

An Evaluation of waste management in Botswana: Achievements and Challenges

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Abstract: This paper examines some of the developments in waste management that are taking place in Botswana based on government documentation and other relevant work on the subject. It explores the main achievements the country has made and highlights on some of the challenges of waste management in the country. Botswana has experienced increased waste generation due to increased population that outweighs the country's capacity to deal with increased volumes of waste and the situation has been worsened by lack of adequate financial, technical, technological, and human resources to deal with the problem. There have been a number of recent developments that show that waste disposal is headed in the right direction and that there is the will to bring about a well regulated, well operated waste management industry in Botswana. The current achievements could serve as a model of what can be achieved by a developing country that sets out to improve the quality of life of its citizens by controlling and adequately disposing of its waste. It is suggested that environmental education be prioritized, national database on the volumes of wastes generated in the country be built and environmental legislation be strengthened. [Journal of American Science 2010;6(9):144-150]. (ISSN: 1545-1003).

Keywords: Botswana, waste management, achievement, challenges, population, legislation, education

1. Introduction

Modification of the environment and increase in population are the main causes of the many processes of deterioration which have altered the ecosystem of our planet, including the generation of waste. There is a growing problem of solid waste management with the development of industry and the expansion of cities of many countries in the world. Wilson (2006) describes waste as 'anything which is no longer useful and needs to be got rid of. Waste is material discarded, used up or left over in the course of industrial, commercial, domestic or other activities.

Indiscriminate dumping of 'waste' and widespread littering have become serious environmental problems in Botswana in recent years (Gould, 1995). It is apparent that municipalities are facing major problems with managing domestic and industrial solid waste. A report by Central Statistics Office (CSO, 1998) office has indicated that in Botswana, 10 000 tons of waste are generated every day. This amount is far greater than the country's collection systems to dispose. Consequently, waste generation and management are one of the major problems the government of Botswana is facing.

Over the past few years, Botswana has witnessed an increase in the consumption rate due to the rapidly increasing economy. According to CSO (1998), Botswana's population has increased by 5% in the past 5 years. The majority of the population is concentrated in urban areas and major. This

population, according to the documentation, has exerted tremendous pressure on the country's waste management systems. The implication is that as the population increases, consumption rates increase and so does waste generation. At the moment, the amount of solid waste generation is far greater than the capacity of the country to support its proper disposal. This has great potential for compromising environmental quality. A study by Kgati and Bolaane (2001) showed that environmental quality has deteriorated due to improper solid waste collection and disposal methods used in Botswana. While the government of Botswana has put a greater effort in providing adequate protection of health and the environment, it is also true that serious gaps remain in the achievement of long-term sustainability of various waste management practices. Economic realities and environmental ideals sometimes clash in waste management. Public attitudes toward wastes and the waste management industry are often problematic, and political pressures for change are never far from the surface. The objective of this study was to make a comprehensive review of the state of solid waste generation and management in Botswana, stating the major trends and emerging issues. The major achievements and constraints are also presented.

1.1 Increasing population growth

Botswana is a semi-arid country with an approximate surface area of 576 000 square kilometers and an estimated population of 1.7 million. Botswana has a small but rapidly growing population which has more than doubled in size in twenty five years. Population growth is estimated at 1.94% per annum (CIA World Factbook, 2010, Figure 1). Between 1971 and 1996, the population increased from 584,644 to 1,495,993. This population is however expected to decrease slowly, averaging about 2.5% per year during the next decade, a rate at which the population will double within 30 years (CSO, 1987; Ibid 1991, Ibid 2001). Consequently, Botswana's population is beginning to recognize that population growth leads to a shortage of resources and facilities and has resulted in increased waste generation and mismanagement in the country.

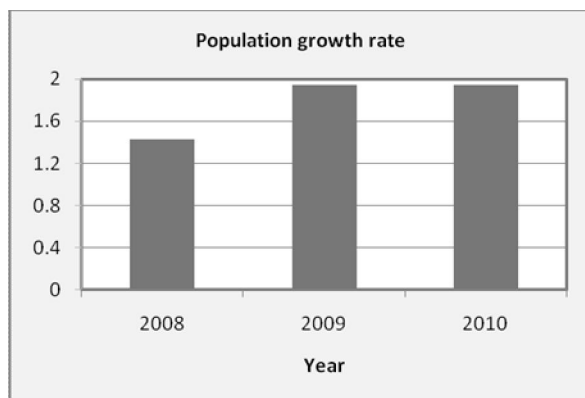


Figure 1: Botswana population growth rate

Botswana's growing economy and population create a rising demand for goods and services provided by businesses, industries and Government. The main drivers of waste generation in Botswana are also closed linked with economic growth, urban consolidation, household formation trends (fewer people in more dwellings), under-provision of garden waste and other recycling services, and community attitudes (Kgati and Bolaane, 2001). The country's consumption patterns tend to be linear: more natural resources are consumed to make products or provide services and waste is generated as an end result. Economic Commission for Africa (1996) reported that the high consumption rates in Botswana have resulted in the country being one of the largest producers of solid waste in Africa. Table 1 shows the different types of wastes generated in Botswana and the quantities generated. Among the various kinds of waste, municipal solid waste is the mostly generated type of waste. Most of the waste is generated in the big

settlements that are densely populated such as Gaborone, Lobatse, Francistown and Maun.

Table 1: Estimates of Botswana's annual waste quantities

Waste type	Quantity
Selected solid waste (tonnes/yr)	
Solid waste at landfill	270,425
Solid hazardous waste	1,560
Hazardous clinical waste	2,500
Scrap metal waste	20,000
Household waste	250,000
Miscellaneous waste	
Liquid hazardous waste (000m3)	34,610
Tires (number)	90,651
Household dry cell batteries (number)	24,000
Lead acid batteries (number)	46,000
Oil waste (000 liters annually)	5,600

Source: CSO (2000, Table 17.1)

1.2 Waste Characteristics

Solid wastes include domestic or household waste, human wastes such as night soils, ashes from incinerators, septic tank sludge and sludge from sewage treatment plants, commercial and industrial waste, hazardous waste, hospital waste, street sweepings, demolition and construction debris, and excavation waste. Other types of wastes include human wastes such as night soils, ashes from incinerators, septic tank sludge and sludge from sewage treatment plants, commercial and industrial waste, hazardous waste, hospital waste, street sweepings, demolition and construction debris, and excavation waste. The consumption of canned food generates 6500 tones of the metal wastes each year. Beverage cans account for 90% of all cans consumed in the country. Batteries wastes are also increasing with the number of vehicles. Very little is known about the amount of hazardous and municipal waste in the country, and the quantities indicated may not provide reliable estimates (National Conservation Strategy Agency, 2002).

The majority of solid waste in Botswana is sent to landfill depots for disposal – an expensive and traditional approach. The rate at which the country is sending waste to landfill is increasing and the greatest waste generators are urban areas (indicated in Table 2) due to increased consumerism and high population densities concentrated in these areas.

Hazardous wastes, including radioactive wastes, which pose a risk to human health and the environment, require special handling and disposal. The rate at which these waste are produced is also increasing at an alarming rate. There is a growing evidence of illegal shipment of hazardous waste across international borders and Botswana is no exception for potentially becoming a dump site. There is no information on the effect of hazardous waste in Botswana. However some studies, e.g. (National Conservation Strategy Agency, 2002; Gwebu, 2003) have revealed likely environmental problems, e.g. infection caused by deficient disposal method of hospital waste; contamination of water due to chemical wastes and pollution of underground water resulting from waste oils.

Table 2: Mean per capita waste generation by locality

	Waste disposed (m ³ /person/year)	Waste disposed (kg/person/year)
Urban	2.32	1.32
Rural	0.36	0.2

Source: CSO (2000, Table 17.2)

1.3 Inadequate waste management and implications for the environment

Inadequate waste management, in general, and the uncontrolled disposal of wastes, in particular, were identified by Segosebe and Vander Post (1991) and Bolaane and Kgati (2001) as core problems in the sustainable protection of environmental quality in Botswana. Waste collection facilities are inadequate and often limited to urban upper income residential neighborhoods. Waste that is not collected is usually dumped and burned in the open, thus releasing CO and CO². Solid waste in rural areas, low-income urban neighborhoods, and countrywide medical waste are disposed of by inefficient incineration methods (CSO, 2000). This leads to increased CO and CO² emissions into the environment.

It is also difficult to estimate the quantity of health care waste generated in the country. Concern has been raised over unsatisfactory storage of waste and the improper handling by staff who often lack proper training on waste handling. Some clinical waste is burned, sharp containers are incinerated or burnt and some are sent to the landfills. Mercury from broken thermometers is collected and returned to hospitals, while some are incinerated at clinic level creating emissions of dangerous mercury. Most hospitals attempt to segregate waste. Failure to segregate waste means clinical waste end up at landfills (National Conservation Strategy Agency,

2001). Mercury from broken thermometers is collected and returned to hospitals, while some are incinerated at clinic level creating emissions of dangerous mercury.

Waste from tyres is durable and non-biodegradable and therefore cannot be easily destroyed by nature. Tyres traps air which makes it difficult to compact them in landfills. Tyres are made up of materials that produce large quantities of black acid when burnt. Tyres are a breeding place for mosquitoes because of their shape which has an ability to capture and store water. It is projected that in 2005 there would be 147 400 registered vehicles in Gaborone. Approximately 832 600 tyres will be required for all these vehicles. Out of this number 306 00 will go to scrap (Maburutse, 2009).

Batteries waste is increasing with the number of vehicles. Almost all battery waste ends up at the landfill sites if not disposed of indiscriminately. They pose a danger if disposed off in this manner because they release toxic substances such as cadmium, nickel, mercury, manganese, lithium, silver, zinc and ammonium chloride. Water resources are likely to be contaminated from such substances. Most of the waste generated in Botswana is disposed at landfills. Some landfill researchers and operators have pointed to weaknesses in the effectiveness of landfills to sustainably manage solid waste, and have proposed improvements in landfills. Open dumping and unsupervised incineration of organic waste occurs in the villages and in low-income urban neighborhoods (Gwebu, 2003). Additional waste volume may pose additional risk when the waste generated exceeds the capacity of the landfill. For instance, if a rural community's 100 ton per day landfill is proposed to expand to accept 4,000 tons per day, Botswana should offset this risk by requiring the added safety factor of an engineered liner with leachate collection system.

1.4 Collection, transportation, recovery, incineration and landfilling

The current waste management situation characterized by the inability of local authorities to collect all the waste generated. Nationally, it is estimated that only 40% of the generated waste is collected for disposal (Segosebe and Vander Post 1991). Waste collection and transportation is limited by inadequate equipment, personnel and financial resources facing all local authorities. Hazardous waste and healthcare waste is mostly incinerated. However, some of them find their way into dumpsites where they get mixed with municipal waste (CSO, 2000).

1.5 Status of Waste Recycling

Available evidence reveals that there are no recycling plans in Botswana. Most of local recycling companies are only involved in collection of recycling materials, which are later exported to other countries, including South Africa and Zimbabwe. The major recycling programme includes collection of metal scraps from motor vehicles, metal scraps from beverage and preserved cans, and waste paper. Collection of scrap metals from motor vehicles, beverage and preserved cans and waste paper appears to have been running for more than 20 years. The success that collections of beverage and preserved cans, and metal scraps from vehicles have attained appears to be relatively better when compared to the collection of waste paper.

In Botswana, waste from construction and demolition is not recycled. A relatively high proportion is illegal dumped in the outskirts of the cities and towns as also observed by (Gwebu, 2003). The recycling of waste paper, unlike the recycling of cans and metal scraps from motor vehicles, have not been receiving positive support. The total amount of recyclable materials removed from municipal solid waste stream at Gaborone landfill site during September 2002, alone was approximately 53 tonnes (Urrio and Brent, 2006). This suggests that if waste management authorities could comply with the required recycling plans and develop proper guidance notes on removal of recyclable materials at landfill sites, the approach could boost the development of recycling industry on a large-scale in Botswana.

2 Recent Achievements and Progress in Waste Disposal

Botswana has several initiatives which are a result of a comprehensive solid waste project that have been undertaken coming from a background where the country had no proper deliberately planned sanitation policies to regulate and guide the disposing and reticulation of waste. There have been a number of recent developments that show that waste disposal is headed in the right direction and that there is the will to bring about a well regulated, well operated waste management industry. Stakeholder participation in waste reduction and prevention in Botswana is an emphasized strategy in sustainable waste management. Participation mandates all stakeholders be part of all efforts in waste management. Involvement is made by the Government, NGO's, Private Sector and the Community.

2.1 National Waste Management Strategy

Botswana Waste Management Strategy (BWMS) was formulated in 1998 by the Department of Waste Management, which is a Government

Department, in order to facilitate and coordinate waste management issues in the country as well as consolidate the initial achievements by relevant stakeholders in the waste management industry. Its main objectives are to minimize and reduce waste in industry, commerce and private households, maximize environmentally sound waste reuse/recycling and promote an environmentally sound waste collection, treatment and disposal.

Progress has been made in waste management policies and strategies, for instance, Waste Management Bill was drafted and was approved by Parliament after internal consultations and Technical Guidelines for waste disposal by landfill have been developed, discussed; and have been consolidated into a final document which is yet to be sanctioned (Maburutse, 2009). Through the National Waste Management Project and Strategy, a number of studies were commissioned from 1996 onwards to evaluate the current waste situation in various sectors and to develop guidelines for improving the status quo. The waste streams that have been addressed include scrap metal, oil containing wastes, medical waste, packaging wastes, industrial wastes, and tyre and battery wastes (Gwebu 2003; Urrio and Brent, 2006). In addition, Botswana is a signatory to the Basel Convention that regulates transboundary movement of hazardous waste and their disposal. All movement of waste through the country is subject to the controls laid down in this convention. The Basel Convention is incorporated in to the country's Waste Management Act of 1998.

2.2 Medical Waste Management Plan

In response to inadequate management and disposal of medical waste in hospitals, clinics, and private practices, a Medical Waste Management Plan has been drawn up and is being finalized. A Code of Practice for Medical Waste has also been produced. It is proposed that the two documents will be one of the requirements for Medical Practitioners to be licensed in Botswana. The Department of Sanitation and Waste Management has undertaken pilot studies aimed at ensuring acceptable medical waste management of wastes. The establishment of medical waste incinerators is also being vigorously pursued to reduce risk of infection resulting from poor disposal of medical waste according to the (National Conservation Strategy Agency, 2001).

The increasing usage of radioactive equipments in the country prompted the Government of Botswana to construct a facility for interim storage of disused or orphan radioactive sources to properly manage and control radioactive waste with effect from 2009 in Selibe Phikwe. The lifespan of the facility will be 50 years. The facility will store

radioactive materials / equipment until when there is no more radiation being generated and can be disposed of safely in a landfill. The National Conservation Strategy Conservation Agency (2001) reported that before the construction of this storage interim, an environmental impact assessment will be carried for the identification and evaluation of the environmental effects which will be caused by the temporary radioactive waste storage facility. Once the storage facility is in operation, groundwater monitoring will be carried out on a regular basis to prevent or minimize radioactive contaminant concentrations in the groundwater.

2.3 Involvement of NGO's

There are a number of NGOs working in the area of Waste Management. National Conservation Strategy Agency report (2003) has cited NGO's such as Somarelang Tikologo, Kalahari Conservation Society and Environmental Heritage Foundation as major partakers in ensuring waste reduction and management. Recently the major oil importing companies like SHELL and Environmental Systems have organized themselves in an undertaking to collect used oil from all over the country. According to the report, tanks are now provided at key sites such as filling stations and other easily accessible sites for all those needing to dispose of waste oil.

2.4 Involvement of the Private Sector

Kgalagadi Breweries and Kgalagadi Beverages packs are cans and returnable bottles for beer and soft Drinks; KBL does not recycle but it reuses bottles (National Conservation Strategy 2003). The bottles that are broken during bottling process are taken to the neighboring South Africa for recycling. Coca-Cola Company also encourages a deposit scheme to encourage the return of bottles. In order to manage metal wastes, Scrapcor (Pty) Ltd in Gaborone buys all sorts of metal scrap in large quantities from big companies and Parastatals like Botswana Power Corporation and Botswana Defence Force as well as from private individuals (National Conservation Strategy, 2003). The involvement of the Private Sector in partnership with local communities in solid waste management activities has created employment and job opportunities to a substantial number of jobless city residents, many of whom were previously-unemployed women and youths. Gradually this experience is being built up, and can be passed on between countries.

Livestock is mainly sold to Botswana Meat Commission (BMC) in Lobatse Township. BMC operates a tannery that produces waste water. The tannery waste water is led into a series of evaporation ponds where after it is pumped into a plot that was

previously used for irrigation. Ultimately the effluent seeps into the heavily polluted Peleng River which most of the year is filled up with water from BMC. The evaporation residue from the evaporation ponds, a white crust or powder is easily displaced by the wind. Cattle are often treated with pesticides for pests such as ticks. Organophosphates and synthetic pyrethroids like Deltramethrin and Cypermethrin are used. There are two major ways of treating cattle with pesticides in Botswana. One is to use partly buried tubs filled with water and pesticides where the cattle are driven through. This method holds the greatest potential for causing environmental problems because water can seep into the ground causing soil and water pollution.

Another method is that pesticides can be applied locally on individual cattle by spraying. This reduces the amount used as only affected areas are treated and pollution of soil and groundwater can be expected to be less serious as it is much localized. The BMC has adopted this method with less environmental effects (National Conservation Strategy, 2003).

2.5 Involvement of the Community

Through community programs such Clean Up Botswana, volunteers are involved in anti-litter strategies. Clean Up Botswana is an important service provider in the areas of litter abatement, water quality, waste and recycling and environmental awareness education. Clean Up Botswana is Botswana's litter management watchdog, maintaining a leading role in analyzing and researching the impact of litter pollution and consumer waste disposal behavior. At the national level, Clean Up Botswana has a mission to inspire and work with all citizens to clean up, fix up and conserve the environment, through events and projects such as Clean Up Botswana Day, Clean Up the World, and the Fix Up, Youth and Business programs.

In 2002 Botswana had a total of 493 sites for the Clean Up Botswana Day over the three campaign days. Clean Up Botswana report that there has been an increase in volunteers in Clean Up Botswana Days from 1998 to 2002 (Bolaane and Kgati, 2001). Community participation in recycling is increasing as a result of the recycling services provided by Local Governments as part of 'kerbside' weekly waste collection. Some level of recycling also occurs in the industrial and commercial sectors; however, these efforts must be increased. In an effort to end our dependency on landfill, Botswana is now moving towards developing improved strategies for waste minimization and waste avoidance and the cleaner operation of businesses and industries.

3. Current and Future Challenges

A number of challenges have inhibited waste management efforts made by Botswana. Currently, Botswana does not have a National Database on volumes of waste generated in the country. The status of waste is derived from studies undertaken by the NSCA, Department of Sanitation and Waste Management (DSWM) in conjunction with the German Technical Co-operation Organization (GTZ). The National Conservation Strategy Agency report (1994) has identified the uncontrolled disposal of wastes as the main threat to sustainable protection of water resources in Botswana. Without preventive measures and tight controls, high risks of water pollution of both ground water and surface water are possible which might lead to deterioration of drinking water quality and pose a severe threat to public health.

The main challenge for the future is to ensure a balance between economic growth environmental conservation, and the rate of population growth. Only 38% of the 250,000 tons of household waste produced in Botswana annually are actually delivered to disposal sites (Urio and Brent, 2006; Maburutse 2009). In the larger villages, 60% of residents have their refuse collected by the local authority compared to only 70% in rural villages. The use of economic instruments such as the implementation of polluter pays principles in waste management has not yet matured. The failure to manage waste properly has also been exacerbated by the lack of adequate financial, technical, technological, and human resources to deal with the problem (Gwebu, 2003).

4. Conclusions

This paper highlighted some of the challenges of waste management system in Botswana and explored the achievements made due to the role played by different stakeholders for waste reduction and prevention. Increased waste generation and improper management are in part due to increased population that outweighs the country's capacity to deal with increased volumes of waste, and also due to lack of adequate financial, technical, technological, and human resources to deal with the problem. It is important to enhance the integration and coordination among different concerned parties and the responsibilities of the various agencies involved should be clearly defined to eliminate confusion and effort duplication. The partners should be drawn from Central Government, local authorities, NGOs, the community and industry. There are still some setbacks and gaps to be filled but the problem of waste control and disposal is well on the way to proper control in Botswana.

5. Recommendations

Finally, in view of the importance of waste reduction and prevention to the national economy of Botswana, this study recommends that environmental education be continued for citizen sensitization on waste prevention and management, reliable database on the quantities of solid waste disposed and recycled are necessary be built in order to conduct state and municipal waste management planning, assure future disposal capacity and provide citizens with a measure of the success of local efforts to recycle and reduce waste as well as strengthen legislation that can bind individuals to adopt the sustainable environmental management strategies. It is important to mount a strong public awareness campaign on the impact of different types of wastes on human health so as to increase community participation and positive attitude and knowledge on the quantity, type and toxicity of hazardous waste and their environmentally sound management.

The current waste management experience demonstrates that formal organizations alone cannot deal adequately with the increasing volumes and complexity and diversity of urban wastes. To address the waste management challenges of the country through sustained waste recycling, re-use and composting programs, a partnership approach needs an appropriate framework, which clearly lays out responsibilities of each party for effective waste management. This is calling for the development of Integrated Waste Management Systems in urban centres of Botswana.

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References

1. Central Statistics Office. Population census-Preliminary results. Government Printer Gaborone, 1991.
2. Central Statistics Office. Population and housing census Results. Government Printer Gaborone, 2001.
3. Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ). Guidelines for the

- disposal of waste by landfill. Botswana National Conservation Strategy. Government printer, Gaborone, 1997.
4. Economic Commission for Africa. Urban Environment and Health in ECA Member States, United Nations, Addis Ababa, 1996.
 5. Gould, J.E.; M.A. Humme and R.L. Senior. Proceedings of Workshop on "Waste" Recycling. Somarelang Tikologo, Gaborone, Botswana, 1995.
 6. Gwebu, TD. Population, Development, and Waste Management in Botswana: Conceptual and Policy Implications for Climate Change. *Environmental Management* 2003;31(3):348–354.
 7. Kgathi, D.L., Bolaane, B. Instruments for sustainable solid waste management in Botswana. *Waste Management & Research* 2001;19: 342-353.
 8. Maburutse , R. *Business Diary*, 2010.
 9. National Conservation Strategy Agency. Botswana's Strategy for Waste Management. Government Printer, Gaborone, 1998.
 10. National Conservation Strategy Agency. Instruments for Sustainable solid waste management in Botswana, 2001.
 11. Segosebe, E and Van der Post, C. Urban Industrial Pollution waste in Botswana, 1991.
 12. Urio, A. F. and Brent, A.C. Solid waste management strategy in Botswana: The reduction of construction waste. *Journal of Civil Engineering* 2006: 48 (2):18-22.
 13. Wilson, D.C.; Velis, C.; Cheeseman, C. Role of Informal Sector recycling in waste management in developing countries. *Habitat International* 2006: 30:797-808.
 14. *World Factbook* 2010.

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