica, 2016). Food can also be turned into fuel through anaerobic digestion, a natural process during which microbes break down organic matter in the absence of oxygen. Farmers have used this process for years to make biogas out of manure; now new machines can speed things up. Anaerobic-digestion facilities are expensive to build, but they can be profitable if companies have a steady supply of food waste, as they would in the growing number of cities and states that have banned restaurants and grocery stores from sending large amounts of leftovers to

landfills. Someday, businesses could build their own digesters, says Thomas DiStefano, a civil and environmental engineer at Bucknell University (Erica, 2016). Ending trash for good are ways which are being developed. If rocket technologies improve, Staley says, we might one day blast trash into space and use the sun’s heat to burn it. But given that our planet has limited resources, burning them after one use probably isn’t the answer. Some environmentalists want to prevent companies from making non-recyclable materials in the first place, and a few have suggested alternatives (Erica, 2016).

It is well documented and widely accepted that people are causing (possibly irreversible) changes to the conditions of our planet and the natural environment. The increased use of non-renewable resources, including oil, gas and minerals, as well as the continually growing global population, rising levels of affluence and standards of living, are all adding to increased consumption patterns and the degrading of our environment (Alana, 2015).

There is a quote which says; “*We are living as if we have an extra planet at our disposal*” The latest Living Planet Report by the WWF published in 2012, reports that globally, we are all significantly overshooting the planet’s resources by nearly half a planet. That is, at our present rates of production and consumption, we are using the equivalent of 1.5 earths to meet our annual demands. If business as usual continues, trends show that the equivalent of two planets will be needed by 2030. The problem is that we do not have more than one planet at our disposal. We absolutely have to begin living within our means (Alana, 2015). There is still potential ways that can be explored to reduce waste burden or turning waste into good. Finland has successfully converted nearly 99% of its waste generation into clean energy. Economic and social systems depend on the sound environmental health for sustainable development to meet the 17 SDGs. Waste recycling with emerging technology would go a long way in clean up of waste from the environment and will not be a tragedy of the commons as it is at the moment.

RECOMMENDATIONS

1. Strict laws governing the disposal and management of wastes
2. Educating the public on the effects of wastes and environmental health towards sustainable environment.
3. Waste recycling methods in view of reducing the waste built up

CONCLUSION

Waste is an eternal burden on the planet earth and its generation and disposal should be ever concern to

human existence and sustainability of the planet. In developing countries such as Kenya, waste disposal is headache to every institution and cause eye sore to both the local and visiting communities. Waste generation from food consumption to industrial activities need to be addressed without any prejudice, political connections or social stratification. Methods of waste disposals so far employed are many but some of the solutions have side effects regarding environmental health and survival of biodiversity. There is therefore need to develop new technologies and innovations to reduce the burden of waste and manage and conserve nature and the aesthetic conditions of our environment for sustainable development.

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