

Review paper

Waste management; a panacea for unemployment and environmental sustainability in developing countries

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ABSTRACT: A study was carried out to evaluate the quantity and generation rate of solid wastes in developing countries. The result of this review showed an increase at an alarming rate in the quantity and generational rate of solid wastes in these countries over the years with a lack of efficient and modern technology for the management of these wastes. The generation rate and collection and disposal of solid wastes are functions of several factors which if well-considered and appropriated could bring the desired solution to the waste management problems. As concerns grow over climate global warming and other ecological hazards, regulations and environmentalists around the world have intensified their clamp down on irresponsible waste disposal practices. Credit to the ever-improving waste management technologies and innovations because virtually everything is now recyclable – cell phones, computers, plastics, organic wastes, nylon, glass, food waste, furniture, vehicles, green waste, paper, water, wood, metal, clothing, jewelry, among others. Thus this review is aimed at articulating the potent argument why developing countries like Nigeria and Ghana should leverage the vast opportunities that abound in waste management such as recycling which presents great opportunities not just to manage our environment but also to create wealth for the teeming population of unemployed youths and at the same time promoting environmental sustainability.

Keywords: Waste management, wealth creation, environmental sustainability, municipal solid waste, reuse, recycle

INTRODUCTION

Solid wastes could be defined as non-liquid and non-gaseous products of human activities, regarded as being useless. It could take the forms of refuse, garbage, and sludge (Leton and Omotosho, 2004). According to (Miller and Tyller, 2011), solid waste is any unwanted or discarded material that is not liquid or a gas. Miller and Tyller, (2011) stated that in nature, there is essentially no solid waste because the waste of one organism becomes nutrients for the organism. A simple but thoughtful definition of solid waste given by (Oduro-AppiahKwaku, 2011) is all materials arising from human and animal activities that are normally solid and discarded as useless or unwanted. In his examples, he said solid waste generally includes house sweepings, kitchen waste, garden waste, cattle dung and waste from cattle sheds,

Agro-waste, broken glass, metal, waste paper, plastic, cloths, rubber, waste from markets and shopping areas, and hotels. He classified solid waste as biodegradable and non-biodegradable. Biodegradable waste refers to material that is capable of being broken down, usually by bacteria, into basic elements. Most organic waste such as kitchen waste, animal dung, agricultural waste, and paper is biodegradable. Non-biodegradable waste is waste that cannot be decomposed by biological processes and they are of two types, the recyclable and non-recyclable (Amegashie-Viglo, 2014). Recyclable waste refers to waste having economic value but destined for disposal (Amegashie-Viglo, 2014). According to Amegashie-Viglo, (2014) such waste can be recovered and reused along with its energy value. Examples include

paper, plastic, old clothes, etc. The non-biodegradable waste consists of waste that does not have economic value. Examples include tetra packs and carbon paper. Managing wastes generated by others has become serious business and the growing prospect arises mostly from the increasing realization that virtually all manner of wastes can now be 'fixed, refurbished, recycled and reused for same or other purposes' (Sampson, 2014). Municipal waste management has created several multi-billion dollar business empires around the world and is gradually becoming a major global economic sector (Snow and Dickinson, 2011; Onwuka and Udeh, 2015). It is also proving to be a highly elastic industry with room for various categories of players and compelling innovation and technological advancements. Interestingly too, the waste management sector remains a haven for discerning investors.

Due to the indispensability of its services, demand is hardly ever adversely affected by turbulent economic conditions (UNEP, 2011). In the UK for example, at the height of the global economic recession in 2009 when several companies in key sectors declared bankruptcy and got placed under administration, the country's waste management sector recorded about the lowest rate of debts, with less than one percent of its business suffering financial turbulence (Sampson, 2014).

Moreover, municipal waste is ever increasing. In many cases, these wastes are not well managed especially in developing countries, as cities and municipalities cannot cope with the accelerated pace of solid waste production (Veolia Environmental Services, 2006 and Timlett, and Williams, 2009). Indeed, waste collection rates are often lower than 50 percent in low-income countries and more than 70 percent of the collected waste is often disposed of through uncontrolled land-filling and about 15 percent is processed through unsafe and informal recycling (Chalm and Goillotchet, 2009).

Establishing and improving facilities for collection, recycling, treatment, and disposal for MSW management can be very costly. For example, building and operating sanitary landfills and incineration plants require huge investments and incur substantial operation and maintenance costs (Townend, 2010).

It becomes imperative that cities, especially those cities in low-income countries, are encouraged to pursue the paths of integrated solid waste management (ISWM) which places the highest priority on waste prevention, waste reduction, and waste recycling instead of just trying to cope with ever-increasing amounts of waste through treatment and disposal (U.S Environmental Protection Agency, 2010). This paper reviewed how integrated solid waste management could be leveraged to create jobs and at the same time, promote environmental sustainability. Finally, the paper looks at the processes and options that are available in the waste management business for the discerning investors Onwuka and Udeh (2015).

Overview of waste management practices in Nigeria

Conventional waste management focuses largely on waste collection, treatment (composting and incineration), and disposal (landfills) (U.S Environmental Protection Agency, 2010). In most cases, wastes are collected from homes and industries and are either burnt, crushed, buried, or dumped into landfills which are created from quarries, borrow pits, and abandoned mines sites (Chandok, 2010). But these traditional methods have been criticized by environmentalists owing to the adverse impact they have on the physical environment (Smyth *et al.*, 2010). In fact, in all its forms – liquid, solid, gas, wastes are a major nuisance to the ecological environment with highly destructive and damaging impact (U.S Environmental Potential Agency). Waste dumps result in the release of hazardous toxins into water channels and land areas. The decomposing waste releases carbon dioxide and other emissions that are capable of further compounding the problem of climate change and global warming (UNEP, 2011 and Habitat, 2010). Besides, the use of landfills remains highly unsustainable. Meanwhile, in many cities in developing countries, collection rates remain low and the quality of collection services is generally poor (Snow and Dickson 2011 and Tchobanoglous *et al.*, 2006). While there are some successful examples where the private sector and communities are involved in waste management services, in many cities of developing countries, involvement of these segments of society is still very limited (Chandak 2010, and University of Toronto, 2008). The wastes collected typically end up in open dumps, where they may be burnt and some cases are deposited in illegal dumping sites with severe environmental consequences (Smyth *et al.*, 2010 and Habitat, 2010). Effective waste management enhances the wellbeing of the ecological environment and the living organisms that dwell in it. An environment where wastes generated are efficiently disposed enjoys cleanliness which impacts positively on the health of humans and the purity of water channels. It also ensures the preservation of nature and its biodiversity, both flora, and fauna, on land and in water (Tchobanoglous *et al.*, 2006 and Staiskis, 2005). Because of the growing danger that landfills pose to human health and the natural environment, several countries have introduced penalties to discourage the practice (Tudor *et al.*, 2011). For example, in July 2012, Australia introduced a carbon pricing mechanism (CPM). In this regime, the country's largest environmental polluters and operators of open landfills which have net greenhouse gas emissions from flaring or electricity generation exceeding the 25,000-tonne CO₂-e carbon dioxide equivalent threshold are liable. Similar laws apply in several other developed economies, necessitating the growing emphasis on waste minimization, recycling, and reuse (Walker *et al.*, 2014). In several low-income economies, the traditional dumping of wastes on landfills

is still the predominant practice. As the limitations in the traditional methods of waste management become more glaring, countries are making more efforts to evolve waste management practices that are more environmentally friendly, cost-effective, and could convert wastes into 'productive resources' (Walker *et al.*, 2014). Several countries have reviewed their environmental laws to compel more sustainable waste management practices. According to the Australian Environmental Protection Act 2007 (cited in ADB, 2008), for example, all wastes should be managed in the following order of preference: Avoidance, Reuse, Recycle, and Recovery energy, Treatment, Containment, and Disposal. It is a paradigm shift from the conventional waste management practices to Integrated Solid Waste Management (ISWM) which is essential for cities to effectively manage the waste stream (UNEP, 2011).

An effective ISWM system considers how to prevent, recycle, and manage solid waste in ways that most effectively protect human health and the environment (UNEP, 2011; Chalmin and Goilochet, 2009). ISWM involves evaluating local needs and conditions, and then selecting and combining the most appropriate waste management activities for those conditions (Wagner and Arnold, 2008 and Medina, 2008).

As a consequence of conventional waste management practices, many cities in developing countries are facing environmental and health risks as well as losing economic opportunities in terms of resource value of waste (Habitat, 2010; Vallero and Braiser, 2008 and University of Sunshine Coast, 2010). Tones of trillions of wastes are generated around the world daily in the form of leftover foods, construction wastes, industrial wastes, abandoned home appliances, furniture, bottles, glasses, cans and containers, plastics, among several others; and there has to be a sustainable way of taking care of them.

A pragmatic and sustainable way is to institutionalize the practice of creating other useful products out of the former wastes - and this is where recycling becomes the panacea, and for developing countries including Nigeria, this has an additional incentive for creating jobs for millions of unemployed youths (Sampson, 2014).

Factors affecting solid waste generation

Several factors influence solid waste generation in Nigeria. Lack of advanced technology facility for separation at source, the strength of solid waste management policy and enforcement, environmental education and awareness, and income status of individuals among others, are factors affecting solid waste scenario in Nigeria.

The quantity and categories of solid waste generation also vary with socio-economic groups in which the high and middle groups take the lion's share (Sridhar *et al.*, 1985).

Reuse and recycling

There has been an emergence of biodegradable solid waste in the production of organic fertilizer and possible use in the production of biogas. Some researchers have studied the great potentials in Nigeria's municipal solid wastes to produce enormous amount of methane gas. Mixtures of manure and ashes from burning of urban solid wastes have been used for soil amelioration to boost agricultural productions in Jos (Pasquini and Alexander, 2004). Resource from wood wastes alone could meet more than Nigeria's needs in the wood-based raw materials for such industries as potash industry, since African wood species have been studied to have potentials for generating good amount of potash (Adewuyi *et al.*, 2008).

Review of environmental sustainability and sustainable waste management

Environmental sustainability

According to Business Dictionary, Environmental Sustainability is defined as maintaining the factors and practices that contribute to the quality of environment on a long-term basis (Business dictionary). In his Millennium Report of the United Nations in 2001, the then UN Secretary-General Kofi Annan stated that "Environmental sustainability is everybody's challenge, our goal must be to meet the economic needs of the present without compromising the ability of the planet to provide for the needs of future generations" (U.N. Millennium Report). Sustainability according to Miller and Tyller, (2011) is the ability of a specified system to survive and function over a specified time. The researcher identified several types of sustainability which included a sustainable society. To them, a sustainable society manages its economy and population size without exceeding all or part of the planet's ability to absorb environmental insults, replenish its sources and sustain human and other forms of life over a specified period usually hundreds to thousands of years. Further, Miller and Tyler, (2011) emphasized that a sustainable society learns how to live within the carrying capacity; the maximum number of organisms that a local, regional, or global environment can support over a specified period. This capacity depends on the available resource supplied and the ability of the environment to absorb, detoxify or recycle wastes produced by resource use. But the definition given by the United Nation Commission on Economic Development in its 1987 Brundtland report seems to be generally acceptable. In its report titled 'Our Common Future', sustainability is defined as that which "meets the needs of the present without compromising the ability of the future generations to meet their own goals". The UN definition of sustainability which has been criticized by some

scientists, argues that it is often difficult to determine the future needs of the next generation which may be different from the needs of people today. It further added that the developed countries' view of the concept of needs is completely different from the views of that of the developing countries. However, even though the UN definition of sustainability may have raised some controversies, it still covers the two fundamental issues; the pressing problem of environmental degradation that results from economic growth and the need for such growth to lighten poverty in the society. Further, despite all these criticisms, there is a general consensus that the rate of environmental degradation is increasing very fast. The rate of transformation of the earth is very rapid especially in the developing countries that are currently undergoing industrialization. Consumption of living resources as raw material and sinks for waste materials is high and growing. To maintain a balance between the environment, economy and man has become the pressing goal that is facing the communities, enterprise organizations, government and the world at large, so the way forward is for both developing and developed nations to work towards a sustainable environment. The opportunity in waste management is a global one, with great potential to provide a twin solution to environmental sustainability and wealth creation. Yet these huge opportunities are hardly fully harnessed. Much of the potential benefits in waste recycling are simply wasting away, not only in developing and low income economies but also in the most advanced economies. Valuable resources are being buried, potential economic benefits are being lost, jobs in the waste management sector are not being created, and human health and the environment suffer. This same paradox is true for several economies outside the EU where the huge wealth beneath the heaps of wastes littering landfills is yet to be determined and explored (Sampson, 2010). This is particularly pathetic for low income economies where heaps of wastes litter the streets unattended, and where millions of youths, skilled and unskilled, roam the streets daily in search of means of sustainable livelihood. UNEP (2010) observed above that by ignoring these heaps and failing to see and explore the business opportunities in them, 'valuable resources are being buried, potential economic benefits are being lost, jobs in the waste management sector are not being created, and human health and the environment suffer'. Government agencies in charge of waste management and the environment should begin to look beyond merely identifying or creating landfills to dump the tones of wastes generated daily into. Their job should include mapping out strategies on how to convert this huge dung into wealth for the poor and jobs for the unemployed. It is quite encouraging that several developing African economies including Nigeria, Cote d'Ivoire, Ghana, Kenya, among others have huge potential, and in fact declared a state of emergency in their agricultural sector. To complement this, perhaps, it

is also high time to create a booming industry out of waste management, since like food; the demand for waste management would forever remain potent (Sampson, 2014). For several low income economies, the potential in waste management as an economic empowerment resource remains almost completely untapped. The wealth beneath the dung is yet to be discovered both at the public and private sector levels (Sampson, 2014). While aspiring entrepreneurs must begin to look this way for business opportunities that have little or no entry barriers and with little or no start off cost, governments and indeed non-profit organizations could also alleviate poverty and the rising unemployment situation by supporting the setting up of waste management businesses at individual and communal levels (Chandak, 2010). This would not only help clean up the environment but also create wealth for the millions of desperate youths in need of means of livelihood. For the millions of job seekers out there looking to start off small scale businesses, opportunities exists in waste recycling at little or no start off cost – collection, sorting, sales and recycling of diverse waste materials including glasses, metals, plastic wastes, cell phones and several others.

Sustainable waste management

The conventional approach of solid waste management has been to manage the removal of solid discards from the immediate vicinity of human settlements. This resulted in the mechanized systems of collection and transportation of waste in the industrialized countries and landfills to bury waste. The waste management has to change its focus from "efficient removal" to waste avoidance, minimization and recycling options with higher priority. Municipal solid waste contains organic waste, plastics, papers, glass, metal and inert substance. Carbon and nitrogen-based organic waste from kitchen, market and abattoir is a source of rich organic manure or energy. Plastics, papers, glass and metals are recycled into new products. Debris can be recycled and earth and inert waste used as landfill cover, this helps in conserving natural resources and also generates employment. Promotion of waste recycling sector and providing that with an institutional support can therefore be in tune with the goals of sustainable development. The key sustainability principles that need to be applied to waste management can be taken from Natural Capitalism that is radical resource productivity and Bio-mimicry. Bio-mimicry refers to lessons learnt from nature; in this case the fact is that in nature, nothing is wasted. The waste from one process becomes raw material for another in continuous closed cycles. In human terms this can be achieved through recycling and composting. Oduroa-Apiah Kwaku, (2010) indicated that the hierarchy ranks waste management operations according to their

environmental or energy benefits hence the purpose of the hierarchy is to make waste management practices as environmentally sound as possible. Any interpretation of the waste hierarchy must also take into consideration broader environmental, social and economic impacts. According to (Oduro-Apiah Kwaku, 2010) source reduction tops the hierarchy because of its potential to reduce system costs, prevent pollution, consume resources and increases efficiency. Basic activities that can be adopted to encourage reuse practices include: reuse of bottles and glasses mostly disposable ones, rent, borrow and share items that are needed only on occasions, repair and maintain durable products. Establishing a waste management plan deeply rooted and accepted at the local authorities and among the inhabitants is seen as the most critical step in Integrated Solid Waste Management. The waste management plan should also consider non-technical aspects such social and environmental effects of waste management and also set the road for how waste management should be improved in the future (Lindel, 2012). An integrated approach to Sustainable Waste Management can deliver both environmental and economic sustainability. Integrated Solid Waste Management (ISWM) is a comprehensive waste prevention, recycling, composting and disposal programme. An effective ISWM system considers how to prevent, recycle and manage solid waste in ways that most effectively protect human health and the environment. ISWM involves evaluating local needs and conditions, and then selecting and combining the most appropriate waste management activities for those conditions (Oduro-Apiah Kwaku, 2010). Environmental sustainability and sustainable waste management share some common features. Both concepts focus on the judicious usage of the earth's resources by humans taking into consideration the future generation and the sink role the environment plays by absorbing generated waste. However, the reality on the ground is that rapid population growth, technological advancement and modern ways of production and distribution are not in tune with the concepts of environmental sustainability of which sustainable waste management is a part. Developed countries of the 20th century are increasingly discovering that their material wealth and technological advancements are submerging them in a volume of wastes that threaten both their environments and their established way of life (Getis *et al.*, 1988).

Job prospect in waste management

In delving into waste management business, a major first step would include identifying the wastes of interest, the likely markets, demand trends, existing recycling plants in the vicinity and how much the recyclers offer per tonne for the materials (Sampson, 2014). It is also important to

get information on existing competition and relevant government policies and regulations regarding the business (Chalmin and Gailloch, 2009). Equally important is the need to identify where the desired waste materials could be sourced. This would usually include households, companies, construction sites, supermarkets, restaurants, hotels, bars, parks, schools, stadia and sports centers, among others. These waste materials are usually collected free and at times the owners of the waste might even be willing to pay a token to have it taken off them. Once collected, the wastes could be sorted by type, colour, content etc, to enhance their value per kilo or tone and their attractiveness to recyclers. Though regulations in several countries mandate recycling centres to collect any volume of wastes on offer from certified operators, the higher the loads of wastes in tonnage, the easier it is to get a market and good price for them (Medina, 2008). For a standard sized waste management business, operational costs would usually include salaries and wages, taxes and fees, equipment, transportation, storage space and rental expenses, utilities and energy, advertising and promotion. If the start off plan is to collect wastes and send to recycling centre in exchange for cash, far less fund is required beyond buying wastes collection bins and transporting the collected items to the designated collection centres. For several low income economies where the waste sector is still highly underdeveloped, little or no regulatory barriers exist to inhibit new entrants (Sampson, 2010 and Modak, 2010). It is also interesting to note that several websites exist that are willing to buy off certain types of solid wastes without any form of physical contact with the waste collectors. Good examples are old cell phones which could attract as much as \$50 per phone, and for which some online buyers are willing to pay the shipping costs for specified quantities (Sinha, 2010). For developing economies where cell phone recycling centres barely exist, and where managing wasted cell phones constitutes a big headache, this creates a potential gold mine for interested collectors. For small businesses that may want to venture into actual recycling, several small sized, low priced waste processors exist which they could leverage as their start off recycling tools. The example of Waste Management Inc., Republic Services Inc., Veolia Environmental Services, among other highly successful waste management companies around the world, have demonstrated the huge business opportunities that waste management portends for big and small entrepreneurs (Veolia Environmental Services, 2006; Modak, 2010 and Sinha, 2010). With waste management, there is something for everyone to do, at individual and institutional levels, depending on available resources.

Options

According to Sampson, (2014) there are several options

for a would-be waste manager. These include:

Pickup option

From the small business perspective, a waste management company could provide just this service – collecting recyclable wastes from individuals, communities and institutions and sending them to recycling centres in exchange for cash. In Sweden and several other developed countries, individuals earn meaningful income from collecting trashed glasses, plastic bottles, tins and several other containers and selling them to designated collection centres. This practice is now institutionalized in most developed countries. To encourage this practice, some countries subsidize recycling programmes from deposits paid on beverage containers.

Rentals

Some waste management businesses also focus on rental services, renting and leasing out waste management equipment and facilities such as dumpsters, drums for small wastes and trucks for bulk wastes. There are also special pick up equipment for the collection of hazardous wastes. Such rental services could be rendered to individuals, businesses, communities, among others.

Manufacturing

Waste management businesses exist that manufacture basic and sophisticated waste management tools, including waste disposal bags, waste bins, roll-off plastic containers, among others. For the medium to large companies, other waste management facilities up for manufacturing include trucks, dumpsters, waste processors and diverse types of recycling plants.

Recycling

Another option for waste management companies is the setting up of recycling facilities where collected wastes are converted into new products. Depending on the size of the company and the waste management facilities on ground, types of waste that could be collected and recycled are green wastes such as cuttings from homes and community gardens, which include leaves, tree limbs and stumps. Others are bulk wastes including heavy items like furniture, mattresses, engine parts, which are today easily recyclable. Organic wastes, including food and other decomposable items; construction and demolition wastes which are wastes resulting from

construction of housing and other infrastructural projects, including unwanted concrete, asphalt, sand, bricks, tiles, etc are also regarded as recycled wastes. Also recyclable are hazardous wastes which include chemicals such as paints, pesticides, ignitable materials and motor oil that have outlived their usefulness. Hazardous wastes are highly harmful to the ecological environment and human health and are therefore disposed and recycled with utmost care and expertise. In most countries, management of hazardous wastes is guided by strict regulations and guidelines (Eurostat, 2010). For potential or existing business owners, opportunities exist in all of these areas of wastes management and more, depending on available capital, facilities and expertise. As concerns grow over climate global warming and other ecological hazards, regulations and environmentalists around the world have intensified their clamp down on irresponsible waste disposal practices. Reuse and recycling of waste materials have become the preferred options. Credit to ever improving waste management technologies and innovations, virtually everything is now recyclable – cell phones, computers, plastics, organic wastes, nylon, glass, food waste, furniture, vehicles, green waste, paper, water, wood, metal, construction wastes, clothing, jewelries, household electronic appliances, etc (Vallero and Braisier, 2008). These have created great business opportunities for discerning entrepreneurs. This is even more so for developing and low income economies where waste management potentials remain largely untapped. Added to this is the fact that waste management creates an endless opportunity that would last for as long as humanity. For potential or existing business owners, opportunities exist in all of these areas of wastes management and more, depending on available capital, facilities and expertise.

Conclusion and Recommendation

The world is developing rapidly. Individuals, communities, industries keep using up more sophisticated items, both biodegradable and non-biodegradable. These items, solid, liquid, gas, or in which ever form they come, must be properly managed once they outlive their usefulness. Credit to ever improving waste management technologies and innovations, virtually everything is now recyclable – cell phones, computers, plastics, organic wastes, nylon, glass, food waste, furniture, vehicles, green waste, paper, water, wood, metal, construction wastes, clothing, jewelries, household electronic appliances, among others. Reuse and recycling of waste materials have become the preferred options. For potential or existing business owners, opportunities exist in all of these areas of wastes management and more, depending on available capital, facilities and expertise. Effective waste management such as recycling presents great opportunities not just to manage our environment better

but also to create wealth for the world's growing teeming unemployed youth in developing countries like Nigeria.

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