Characteristics, threats and opportunities of landfill scavenging: The case of Gaborone-Botswana

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Key words: Botswana, landfilling, waste management, scavenging

Abstract

In Gaborone, as in other large cities in the developing world, individuals try to make a living by engaging in novel occupations such as landfill scavenging. This paper reports on a research conducted in the Gaborone landfill, the largest in Botswana. The study content-analyzed available literature from other countries. It also relied mainly on direct field observations. The discussions on and answers to closed and interview schedules by stakeholders, affected- and- interested – persons, provided the information on the threats and opportunities related to the landfill site and its informal management activities. This on-going case study lends credence to the potential of scavenging in sustaining livelihoods among those who cannot secure employment in the formal urban market. Scavenging tends to be useful although it may hazardous to the informal entrepreneurs. Taking all the threats into consideration, the decommissioning and closure of the landfill seems inevitable, in spite of the apparent short-term livelihood opportunities it provides to the informal sector.

Introduction

Botswana is usually regarded as a model for economic development in Africa. However, like most developing countries, it faces the challenges of uplifting the welfare of its population. Currently, unemployment among the economically active population is above 20 percent and over 30 percent of the population lives below the poverty datum line. The government cannot confront and solve these problems on its own, through formal employment creation. Therefore, it has put into place several programmes in order to support self employment. However, the inadequacy of these commendable efforts has led some individuals to venture into novel occupations such as landfill scavenging. The activities of this sub-sector have not been widely documented in this country, apart from the sensational and unsystematic castigations, from the mass media. This paper intends to fill the gap in our understanding of the attributes and dynamics of this sub-sector in Gaborone, the capital city of Botswana, where the country's largest landfill is located.

After this introduction, the theoretical and conceptual bases of multi-circuit typologies of the urban economies in the developing countries are discussed. The intention is to highlight the strong inter-connectedness, between the formal and informal sectors of the urban economy, that has been confirmed by studies from other developing countries. Scavenging and the waste management hierarchy are then considered. This is because in Botswana, as in most other countries in Africa, the landfill scavengers are regarded as a shameful nuisance and continue to receive negative media coverage and stereotyping. Rarely is it appreciated that landfill scavenging is a vital component of a viable waste management strategy.

The methods that were used to carry out the research are then outlined. Because the study is intended to capture the everyday living aspect of the scavengers, including how they perceive their livelihoods, health conditions and personal profiles, a combination of methods such as qualitative, quantitative and archival types were employed.

The discussion of the methodology is followed by a description of the location and population growth trends in the study area. Gaborone is the fastest growing city in sub-Saharan Africa. As a result, the problems of over-urbanization could be more acute here than elsewhere. This poses a challenge to the achievement of the goals of sustainable urbanization. This case study therefore presents an interesting illustration of how this emerging city is attempting to achieve those goals through sustainable employment creation and waste management.

Finally, an analytical report of the findings and concluding remarks are presented. This takes the form evaluating the viability of landfill scavenging in Gaborone including examining the probable scenarios should the landfill be forced to close.

Theoretical and conceptual framework

The following section reviews a range of seminal theoretical debates on linkages that exist between the formal and informal sectors of the urban economy, in the developing world, before focusing on scavenging as a waste management strategy.

The economic circuits of the urban economy

Some of the earliest investigations on the theoretical conceptualization of the constituents of urban economies in developing countries have emphasized that the city should not be studied as a monolithic and homogeneous economic entity, but should be thought of as consistent of two economic sub-systems, namely the "upper " or "modern circuit" and the "lower circuit" (Santos, 1979). These two circuits have reciprocal functional associations, apart from those relations with society and their surroundings. Urban life is conditioned by the dynamics of each circuit, yet each circuit maintains a discreet relationship with urban space. The upper circuit is the direct result of technological progress and its most representative elements are the corporate monopolies. Most of its relations take place outside the city and its surrounding area and operate within the national or international framework. The lower circuit consists of small-scale activities and is almost exclusively for the poor. Unlike the upper circuit, the lower circuit is well-entrenched in the city and enjoys privileged relations with its environment.

Several studies have explored the relationship between the formal and informal sectors within the urban economies of Southern Africa. Simon has contended that the debate on the nature of such bonds has rested more on theoretical or philosophical positions rather than empirical research (1981). He has confirmed the existence of strong linkages between formal and informal enterprises in Windhoek-Namibia and concluded that such bonds have not been exploitative (1984). In Harare-Zimbabwe, Tevera's study revealed that scavenging makes the scavengers "piece workers" since they receive a "piece wage" from the formal sector recyling companies that pay them a weekly wage (Tevera, 1993). The association between the formal and informal sectors has also been explored in South Africa. There, research has highlighted the dominant–subordinate interactions by underscoring the fact that the informal sector should be conceptualized as a form of production and reproduction, with considerable stratification and discordant social relations, dependant upon, integrated with and subordinate to the capitalist mode of production (Wellings and Sutcliffe, 1984). Wellings and Sutcliffe have expressed skepticism about the reformist perspectives which fail to appreciate the asymmetric relationship between the formal and informal sectors. Their conclusion is that since the informal sector operates in spaces that are created and controlled by the formal capitalist mode of production, the opportunities for its autonomous development are severely limited.

The World Bank has also recently reported on the activities of waste pickers in Africa, Latin America, the Caribbean, East Asia and the Pacific (Johannessen and Boyer, 1999). The report noted that negative impacts of scavenging have been reduced in certain metropolitan centres by formalizing their work, either by employing them directly or by engaging contractors to do their work. The linkage between the formal and informal sectors has also been consistently confirmed by studies conducted by the ILO (1998, 1999), Hall and Pfeiffer (2000, p. 73), and Montgomery (2003).

Technological modernization in urban sub-Saharan Africa creates only a limited number of jobs, given the capital intensity of formal industrial production. Furthermore, much of the resulting indirect employment is either generated in metropolitan countries or for expatriates working locally. Formal industry is becoming increasingly incapable of meeting an increasing local need for increased employment. Botswana has a narrow industrial base. The constraints to expansion include a small population of 1.7 million, competition from South Africa, lower labour productivity and relatively expensive utility costs. The mining sector, which accounts for over 80% of export revenue earnings, has high capital to labour ratios. The agricultural sector has been declining over the years because of periodic droughts and unremunerative commodity prices in that sector.

In Africa, urban informal employment is estimated to absorb 61% of the urban labour force. This sector was expected to generate more than 93% of all additional jobs in the region in the 1990s (ILO Key Indicators of the Labour Market, 1999). UN-HABITAT (2003, p. 103) quotes a figure from the *Economist* which claimed that informal sector activities typically added between 20% and 30% to African GDPs in 1993. Africa Environment Outlook claims that opportunities for income generation through recycling in the informal sector are gaining recognition (http://www.grida.no/aeo). Tevera notes that scavenging, should be viewed, as representing a survival response, by the urban poor, to lack of employment opportunities, a strategy that is preferred to begging in the street or stealing (Tevera, 1993 p. 95). He remarks that the number of scavengers is likely to increase as the unemployment situation worsens in Zimbabwe.

The preceding views have provided a range of perspectives on the linkages between the formal and informal sectors of the urban economy in sub-Saharan Africa. Of significance to this paper is the important role of the informal sector in providing a source of living for the urban poor, through its linkages with the formal sector. A very useful way of illustrating the relationship of the economic activities of the informal sector with the other sectors of the urban economy is through backward and forward linkages characterized by either single origins and destinations, single origins and multiple destinations or multiple origins and single destinations

(Hurst, 1972; Matewere, 1988). In each case, the origin is the supplier of the good or service and the destination is the consumer. The specific sectoral relationships are discussed later in the paper under industrial linkage effects of items that are collected from the landfill.

Landfill scavenging, is one activity that falls within the lower circuit; how it interacts with the modern circuit and how it contributes to the welfare of the informal entrepreneurs, will be the focus of the paper.

Scavenging as a waste management strategy

Waste management is the systematic control of all unwanted byproducts of human activities. The internationally accepted conceptual framework for such control takes the form of the following sequence:

Waste reduction → Reuse/recycle
→ Treatment Safe → Landfill disposal

The first process of the conceptualization involves minimizing waste output from industrial, commercial and domestic sources, reuse of some of the collected waste products after their primary use, and recycling/remanufacturing items from waste. Hazardous waste must be treated to eliminate its toxicity and harmfulness before disposal. Finally, no-recyclable and/or unusable waste has to be disposed of in a non-hazardous environmentally friendly manner. Solid waste may be disposed of through landfilling. In Botswana the Waste Management Act and Strategy and Landfill Guidelines underline the importance of landfilling. Landfill scavenging, as part of an urban waste management strategy system, saves resources by retrieving and reusing and recycling them. It also protects the environment.

Over the past few years, several city authorities have moved from what can be conceptualized as ''waste management'' to that of "resource recognition" as they attempt to incorporate social and environmental goals into their solid waste management systems. In that context, they acknowledge that those individuals previously regarded as scavengers and pickers are in fact recyclers and reclaimers who need to be incorporated into city-wide waste management systems, in ways which benefit them and the city environment (Margarita, 1992; UNCHS, 1994). This points to the possibilities for further developing the contribution of waste pickers towards a clean and resource-efficient city while also improving the returns that scavengers receive from this work and addressing the health problems which accompany their work.

Scavenging is the act of searching through and retrieving discarded items that other people do not want. Waste picking has acted as a response to widespread poverty, unemployment and lack of social security services (Baud and Schenk, 1994, Huysman, 1994). Several studies in Asian cities have focused on the social aspects of landfill scavenging and also analyzed scavenging as a traditional mode of production (Sicular, 1981 and Furedy, 1990).

Furedy has described the web of economic interactions by which Asian cities have extensive "waste economies" structured through itinerant waste buyers, waste pickers, small waste shops, second hand markets, dealers, transporters and a range of recycling industries (Furedy, 1994). Salvaging does not therefore only supply the local cottage industry with raw material, it also contributes to the creation of a multitude of small jobs which enable the many who are excluded from the modern economy to make a living. The refuse bins of the rich, because they contain the most treasures, entice even the municipal collectors who hang sacks on their lorries so as to put aside any marketable items. Thus everything that has a marketable value is siphoned off in the process of waste removal and elimination.

Scavengers collect different products from the landfill, which they either sell or use to create new marketable products. Large numbers of waste pickers (scavengers) may scour the landfills for materials of economic or personal value. The returns from the sale of these materials go to the waste pickers, and not to the agency operating the facility. The income derived from such products is used to meet basic domestic requirements such as food, housing, clothing, water and electricity (Waas, 1991). Case studies by the Economic Commission for Africa highlight a similar trend for North African cities (1996). This survey will examine the uses to which the recovered materials are made by the entrepreneurs at the Gaborone landfill.

Research methodology

In Gaborone, landfill scavenging and its linked economic activities, sustains the livelihoods of the urban poor. Scavenging however poses certain threats to those involved in such an enterprise. The research design of the study had three parts that have been outlined in greater detail in a recent survey by Rankokwane (2003). First, a total of 25 scavengers at the Gaborone landfill were interviewed over a two month period in 2003. Additional interviews, involving mainly technical officers, was also conducted in 2005.

Scavengers tend to have a spasmodic "work schedule" and generally shy away from unfamiliar strangers prying into their business. However, since most of the scavengers engage in the same activity, the sample provided sufficiently representative material for this part of the analysis, because responses to key questions were becoming more repetitive.

In order to obtain a more complete and balanced perspective, the researchers also interviewed three councilors, two chiefs (*dikgosi*), and Social Workers from adjacent low income neighbourhoods. The Director of the Department of Sanitation and Waste Management, and the Department of Health and Sanitation at the Gaborone City Council were also interviewed.

Documents related to the topic of study from the University of Botswana library and other national libraries of the National Conservation Strategy Agency, environmental NGOs and Gaborone City Council, the internet and the Department of Sanitation and Waste Management were consulted. Formal sector entrepreneurs were asked about the use to which they put the materials obtained from scavengers.

The information from secondary sources was content-analyzed. The raw data were processed using Excel software and provided graphics, tables and descriptive statistics for analysis. Personal observations and responses to open-ended interviews were organized into themes and were used to complement survey research results.

Location and population growth trends of Gaborone

Gaborone is located in the southeastern part of Botswana. The latest results from the census on Population and Housing show that this is the most densely populated and yet rapidly growing part of the country (CSO 2003). Table 1 shows the population growth trends of Gaborone and its satellite communities over the last two decades.

The absolute growth figures show that the Gaborone city system has experienced phenomenal growth over the last 20 years. For comparative purposes, Table 2 expresses the absolute figures as intercensal growth rates.

The high growth rates are due to urbanization which has been fuelled by rural–urban migration. However, such rapid growth has not been accompanied by commensurate increases in formal sector employment opportunities. This has led to the growth of informal sector employment, including landfill scavenging.

Location and operation of the landfill

The Gaborone landfill, see Figure 1, constructed in 1993, was located a few metres away from the Gaborone dam, on the then outskirts of the capital city Gaborone, whose total *de facto* population is now 186 000 (CSO, 2001).

The Gaborone landfill resembles most such structures in the rest of Africa the majority of which are open dumps (The International Source Book on Environmentally Sound Technologies for Municipal Solid Waste Management 1996). These facilities are initially located at the perimeter of major urban centers in open lots, wetland areas, or next to surface water sources. Thus landfill siting is generally based on considerations of access to collection vehicles rather than hydrological or public health considerations. Although many municipalities have statutory requirements for the construction and maintenance of landfills, they are generally not enforced. In most instances, the landfills are owned and operated by the same public agency that is charged with enforcing the minimum standards. Most of these facilities are neither lined nor fenced. Management operations are minimal. Operating practice generally does not include compaction or the application of daily cover.

Table 1. Population trends of Gaborone and its satellites 1981–2001

Area	1981	1991	2001
Gaborone	59 700	133 500	186 000
Gaborone Satellites	80 889	141 297	247 100
Total	140 589	274 797	433 100

(*Source:* Population and Housing Census Dissemination Seminar, 2001)

Table 2. Intercensal percentage growth

Area	1981–1991	1991–2001	1981–2001
Gaborone	123.6	39.3	211.5
Gaborone Satellites	74.7	74.9	205.5
Total	95.5	57.6	208.1

(*Source:* Derived from Population and Housing Census Dissemination Seminar, 2001).

Often, a lack of financial and human resources, coupled with absent enabling policies, limit the extent to which landfills can be built, operated and maintained at minimum standards of sanitary practice (Phatshwe undated). This may reflect the absence of appropriate equipment or supportive regulative instruments to carry out these practices (Kgathi and Bolaane, 2001; Ntana, 2001).

Because of the rapid spatial expansion of the Gaborone built-up area, the landfill is now being engulfed by urban commercial development. Also because of voluminous discharge of domestic waste due to increasing disposable incomes covering material, and rubble from the booming construction industry, the landfill is rapidly reaching its maximum potential capacity.

Figure 2 illustrates the spatial organization of the Gaborone landfill.

The landfill is partitioned into five zones. At the main entrance are the administration offices. This is where all the records and files on the operations of the landfill and related activities are kept. The other zones are for: the disposal of waste food: trees, wooden materials and construction rubble; tyres; and metal products, respectively. However, because of the magnitude of waste received at the landfill, poor management and shortage of space, these zones are no longer clearly defined. As a result, it is possible to find an admixture of different items in one zone of the landfill.

The fence that had been erected around the landfill has since disintegrated. This makes it difficult for its proper management resulting in animals such as goats, cows and donkeys from some satellite communities gaining easy entrance into the landfill. Also, any scavenging person can gain entry through ungazetted points.

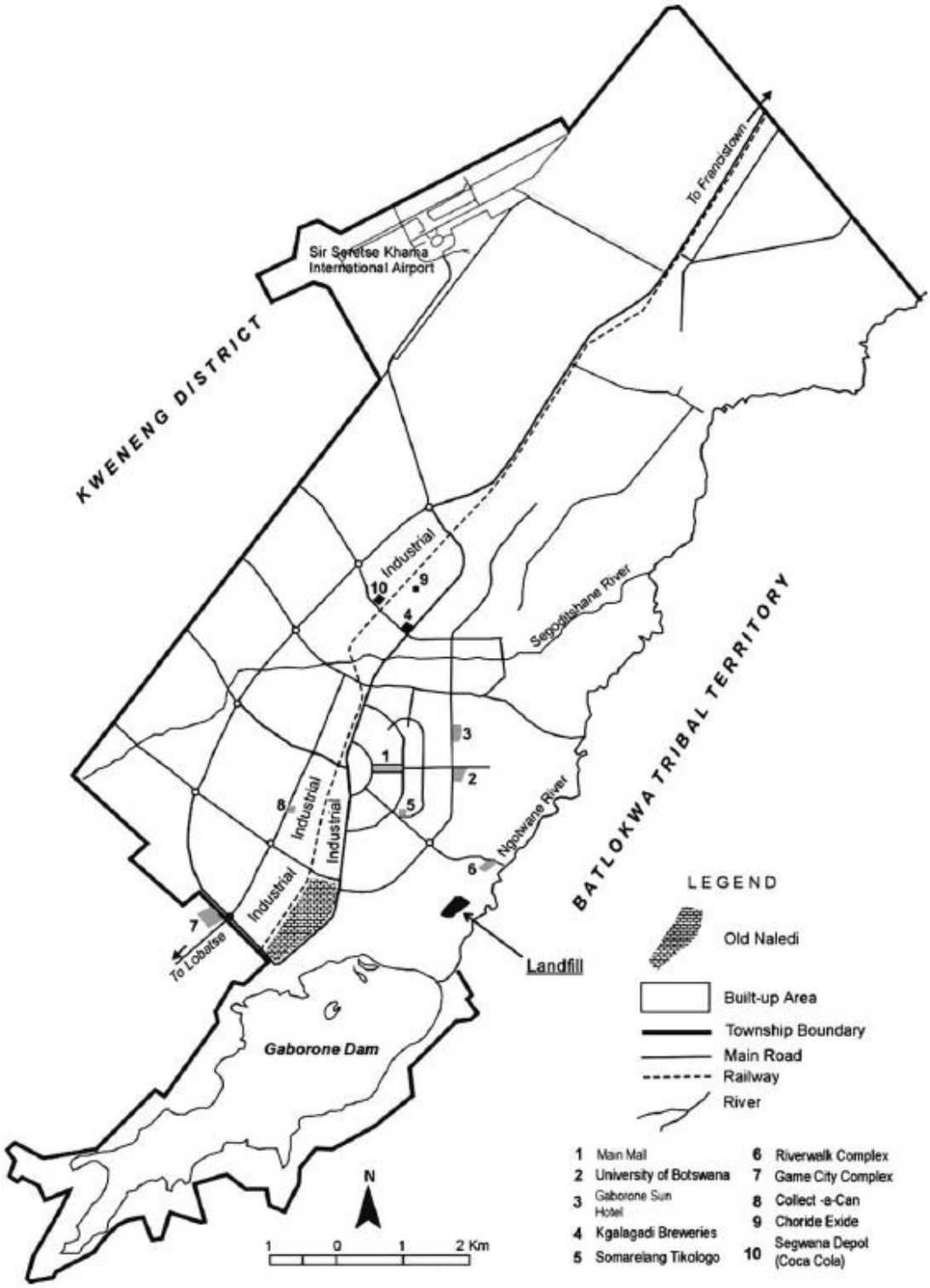
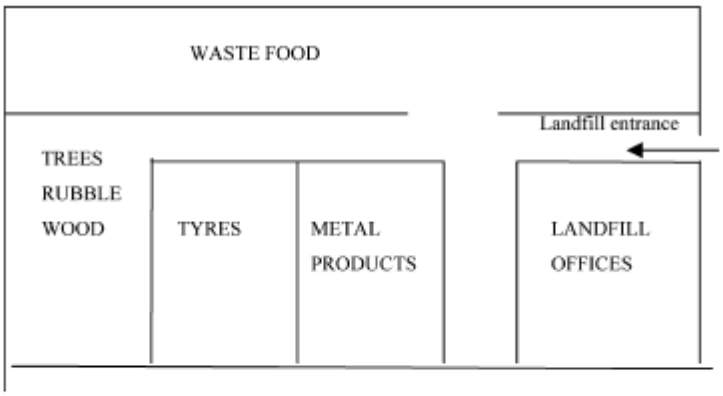


Figure 1. Location of Gaborone landfill.



Source: Rankokwane, 2003

Figure 2. The spatial organization of the Gaborone landfill (Source: Rankokwane 2003).

Major sources and types of waste

There are different types of activities taking place in and around Gaborone. These range from residential, economic and industrial uses. It is from these that the waste originates. The types of waste generated include demolition and construction rubble, metal scraps, scrap tyres, bottles, plastics, paper, cardboard and other miscellaneous items.

Gaborone has the usual facilities of any modern capital city, small though it may be by world standards. The city boasts of international hotels, which include the Gaborone Sun, President Hotel, and the Grand Palm and Cresta Hotel. There are several shopping complexes around the city, which include Broadhurst Mall, Game City Mall, and the Riverwalk Mall. These boast of clothing shops, restaurants, services and supplies. These are complemented by a variety of Neighbourhood Centres, Large General Dealers and Small General Dealers. These generate waste in the form of plastic, bottles, paper, metal cans, metal strips and waste food.

There are three cinemas, a university campus, primary and secondary schools, a national museum with outstanding exhibits, a national stadium, the bus and train termini and, 16 km away from the center of the city, is the Sir Seretse Khama International Airport. All these uses generate large volumes waste in the form of plastics, paper and waste food.

Over the past two decades, the population of Gaborone has been growing at an unprecedented rate, as shown in Table 2. With the increasing population, the city's solid waste problem is becoming more and more serious because of the increasing volumes of refuse and the limited space where it can be disposed of. The increasing population and affluence, together with the demand for consumer goods, has led to more waste being generated from households in Gaborone. The usual practice is to collect these unwanted products, along with the rest of the stream, and co-dispose them at the same open dump for regular management. Considering the increasing total number of households in Gaborone, it is reasonable to speculate that the amount of waste generated by households has, correspondingly, been increasing. The main types of household waste generated include organic waste, paper, plastic, cans and cloth.

Economic development, driven by industrial technology, steadily raises living standards. Mass production stimulates mass consumption. People soon 'learn' to need the expanding array of goods that their society produces. The industrial areas consist of units which handle food, beverages, textiles, wood products, glass, metals and rubber products. They process raw materials and are generally regarded as the greatest generators of waste because they are involved with large scale manufacturing of goods. The problems created by the increasing volume of refuse as a result of the increasing population concentration in the city are becoming so serious that existing waste management practices cannot cope with them (Phatshwe undated; Gwebu 2003c, 2003d).

The industrial, commercial and residential areas generate large amounts of wastes, which are deposited at the Gaborone landfill, which is expected to close prematurely because of the magnitude of the waste disposed from metropolitan Gaborone.

Scavenging and scavengers

Botswana has been experiencing phenomenal of rural-urban migration, as more and more people have been moving from rural areas to urban areas in search of better employment opportunities (Gwebu, 2003a, 2003b). Formal unemployment in Gaborone exceeds 30%. The likelihood of this increasing remains high due to retrenchments from the public sector, which is the main urban employer; low foreign direct investment (FDI) due to low labour productivity, high utility costs and; threats to import substituting enterprises from

cheaper and better quality goods from South Africa. Agriculture is also witnessing a decline in manpower due to periodic droughts and mechanization and the unremunerative nature of the enterprise due to low commodity prices.

Once the prospects of formal employment fade away, some of the rural–urban migrants begin to resort to informal means of survival such as scavenging from the Gaborone landfill which acts as a source of food and income from waste products such as paper, plastics, cardboard, leather, and discarded furniture. These items are used to manufacture new products, which are later sold either to the public or to recycling companies. Households and the commercial sector outlets particularly stores, restaurants, markets and service stations generate food waste.

The main activities at the landfill, observed from two months fieldwork in 2003, mentioned earlier, involve the daily delivery of waste by trucks from the Gaborone City Council, private companies and individuals. It is at the main gate that private companies and individuals are directed towards the appropriate unloading zone, depending on the type of consignment. The Gaborone City Council permits and encourages recycling efforts at the landfill, for some designated materials, through scavenging. There are two forms of scavenging at the landfill namely; general scavenging, otherwise known as illegal scavenging, and legal scavenging. Illegal scavengers are those individuals who have not been granted permission by the Gaborone City Council to collect materials at the landfill. Legal scavengers on the other hand are those who have been granted the permission to pick items from the landfill. City Council has granted permits to 16 aluminum can collectors, 10 waste paper retrievers, 3 tyre collectors and 1 scrap metal recoverer[1]. From the observations made at the landfill, there are more illegal scavengers than their legal counterparts. On a typical day, when the weather is dry and no police officers are around to patrol the area and restore order, there may be between 100 and 150 scavengers[2]. The fact that some of the waste may not have been separated accordingly, often makes it difficult for proper management.

Once the waste has been piled, a caterpillar levels the surface so that vehicles can move in and around with minimal disturbance. This also serves as a strategy to prevent the scavengers from picking waste that may be harmful to them. However, these scavengers normally finish picking whatever they want by the time the bulldozer starts its work. Today the landfill is more that brimful and the fact that it does not provide a contoured access makes it difficult for vehicles to approach, unload their content or to compact it.

Socio-demographic characteristics of the entrepreneurs

The findings of our 2003 survey on 25 scavengers show that most entrepreneurs are from the adjacent high density low income neighbourhoods such as Old Naledi, shown in Figure 1. About 10 m away from the landfill, on the Southeastern side, are the transient housing structures for the scavengers who earn their living solely from the landfill. The structures have been constructed from the discarded materials collected from the landfill which include wooden planks, cardboards and metal strips.

Age

Scavengers are mostly youthful with 16 of them (64%) within the 15–24 age category. The youth are mostly school dropouts and leavers engaged in self-help activities or supplementing household incomes. The rest consists of 25–39 year olds who have been unsuccessful in their quest for other types of employment. This is the category within which most rural–urban migrants and transnational movers from the neighbouring politically volatile and economically depressed Zimbabwe are found. Two of the illegal scavengers were from Zimbabwe. Since all these people have no other means of earning a living, they resort to scavenging which, at least, assures them of some form of employment to which they have no access either in the modern sector or their country of origin.

Gender of respondents

Twenty of the respondents (80%) were males while the rest were females. The gender disparity between males and females can be attributed to the Tswana traditional roles that stereotype males to be breadwinners. However, with the gradual erosion of the traditional ascribed roles of males, some women have come to assume the position of being breadwinners, hence the participation of women in scavenging at the landfill. The gender disparity can also be attributed to scavenging as a gender-biased and risky career into which males mainly may venture.

Marital status of respondents

Thirteen of the scavengers (52%) are single, 11 are either married or cohabiting (44%) and only 1 is widowed. The 48% of scavengers (who include the widowed, married and cohabiting) use the Gaborone landfill, as a means of sustaining other family members, be it children, parents or their potential wives, in the case of cohabitation. Single males do not only support themselves but other members of the extended family.

Highest education level attained by respondents

None of the respondents were completely uneducated. Six of them (24%) had completed Standard 1–7, 11 of them (44%) had Junior Certificate, 3 had 'O' and 'A' levels and 8 or 8% had diplomas. Two of those that had attained a diploma level of education were from

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neighbouring Zimbabwe. These results show that although most of the scavengers at the Gaborone landfill have basic numeracy and literacy they do not have the economic means of either pursuing further education or of earning a living apart from scavenging. Since most of the locals have low levels of education, it is very difficult for them to access some of the government programmes such as Citizen Entrepreneurial Development Agency (CEDA), Small, Medium and Micro Enterprise (SMME) and the Financial Assistance Policy that have been aimed at empowering the citizens of Botswana economically eventually alleviate poverty in the country.

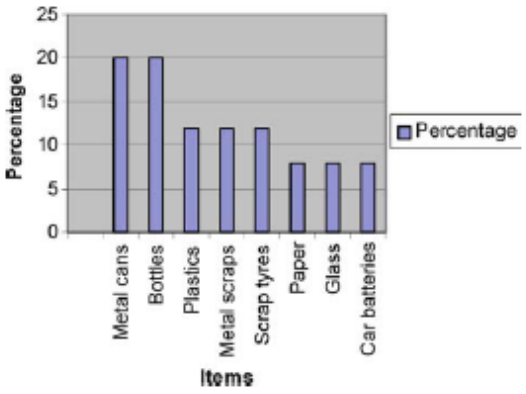

Figure 4. Marketed items (Source: Rankokwane 2003).

Perceived opportunities from the landfill

There are a number of items that the scavengers collect from the landfill and these include immediate direct use and marketable commodities. The total direct use items which are salvaged and reserved for immediate household subsistence consumption, in terms of their relative importance, are illustrated in Figure 3.

Clothing materials such as worn-out shirts, trousers, dresses and shoes are mended and worn by scavengers or their dependents. Waste food is mainly collected for consumption by scavengers, though some may be sold to the communities of Old Naledi and Bontleng. Waste food varies from discarded ready-made food such as cooked and/or canned food to raw food such as cattle, sheep and goat carcasses. Cardboard, wooden planks and wire are used to set up or repair housing structures for the scavengers. Marketed items are shown in Figure 4 in order of perceived importance.

Some buying and selling of the recovered items occurs between small scale scavengers and large scale ones at the landfill. However, most of these items are traded with clients who are mostly the formal sector enterprises. The functional inter-relationships involved are discussed in detail below.

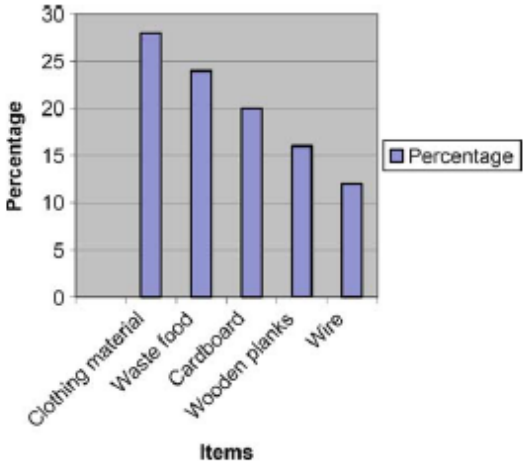

Figure 3. Direct items salvaged (Source: Rankokwane 2003).

Industrial linkage effects of items collected from the landfill

The items collected from the landfill have substantial utility and exchange value to both the scavengers, the local entrepreneurs and ultimately the society at large. Unfortunately, scavengers do not maintain any records on quantities of collected commodities or financial revenues that accrue from their transactions. However, the following estimates of income, shown in Table 3, derived from the sale of items, underscored the financial contribution of scavenging to the household economy.

Zimbabweans retrieve tyres for sale to donkey cart manufacturers and retreaders in their country. A monthly turnover of P3 500 (US$ 700) is estimated from such sales. The field research findings of linkages between scavenging and the formal sector are discussed in the following paragraphs.

Metal scrap

The most prevalent type of metal scrap collected at the Gaborone landfill is cans. These are purchased from the scavengers to be recycled into new metals by the formal sector firms. Can waste is mainly sourced from two types of packaging material, namely, beverage cans and preserve cans. Beverage cans dominate this group of

Table 3. Estimates of quantities and price of selected recovered items

Item	Est. Quantity Collected/day	Selling price (P)	Total (P)
Copper wire	30 kg	6/kg	180
Aluminum strip	40 kg	2.5/kg	100
Scrap metal	30 kg	0.25/kg	7.5
I litre glass bottles	100	1 ea	100
Total			387.5
1$ US = P5			

(*Source:* Fieldwork 31/05/2005)

waste. Scavengers who collect cans from the Gaborone landfill sell them to liquor restaurants, bars and bottle stores. These three recipients stockpile the can waste which is later collected by Pako Phetle, T M Makuku and WIZZCAN recycling companies that subsequently sell them to Collect-a-Can Company, through Somarelang Tikologo, an environmental NGO.

These can scraps are availed the best recovery and recycling system in Botswana. A South-African-based company called 'Collect-A-Can' is leading in an effort of recovering and recycling can scraps. The priority of 'Collect-A-Can' is to collect beverage cans because of their intrinsic value and also due to their relatively higher contribution to litter than other household cans.

The other recovered metal scraps are sold to De Bruins, Alman metals and Power metals recycling companies. However, for the sake of sustainable business operation, these companies also collect metal scraps from auto repair garages in order to increase quantities.

Waste paper

The predominant type, by weight, of paper waste is packaging material. Scavengers collect waste paper from the landfill and sell it to the three companies that specialize in the recycling of paper. These are Boswa Recycling Company, Botswana Tissue and Pyramid Holdings. However, in addition to the paper that is picked at the landfill by scavengers, these companies also collect additional paper waste from local institutions such as schools, the University of Botswana and shopping complexes to boost their volumes for sustainable recycling.

Waste plastic

Scavengers collect waste plastic from the Gaborone landfill and sell it to FRK Trading, Tiles-Tapes and Adhesives Botswana and Alman Metals Recycling Companies. Some of the types of plastic products made by the recycling companies include:

Polyethylene Terephthalate, a type of plastic which is highly transparent and can be used for manufacturing bottles, containers, bakery trays, plastic strapping clothing and carpets.

High density Polyethylene plastics are strongly coloured or white, non-transparent and non-translucent. They are remanufactured into buckets, bottles, containers, toys, fuel tanks, pipes, bins, bags, crates and motor oil containers.

Polyvinyl Chloride (PVC) plastics have high clarity, do not crack when bent sharply and stop burning when the flame is taken away. Rigid PVC (PVC-U) is harder. It is used in the manufacture of liquid and oil containers, clear trays for food, pipes, credit cards, medical products, pliable materials, cable insulation, irrigation pipes, shower curtains and rain gutters.

Low density Polyethylene plastic is soft, transparent and slightly milky coloured. This is the most easily recyclable of the different types of plastics. It is manufactured into packaging film, bags, squeeze bottles, toys and pipes, shrink-wrap, and thin plastic bags.

Polypropylene is transparent and translucent and does not crack when sharply bent. It is manufactured into plastic screw caps, dairy product containers, plastic cups and cutlery, chairs, kitchenware, candy wrappers and woven plastic sacks, plastic forks, ice cream and margarine containers, fizzy drink bottle caps, autoparts, carpets and industrial fibres. Due to the high demand for plastic products, the recycling firms also rely on alternative suppliers to supplement what they purchase from the scavengers.

Glass waste

Currently Somarelang Tikologo, an environmental NGO, is the only organization in the country that specializes in the recycling of glass. This therefore implies that the scavengers can pick up glass material from the landfill and sell it directly to Somarelang Tikologo.

Bottles

These are normally 1 l and 250 ml bottles for fizzy drinks. As in the case with metal cans, scavengers collect bottles and sell them to liquor restaurants, bars and bottle stores. The bars, bottle stores and restaurants later sell these bottles to the two major bottling companies in the country, which are the Kgalagadi Breweries and Coca-Cola. These use returnable bottles and therefore encourage consumers to return their empties through cash incentives. As an incentive for the use of returnable bottles, Kgalagadi Breweries sells the beverage that is packed in the returnable bottles 23% cheaper than cans with the same volume of contents. In an effort by the Coca-Cola Company to encourage the returning of the returnable bottles, deposits are made to all returnable bottles. The charge for the empties varies with the size of the bottle.

Scrap tyres and car batteries

A Gaborone-based company, Chloride Exide, specializes in the recycling of scrap tyres and car batteries. Scavengers pick up scrap tyres and car batteries and sell them directly to this company. In an attempt to increase quantities and meet sustainable production levels, the company also collects these items from other outlets around Gaborone. The tyres can be re-used to make sandals, flowerpots, mats or rethreaded to make tyres for donkey carts. A large consignment of tyres is exported across the border by Zimbabweans.

Threats to the Gaborone landfill

The landfill is now an unsustainable entity in terms of its locational, structural and management attributes.

No environmental and socio-cultural impact assessment studies were conducted prior its construction. As a result, it was located very close to the reservoir which supplies the City with water. Prospects of leachate seeping into the dam are high. Neither population projections nor urban-industrial spatial growth patterns were made prior to the construction of the facility. Because of increasing population, greater availability of disposable income, booming construction in the housing and transportation sectors, substantial amounts of waste are being generated. The landfill is overwhelmed and cannot handle the volume of waste generated by the City. The physical expansion of the city has almost engulfed the landfill and this exposes adjacent land-uses to its incompatible activities and health hazards. The utility is poorly managed and thus exposes residents and users to all forms of socioeconomic and health threats. It is due to some of the above-mentioned problems that the Gaborone City Council and certain sections of the society feel strongly that the landfill should be closed (Botswana Daily News, 2003).

In spite of the economic importance of scavenging to the livelihood of individuals from the low income neighbourhoods, there is a downside to this activity. There are a number of factors that are likely to lead to the closure of the Gaborone landfill. The significance of each of these is elaborated upon below. The city's solid waste problem has become more serious because of the increased volume of domestic refuse, construction rubble and industrial waste, fuelled by a rapidly increasing population. Constructed in 1993, the landfill is expected to close prematurely because of the unexpectedly voluminous magnitude of waste disposed from the rapidly expanding Greater Gaborone region.

Initially, the Gaborone landfill was sited/located outside the built-up area but due to the growth of the city outwards, it has now become a misfit. The guidelines for the siting of the landfill (Republic of Botswana, 1997) have clearly stipulated that;

- The landfill should be wire-fenced all around, as a deterrent to scavenging and the dispersal of waste by wind,
- The landfill should be engineered to prevent ground water pollution by leachate and have a leachate collection service,
- Odours should be minimized by covering each day's waste with inert material (soil and construction rubble),
- The landfill should be sub-divided into several sections, to accommodate different waste types received.

The Gaborone City Council has been criticized by the general public for shoddy landfill management. Symptoms of this are:

- The landfill no longer has paddocks where the waste can be separated according to type, after dumping.
- The waste disposed of at the landfill is not regularly covered with soil hence the production of bad smells. This is attributed to the frequent breakdown of caterpillars.
- The boreholes that have been drilled around the landfill, to detect the amount of leachate produced, have broken down.

Leachate is a strong pollutant as a by-product of the decomposition of organic matter that can produce organic acids that dissolve many harmful materials in the waste. It is for this reason that many people believe that the production of leachate may pollute the water at the Gaborone dam because the drains that form the leachate collection system can no longer help to divert surface rainwater to ponds where they are allowed to evaporate.

Some residents of Gaborone have complained about the fire outbreaks that are believed to be caused by the scavengers in search of items such as metals and bottles. It is quite interesting to note that even the scavengers admit that these fires do not only harm the surroundings of the landfill, but also pose a threat to their very existence at the landfill. Because of its close proximity to the residential areas and shopping centers such as Riverwalk shopping Complex, it is now viewed negatively by nearby settlers as a result of "Not In My Backyard" Syndrome. Noise, fumes, the stench and flies that are associated with the operation of the landfill go against the health guidelines.

One of the issues that have recently dominated environmental health concerns is that scavengers are themselves exposed to serious health risks. For example, scavengers are vulnerable to accidents from moving vehicles. Table 4 is a summary of the additional perceived hazards identified from the respondents by this study.

The Table highlights the need for regulating scavenging at the landfill by:

- synchronizing the activities of the scavengers with those of the vehicles;
- enforcing the use of basic protective clothing;
- alerting the scavengers about the inherent dangers involved in handling and/or consumption of certain waste items; and
- inculcation of rudimentary first aid treatment.

With all the risks in mind, the decommissioning and closure of the landfill is inevitable in spite of the apparent short-term opportunities it provides, according to the Department of Sanitation and Waste Management. The Gaborone City Council is therefore in the process of opening up a new landfill 30 km to the west of the municipal boundaries.

There are two possible scenarios that could emerge from the closure of the landfill. The best case scenario would involve scavengers organizing themselves into and registering themselves as co-operatives. This would have several advantages. First, they would realize scale economies. Secondly, they would qualify for financial and other supportive assistance from both government and non-governmental organizations. Thirdly, they would be in a stronger position to negotiate better contracts with the recycling firms and City Council. The success of such co-operatives has been cited in several

Table 4. Perceived hazards at the landfill

Hazard	Remarks
Accidents	When activity becomes very busy, there is intense jostling among the scavengers as they race for arriving vehicles whilst trying to avoid being injured by the compacting caterpillars. However, in spite of maximum caution on the part of the drivers, serious accidents are sometimes inevitable.
Cuts and burns	The respondents reported minor accidents resulting from stepping onto or handling some broken glasses or sharp metals. Cuts and wounds due to sharp objects further result in infection and inflammation of the exposed skin. In some cases this could result in tetanus. These experiences have led to some of the scavengers using shaped rods to pick up recyclables. Some complained of being burnt by latent fires, flammable and corrosive substances.
Eye irritation	Most of the scavengers complained about pain in their eyes. This is due to the smoke, particulates and dust at the landfill. Eye irritation is a result of inadvertent rubbing of the eyes during the scavenging process, with dirty hands.
Respiratory diseases	Most of the scavengers reported constant coughing and sneezing, wheezing and chronic colds. These could be associated with continuous inhalation of smoke, dust particulates, and corrosive gaseous emissions. Some reported cases of tuberculosis and attributed these to unsanitary conditions and unhealthy practices at the landfill.
Dental problems	Toothache was commonly reported by the scavengers. This could be the result of consumption of poisonous waste food.
Parasitic and digestive gastrointestinal problems	Most scavengers reported constant constipation and severe stomach aches. Diarrhoea is also a common ailment. Foods and drinks contaminated by flies and insects causes intestinal infection because proper sanitation facilities are totally absent whilst unhygienic conditions prevail in the area. One of the products collected at the landfill, usually by illegal scavengers, is waste food. This food is considered "expired" or spoilt and unfit for human consumption. Those who eat such products risk getting botulism/food poisoning. In many cases, these products are disposed of in the same container with poisonous waste.
Backache and pains	Bending and carrying heavy loads of scavenged items causes backache and pains in the arms and legs. These pains often result in slower work amongst the scavengers. Such pains could be due to occupational trauma and poor nutrition.
Skin diseases	These are due to non-adherence to basic health standards such as the non-use of protective clothing. Untreated skin lacerations are frequent.
Low morale and behavioural problems	The moods and emotions of the scavengers vary according to the availability of recyclables and working conditions. When unsatisfactory conditions prevail, many psychological and psychosomatic problems may arise, causing insomnia, excessive worry, hypertension and depression. Such conditions could predispose individuals to homicidal and suicidal risks. Aggressive if not provocative behaviour was a universal trait among the entrepreneurs who appear to operate under the "survival of the fittest" setting.

(*Source:* Derived from Rankokwane 2003, pp. 42–46).

cities in other developing nations. For example, a relatively recent World Bank study of Belo Horizonte, Brazil reports members of a waste picking cooperative earning a weekly income that was four times the national minimum wage (Johannessen and Boyer, 1999). In Bogota, similar cooperatives have successfully bidded for lucrative municipal waste collection contracts (Margarita, 1992). In Cairo, the Environmental Protection Company that developed out of a group of informal waste collectors, has won contracts for waste collection around the city (UNCHS, 1994).The formal sector companies would encourage this best case scenario.

The worst case scenario could occur if the waste pickers attempted to respond to the challenge of the landfill closure as individuals. For instance, depending on how the scavengers perceive and assess the distance to the new landfill site, some could think of commuting daily to their new "place of work" or set up more permanent camps around the new landfill, as has been the case in other African cities. Other waste pickers might have to opt out of their occupation altogether because of distance. Studies by the World Bank have shown that in the major cities of Ghana and Côte d'Ivoire, scavenging is uncommon because the cost of transporting recyclable materials to recycling industries exceeds the value of the recyclables (Johannessen and Boyer, 1999). Should the waste pickers follow the second scenario, all the stakeholders agree that City Council could find itself burdened with an additional number of unemployed who might have to resort to antisocial methods of eking out a living in order to sustain themselves and/or their families. This is because, as has been shown above, there are a limited number of alternative employment opportunities in Botswana.

Summary and conclusion

Like most capital cities in sub-Sahara Africa, the population of Gaborone has been growing very rapidly over the last 20 years, due to rural–urban migration. Unfortunately this trend has not been matched by expansion of employment opportunities in the formal sector.

The nation's capital city is not a monolithic economic entity and upper and lower economic circuits,

which interact through functional linkages, have been identified in this case study. Scavenging, as part of the lower circuit, exists in backward–forward relationships involving the various segments of the modern urban economic sectors. The landfill provides a spatial, functional and operational context within which the above economic activities occur.

From the preceding linkage analysis, it is clear that Gaborone landfill scavenging maintains strong forward links with the operations of certain local and externally based recycling industries. Even where the materials from the scavengers alone may be inadequate to sustain the business of recycling, it is evident that some of the formal sector companies still maintain important backward linkages with the activities of scavenging at the landfill.

Not all the retrieved items are sold to recycling firms however. Some are sold to the general public, and other local dealers. With increasing unemployment in the formal sector, estimated at 30%, officially, scavenging is likely to provide full time employment for most of those who engage in it. The marketed items, either to firms, marketeers or individuals, bring in about half of the household income. The rest of the retrieved items are either converted to direct subsistence in the form of food, clothing and other direct domestic uses. Foreign scavengers subsist entirely from proceeds of their enterprising. Some indicated that they purchased retail items from the shops in Botswana for subsequent trade in Zimbabwe.

Within the context of sustainable waste management, scavenging promotes social equity by ensuring that those who engage in it are enabled to access a source of income to sustain their livelihoods. Scavenging therefore facilitates income redistribution. Their waste recycling, reuse and reduction activities ensure ecological sustainability. They also expedite economic efficiency through their resource utilization practices. But all this is achieved at cost to the informal entrepreneurs in terms of health risks. Also the exceeded capacity, untenable locational setting and poor management practices at the landfill now render the utility to be more of a liability than an asset.

Notes

1. Bitsang Sadi the Principal Technical Officer at the Landfill personal conversation 31/5/2005.
2. Baker McDonald the Technical Officer at the Landfill personal conversation 31/5/2005.

Acknowledgements

The authors would like to acknowledge insightful comments made by the editor and three independent referees, that facilitated the improvement of the draft manuscript. The University of Botswana provided funding for fieldwork. The Department of Environmental Science staff, especially Dr J.R. Atlhopheng, Mr M.I. Mulalu and Mr G. Koorutwe provided the support input.

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