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Social Assessment for the Refinement of Solid Waste Management System in Port Harcourt Metropolis

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Abstract:

The issues with open dumps in populated settlements like Port Harcourt overbear on public health and environmental sanity. The shift of emphasis in this study from traditional system to modern system of waste management is to conform to international best practices in the solid waste management sector. With the help of qualitative design, traditional waste management system in practice today in Port Harcourt is critically reviewed using a social assessment strategy. A social assessment strategy developed for the study validated the suitability of waste minimisation, reuse, recycling, material recovery and sanitary landfill disposal for the city. Findings reveal that traditional methods of waste management are susceptible to public health challenges, urban decay and environmental degradation and associated problems. It is recommended that a transition from traditional to modern waste management system should be adopted for refuse control system in the metropolitan area.

Keywords: Municipal solid wastes, social assessment and waste management methods

1. Introduction

Waste management in Europe and the United States of America is targeted at improving the quality of public health and environment by sustained programme of enhanced services and equipments. The situation is not the same with developing countries of Asia and Africa. According to UNEP (2005) the situation is even extremely difficult in countries with low GDP and acute resource scarcity. In many African countries including Nigeria, the problem of urban waste management is not necessarily that of low GDP rates and acute resource scarcity because huge budgets have been allocated to this sector with little success. A combination of factors has contributed to the stagnation in the waste management sector. There is the issue of over reliance on traditional methods of refuse disposal such as open dumping. Due to these methods of disposal, there are visible signs of indiscriminate litter of refuse around urban neighbourhoods. Ekemini (2012) describe the situation in Port Harcourt as alarming and disturbing with open dumps blocking major roads and streets. The structure under which waste materials are collected and managed for instance constitute an impediment to modern methods of waste management. As such, modern methods of waste management in Europe and the United States such as source reduction, reuse, recycling, resource recovery and landfill operations are yet to be adopted.

Awosusi (2010) argues that since open dumping does not require sophisticated planning and implementation, dumpsites easily attract flies, vermin and scavenging activities. More so, these activities in the open dumps perpetually generate a stench of foul smell from the decaying organic matter with concomitant adverse effect on public health and urban environment. In Port Harcourt city, the difficulty in tackling waste management crisis has spanned several years due to the inability of the authorities to evolve a working waste management structure. Agbarachi (2009) is of the opinion that psychological factors such as inadequate public health education and environmental awareness have led to the situation. Nevertheless, if there were to be a working structure in the city, the issue of inadequate psychological awareness could have been managed with less difficulty. However, Port Harcourt metropolis requires a well-structured system of refuse management if the crisis in the sector is to be under control. UN Habitat (2010) argues that it is needful for municipalities especially in third world countries to develop internal winning strategies for coping with waste management challenges at all times.

What are those traditional lifestyles in Port Harcourt which must be taken into consideration in order to modernise waste management in the area? Forms of life in communities along the coastal areas of the state where waste disposal is done directly into the waters must be revived. In these coastal communities, waste components from sludge, all forms of human wastes, animal wastes, plastics, metals (ferrous and non-ferrous) and other forms of refuse whether hazardous or not are dumped directly into nearby waters. On the other way, round, upland communities prefer burying refuse materials on the ground. In most cases, disposal is done in community dumpsites. Some of the dumpsites have developed into a mountain of trash as is the case with Akpajo community dumpsite. In

communities within Port Harcourt and Obio/Akpor areas where skeletal modern services are provided, waste materials are collected by urban waste management workers and evacuated in dilapidated trucks to large scale dumpsites. This style of waste management is not only unsystematic and undiversified; it is unsustainable in terms of resource conservation. Considerable metric tons of recoverable materials for reuse and recycling are lost to the dumpsites.

The issue of reckless abandonment of refuse materials in the streets of Port Harcourt can be attributed to the pattern of middle class consumer behaviour (Robertson, et al 2011). The urban life style and popular culture among middle class families who constitute a large percentage of Port Harcourt population shows significant rise in consumer purchases (Robertson et al, 2011 pp.30-33). It has been observed that since the late sixties after the discovery of oil in the Niger Delta region coupled with subsequent exploration activities, increase in income levels of most middle-class families in Port Harcourt rose substantially. Oil activities created a boom in trade due to influx of companies into Port Harcourt. The boom in trade inadvertently affected consumption rates too. Since then, consumption rates have remained high especially among middle class families. Akosile (2011) corroborate this argument where he argued that there has been changes in the class structure over the years in Nigeria as a whole attributed to systematic expansion in economic growth showing in a boom in consumption.

At the centre of waste management crisis is the issue of consumer buying behaviour. Unregulated purchasing character of the consumer coupled with poorly organised waste management system has been the foundation of the crisis in the sector. Rani (2014) is of the opinion that psychological factors and cultural attributes of consumers are possible target areas for manufacturers and brand promoters. In this case of unregulated purchasing character of the consumer it is often difficult to control refuse generation especially in the absence of sound waste management policy and regulations which restricts behaviour. Invariably, consumer's sub culture, social class, social group, family, and personality which are target areas of consumer purchasing behaviour must be regulated (Rani, 2014).

2. Conceptual Analysis

In this section, four concepts which are central in this study have been tactfully analysed. These concepts formed the basis upon which discussions are based. These concepts are social assessment, municipal solid waste and waste management methods. Waste management methods are open dumps, reuse, recycling, organic composting, resource recovery and landfills.

2.1. Social Assessment

Bernstein (1997) maintained that social assessment in solid waste management is to analyse the social issues surrounding the management of refuse materials. In the first place, it is important to note what is social about refuse management. It is by so doing that the idea of social assessment will unfold. When need, assessment is conducted to ascertain the right atmosphere under which a waste management programme operates, a social assessment is conducted. More so, when stakeholders decide on service systems relating to operating a waste management programme, a social assessment is done. When important issues relating to project sitting, increase in rate of stakeholder participation and material contributions are made in respect to the functionality of refuse management scheme, it is as a result of social assessment (Bernstein, 1997). Kadfak (2011) corroborate this argument where he argues that it is the social relations in solid waste management that act to shape the right atmosphere for a successful refuse management scheme. Be that as it may, it thus entails that the social realm in refuse management shapes the situation for a sound environmental behaviour.

It is necessary to establish that the rate of individual compliance determine to a large extent how social relations work in any refuse management scheme. Burn (1991) discovered that individuals whose neighbours adopted a recycling programme showed higher tendency of compliance to the programme than those who had no idea about anyone who previously adopted the programme. Wills-Brower (2012) asserts that there is a natural inclination for people to adopt a recycling behaviour if others are already complying to it in order to avoid the tag of been seen as outcast to the accepted conventional behaviour. The social realm only acts as the right environment for people to participate in the programme when they are being carried along. Therefore, it is very vital to negotiate with all stakeholders in waste management process to determine aspects where participatory action is needed. It is at the negotiation, planning and implementation stages of the waste management scheme that social assessment plays a central role. In order to conduct a social assessment on wastes, categories of wastes and sources of generation must be ascertained to aid in understanding the subject being analysed.

2.2. Municipal Solid Waste

Understanding the domain of municipal solid waste has become difficult due to the extraordinary processes engaged in its management. Since materials have been successfully recovered and recycled meaningfully, the difficulty as argued by those promoting sustained consumption is how to balance the economic gains of recoverable materials. Whether or not there could be substantial economic return from recoverable resources, what is vital here is that the subject matter of solid waste management has been extended to resource recovery. Since the scope of the study is on modern methods of refuse management, then we shall confine our thesis on municipal solid waste management. What then is municipal solid waste? Municipal Solid Waste is more of the heterogeneous metric tons of unwanted materials generated within the metropolitan area as well as the homogeneous agricultural and mining debris produced over time (Meenakshi, 2012). Here again is the debate about waste materials as unwanted elements. Duggal (2009) puts it this way, the emphasis on Municipal solid waste is about public health factor with minimal economic benefits being of secondary value. Be that as it may, one thing that is clear remain that what is being managed as wastes constitute materials whose value have deteriorated beyond acceptable standards. This appears to be the only escape from the reoccurrence of economic variables in any refuse management scheme.

In any case, Solid Waste Materials from multiple sources must be properly handled, stored, transported and disposed under the best sanitary condition. The increasing volume of Municipal Solid Waste Materials has created a big public health issue thereby requiring expert managerial concern (Uberoi, 1999). In Port Harcourt, the failure to introduce modern methods of refuse management has created a serious environmental issue. This compounds the inadequacy in proper refuse disposal and the over reliance on traditional waste management methods. Uwakwe (2012) who studied Eneka open dump in Port Harcourt pointed out the urgent need for expert managerial concern in waste disposal in the city. Expert managerial knowhow to him is required in source handling, collection, spread of disposal points, evacuation process, reuse, recycling and recovery of resources from wastes to save lives and environmental resources from colossal damage.

Previous studies showed that traditional forms of refuse management in Port Harcourt pose severe threats to ecosystems around open dumps. There is threat not only to livelihoods but entire ecosystems. According to Uwakwe (2012) the dump site at Eneka area of Port Harcourt showed moderate hazard potential which requires immediate upgrading to a landfill. Eneka is a suburb area in the outskirts of Port Harcourt but within the city centre, there are visible signs of open dumps within the metropolis, see figure 1 and 2 below. Ekemini (2012) concluded that open dumping in Port Harcourt has reached astronomical heights in many parts of the city. Under this circumstance, it is advised that proactive measures are adopted. UNEP (2005) cautioned that the severity of the problem of municipal solid waste management in developing countries like Nigeria is worsened by financial, human and scarcity of other critical resources. The issue with Port Harcourt waste management is rooted in the critical problem associated with the traditional structure of waste administration. The traditional structure has bedevilled the modernisation of waste management services.

The traditional structure of municipal solid waste management affects the nature of waste handling, processing, street cleaning, evacuation and disposal techniques; this account for ubiquitous nature of open dumps in Port Harcourt metropolis. This structure of waste management in the city is not only traditional in style of administration but it is also distorted in operation with no clearly designated disposal points. Figure 1 below depicts a disposal



*Figure 1: Commingled waste materials deposited by the road side in central area of Mile 1, Diobu, Port Harcourt.
Source: Field work (2016)*

point in Diobu area of the city. In this instance, commingled materials are deposited by the road not minding the area of the city. Diobu is the centre of business activities in Port Harcourt typical of housing and population densities as well as urban markets stretching from mile 1 down to mile 4. But it is common to find refuse materials deposited by the roadside as seen here. It is not just the issue of open dumps in the area but there is the case of blocked and non-functional drainage systems. Each time it rains, there is the challenge with flooding since the gutters and rain water canals have been deliberately stuffed with debris.

The challenge with open dumping is not just restricted to road side but it has also been observed in uncompleted structures, dilapidated apartments and any available area within the metropolis. Figure 2 and 3 below exemplifies scenes of non-designated disposal points where refuse materials have been dumped. Such areas not designated as dump sites are often not earmarked for evacuation so the refuse materials are not always attended to as seen in these figures.



Figure 2: Scene of open dump at Mile 4 civic centre, Ikwerre road of Port Harcourt

Source: Field work (2016)



Figure 3: Scene of refuse materials dump at undeveloped plot at Peter Odili road, Port Harcourt

Source: Field work (2016)

SN	Sources of Wastes	Example	Hazard Level	Environmental/ Social control Approach
1.	Market wastes	Plastics, shopping wares, nylon bags, Styrofoam, shoes, clothing, food and vegetables	High	Reuse, recycle and recover materials.
2.	Litter	Paper, packaging waste, Batteries, tires, bottles, and cans.	High	Reuse, recycle and and landfill.
3.	Slaughter house wastes	Meat, blood, water and carbon monoxide.	High	Organic composting
4.	Agricultural wastes	Food resources.	Moderate	Organic composting
5.	Domestic wastes	Food, paper, bottles, wood, etc.	Moderate	Reuse, recycling and landfill.
6.	Construction wastes	Sand, asbestos, wood, concrete, asphalt, etc.	Moderate	Reuse and recycle
7.	Waste heat	Heat from automobiles, Air conditioning systems, Power generating sets, etc	High	Reuse and recycle
8.	Electronic wastes	All electronic appliances, Computers, phones and Associated gadgets.	High	Reuse, recycle and recover materials
9.	Industrial wastes	Industrial wares both Hazardous and non Hazardous wastes.	High	Reuse, recycle and recover materials
10.	Medical wastes	Pathological wastes e.g. syringes and all wastes generated at Hospitals, Pharmacies, Maternity homes and dispensaries.	High	Recover materials and landfill residues.
11.	Marine waste	Ocean debris and wastes dumped directly into the water ways.	High/moderate	Clean up materials sort into categories reuse, recycle and recover materials.
12	Waste sand	Sand on gutters and canals	Moderate	Recover and reuse

*Table 1: Social Assessment of Waste Management Problem Showing Hazard Level and Environmental/Social Control Approach in Port Harcourt
Source: (Field work, 2016)*

Table 1 above exemplify a typical social assessment process indicating environmental and health hazard level of municipal solid wastes generated in Port Harcourt metropolis. The social control approach is the solutions needed to manage the wastes materials. The social control approach is adopted based on international best practice system obtainable in developed countries of Europe and the United States. It is however pathetic to see that such best practice system in equipments and service delivery is yet to be adopted and implemented in Port Harcourt.

2.3. Open Dumps

Open dumping is one of the traditional methods of waste disposal in most African countries. Meenakshi (2012) argue that open dumping is not only traditional per se but it is an out modelled means of disposal with short comings in aesthetics, environmental and public health concerns. Other methods of traditional waste management system in Africa include burying in the ground, burning to ashes, backyard disposal and disposal into rivers. Open dumping in particular has persisted in parts of Nigeria and Port Harcourt in this case over the years because the government has paid little attention to modern techniques of Solid Waste Management. Open dumping of waste materials means leaving commingled materials to decompose on its own not minding the consequences to both the environment and human health. Refuse materials of biodegradable content may respond appropriately due to a process called photo-degradation. Photo-degradation occurs when materials are persistently exposed to sunlight effect. Non-putrefied organic matter such as plastics, bottles, metals, concrete, asbestos, etc. may require additional treatment. This accounts for the reason why both organic and non-organic waste residues must be properly handled and disposed under the best sanitary conditions.

Open dumping is prone to conditions that affect soil quality and biodiversity in sites where materials are dumped. According to Ali et al (2013) open dumping is prone to depreciating soil quality and drastic reductions in vegetations. The heavy presence of metal concentration at the disposal sites prevented the soil from recuperating. A consequence of non-recuperating soil lowered the effect of

vegetation in the areas studied and plant diversity was significantly reduced (Ali et al, 2013). It was concluded that the reduction in soil quality and plant diversity was as a result of the activities at the dumpsites. Open dumping of refuse materials is disadvantageous in a number of ways such as causing threat to human lives (insects and rodents), air and water pollution (<http://www.gdrc.org/uem/waste/disposal.html>). Statistics from the Nigeria Centre for Disease Control (NCDC) reported 101 deaths resulting from cases of Lassa fever including health personnel (www.informationng.com/2016/02/lassa-fever-has-now-killed-101-people-ncdc.html) Lassa fever is transmitted from rodents to man and the easy means of contact is improper handling and disposal of wastes materials.

2.4. Waste Reuse and Recycling

Waste management practitioners always emphasise that the best way to handle the issue of waste is to reduce the quantity being generated at source level. The US EPA (2015) noted that the most effective way to lower material requirements is at the production, packaging and distribution stages. At all these stages, materials are carefully packaged and in most cases excess materials are added especially at packaging stages. These materials always pose severe threats the moment they become wastes. Windsperger (nd) argue that industrial ecology should be promoted to alter the processes of production so that industrial systems will accommodate recycling of materials to save cost of production and environmental resources. When materials are reused, it promotes industrial ecology by enhancing the elongation of material lifecycle. What then is waste reuse? Reuse is distinct from recycling both in doctrine and practice. Reuse keeps materials out of landfills when materials are picked up, cleaned and put back into use with or with no processing depending on the quality of the material being recovered in the first place

(http://loadingdock.org/redo/Benefits_of_Reuse/body_benefits_of_reuse.html). Nevertheless, Uberoi (1999) believes that waste reuse entails using materials over and over again in their original form.

In the case of recycling, the materials are collected, segregated and valuable components recovered from the wastes for use in producing an entirely new product. The sharp contrast between reuse and recycling is that in reusing, the second-hand value of the entire material element is put back into use rather than being disposed. In recycling, valuable components of the material are either entirely or partially recovered for processing into an entirely new product (Khanna, 2012). The benefits of reusing material are that it saves energy, money, prevents pollution, helps sustain environment and reduces greenhouse gases that contribute to global climate change (Shakirova, 2013). In summary, material reuse is generally beneficial in three dimensions: material, environmental and financial aspects. Materially, waste reuse lifts the unhealthy pressure placed by manufacturers on environmental resources; environmentally, it averts the dangers of pollution and saves the cost of energy. Financially, waste reuse puts money both in the pockets of manufacturers and consumers because of elongation of material life cycle. Recycling economists argue that the externalities of recycling are the unquantifiable percentage of reductions in greenhouse gas emissions, particulate matter, hazardous leaching from landfills, energy consumption, waste generations and resource consumption (Khanna, 2008).

2.5. Organic Composting

Organic composting or composting as commonly seen in most literatures means the same thing in doctrine and practice. Composting involves the process of decomposing biodegradable organic component of municipal solid waste using a biochemical process leading to the conversion of wastes into humus (Pandey, 1997 and Duggal, 2008). Composting is done basically to benefit agricultural economy. Nevertheless, sources of waste materials used for composting are derived from kitchen wastes, garden wastes, market wastes, slaughterhouse waste and agricultural wastes. According to Misra and Roy (nd) the potential which organic composting has in converting organic wastes into manure (a rich humus component) is highly attractive. Some of these potentials include

- i. Enhancement of soil fertility and healthy soil conditions
- ii. Enhancement of agricultural productivity
- iii. Improvement of soil biodiversity
- iv. Reduction in rates of ecological risks and
- v. Creation of better environmental conditions.

2.6. Resource Recovery

Modern waste management system requires that materials are carefully collected, treated and valuables recovered for processing. Sophisticated engineering techniques are required using standard equipments and facilities for the recovery of valuable materials for further use (Meenakshi, 2012). Materials recovered may include plastics, metals, iron, bottles, cans, wood, etc. as the case may depend on the content of the commingled materials. A process which leads to resource recovery is that materials are either separated at source level then delivered to a recovery facility or they are taken to a buy-back centre or a curb side centre (Tchobanoglous et al, 1993). After this stage, materials are then taken to the material recovery facility (see figure 4 below). In simple terms, the functional process in a recovery facility is that advanced technology is used for sorting and separation of materials. After that, materials are then further processed using any of the treatment processes. The treatment processes may include mechanical, chemical and biological means with the waste residues evacuated to the landfills.

The essential thing about resource recovery lies in resource conservation and biodiversity retention, land conservation as well as reduction in usage of energy resources (Randell Environmental Consulting, 2012). Economists may argue that these are externalities which do not give quantifiable percentage of economic gains derived from resource recovery. Be that as it may, it may be strongly argued here that the social consequence of recovering materials from wastes is the synergy which the process creates between industry

and the community. In this sense, since it is the community which serves the municipal wastes which is recovered at the facility, then the synergy is inadvertently created. The industry in turn gives the feedback in terms of what is expected from the community to furnish its industrial needs in form of resource creation. The extent of participatory action goes to the realm of policy initiative from the community level that will lead to waste to resource creation for a sustainable environment. Social and political considerations such as involvement of informal sector and the decision to increase extent of participatory action in decision making on solid waste management has yielded more significant results than technical innovations (Furedy, 1984). Even at that, social considerations have far more potential in transforming the sector than technical innovations.

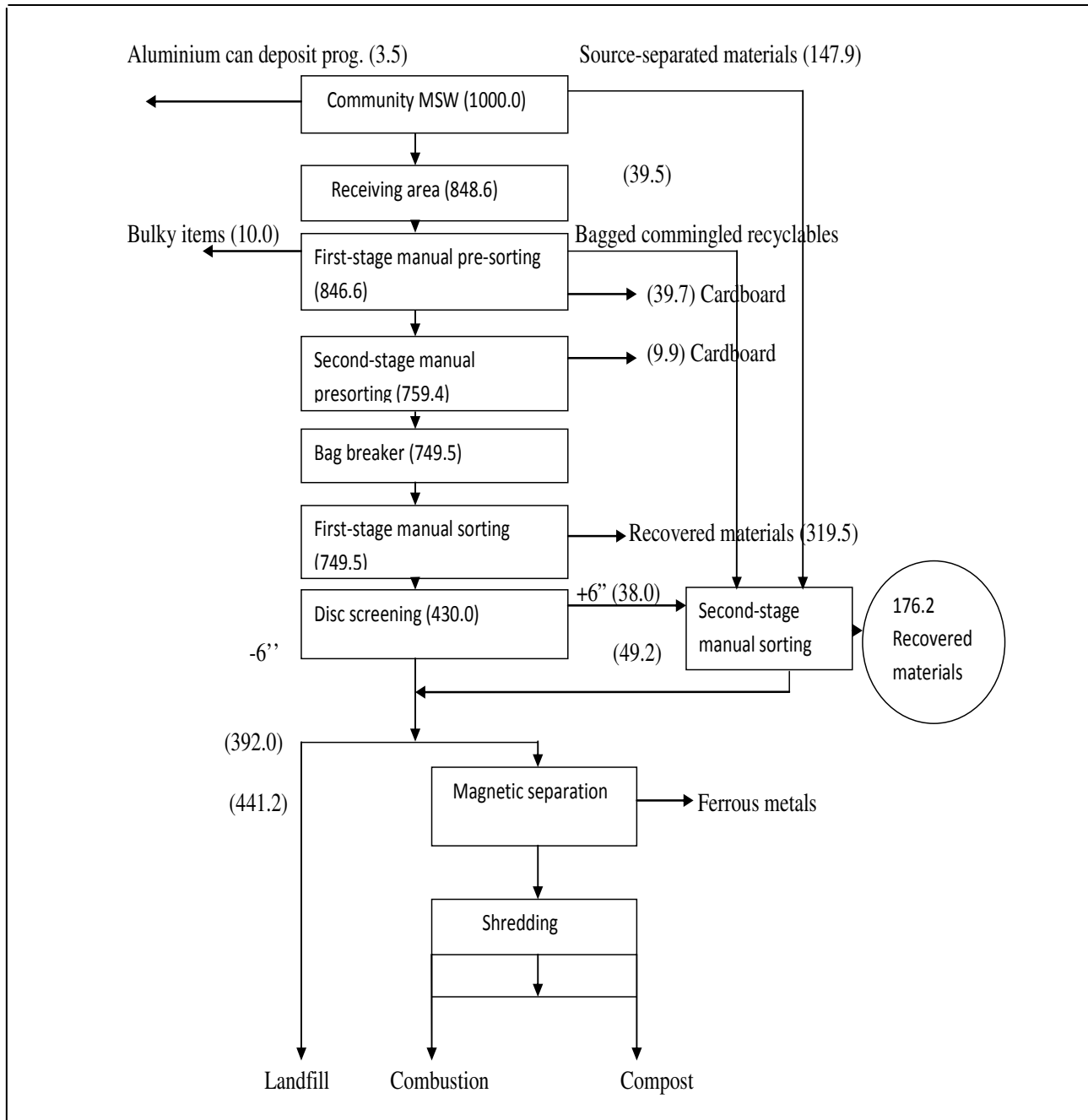


Figure 4: Diagram showing stages of a material recovery facility indicating material balance in quantities (ton/d)
 Source: Tchobanoglous, et al (1993, p. 597)

2.7. Landfills

Landfill areas require numerous stages of administration starting from planning to site management and maintenance with daily disposal of materials in a compacted layer of soil (Meenakshi, 2012). After locating a potential landfill site, the next action is for the authorisation of Environmental Impact Assessment to determine the suitability of the site. Environmental concern as it affects the livelihood of surrounding ecosystems is vital to underscore the suitability of the site. Another vital stage then becomes the engineering design of the landfill area. It is a significant stage in landfill construction since most waste residues contain poisonous substances. The topography of the site must be considered in order to keep leaching under control. Cases of contamination of ground water sources and environmental decay have been reported in poorly managed landfill sites. This justifies the need to engage expert managerial know-how at the designing, construction, management and maintenance of the site.

Landfills afford waste managers the opportunity to dispose in the ground without harming the environment or causing public health nuisance since high engineering principles are taken into consideration in the management of the site (UNEP Module 4, nd). There is sufficient assessment of the landfill site and conditions such as the ecology and topography of the area are often considered as well as the hydrological and climatic conditions of the site before commencement of operation. The operational plan and cost evaluation too gives the right mind set to those establishing a landfill for administrative convenience. Management issues such as site identification, soil, water and microclimatic conditions, design of gas recovery system, drainage system and leachate treatment facility are operational requirements to be taken into account before landfill project implementation (UNEP Module 4, nd). However, management must take cognisance of adequate and frequent control of the site starting from the construction phase to cost accounting and regulation of environmental safety of the landfill. UN Habitat (2010) in its guidelines for the design and operation of landfills stipulates that such sites must be constructed to avoid public health and ecological problems.

“Landfills have associated negative consequences such as groundwater and surface water contamination, greenhouse gas emissions and health hazards such as landfill fires and landslides. Despite these challenges, landfilling remains the cheapest way of waste disposal available for municipal authorities”. UN Habitat (2010)

Munawar and Fellner (2013) argue further that most countries of the world today are still associated with the negative impacts of landfills on the environment. However, it remains vital that the siting of landfills is always a deliberate attempt by waste managers to safeguard human health, urban aesthetics, the environment and its natural resources.

3. Discussion

The use of social assessment method has afforded the opportunity to critically examine the social issues surrounding the management of solid waste materials in Port Harcourt metropolis. In understanding, what was done using social assessment method in relation to waste management practice, it will be helpful to rely on the explanation of Budge and Vanclay (1996) where it is asserted that social assessment can only be meaningfully engaged

As the process of assessing or estimating, in advance, the social consequences that are likely to follow from specific policy actions or project development, particularly in the context of appropriate national, state, or provincial environmental policy legislation (p.59).

Therefore, the entire waste management system in Port Harcourt was reviewed to assess the social consequences of the waste management structure in operation.

Need assessment of waste management structure in Port Harcourt reveals the inadequacy of environmental awareness and public health education as adversely affecting refuse management in the city (Agarachi, 2009 and Ekemini, 2012). In a separate study, Ubleble (2016) found out that the lack of community participation and poorly designated spread of disposal points in Port Harcourt metropolis have adversely affected environmental quality and caused public health concerns in Port Harcourt. To deal effectively with these issues, a re-evaluation of the entire system was conducted and it revealed that a modern waste management system was highly needed in Port Harcourt.

Municipal solid waste materials which consist of homogenous and heterogeneous matter generated in Port Harcourt metropolis require proper management system at all stages to avoid the continuous stench of urban decay and public health challenge being experienced in the area. Open dumps being currently used in the area for disposal of wastes is short of international best practices in refuse management. Apart from the stench of foul smell and possibility of epidemic outbreak which is often associated with it, it is also traditional and unsystematic in style. Waste minimisation at source is required. More so, waste reuse and recycling are similarly needed. In order to get this done, there is need for a sound solid waste management policy and legislation. To bring about the policy, government must engage all stakeholders involved in waste management services. Participatory action is required using a bottom-top approach. The advantage here is that marginal people will feel involved in the waste management programme. Equipments and service systems demand upgrading. The upgrading of facilities is needed to introduce reuse, recycling and recovery of resources. Residues from waste stream also require to be handled under best practice systems. Open dumps are no longer needed so should be replaced with sanitary landfills due to the advantage which landfills have over them. It is of importance for the waste management authorities in Port Harcourt to transit from traditional to modernised methods of waste management in order to align with international best practices in the sector.

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