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The Socio-economic and Environmental Implications of Residential Buildings in Proximate Distance to Landfill Site. A Case of Olusosun Landfill, Ojota Lagos

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Abstract
Rapid population growth, urbanization and the associated increase in housing need has lead landfills to compete with residential developments, especially in peri-urban areas of developing countries, including Nigeria. This study explores extensively the socio-economic and environmental impacts of landfill sites on residential buildings, especially those in proximate distance to it, with a focus on the Olusosun landfill in Ojota, Lagos. In achieving this aim, the study examined the socio-demographic characteristics of the residents living in close proximity between 200-500 metres to the landfill site, identified the health and environmental hazards experienced by residents, examined the condition of residential buildings between 200-500 metres to the landfill site and evaluated the relationship between the distance of landfill site and condition of buildings in the study area. The purposive and stratified random sampling method was employed in carrying out the research survey, where Olusosun community was divided into three (3) strata using distance from the dumpsite and population density as criteria adopted by the researcher. Consequently, eighty-two (82) questionnaires were retrieved from the respondents, out of the total eighty-five (85) structured questionnaires administered. Descriptive statistical tool was used to analyse the perceptions of the respondents. However, the study revealed that several socio-economic, environmental and health implications arise as a result of this haphazard development, these include; thermal discomfort, diseases, low rental value of residential buildings, poor aesthetic value and water contamination. Also, the result from the Crosstab and Chi-Square test concluded that there was no enough evidence to suggest an association between distance of landfill and building conditions in the study area. The study, therefore recommends that there should be proper monitoring and robust waste management strategy, social inclusion in waste management, promote health and safety, harness other waste disposal methods, provide legal structures/institutions on waste management, climate change mitigation and safeguarding the environment for sustainability.
Keywords: socio-economic, environmental, residential buildings, proximate distance, landfill
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1. Introduction

One of the many challenges today in developing countries is selecting the most suitable area for disposing municipal solid waste (Kharlamova, et al. 2016). Mainly, solid wastes that are generated from residential areas and industrial developments create serious environmental problems. There are various techniques used for solid waste management such as: land filling, thermal treatment, biological treatment, and recycling. Any of the methods to be used must be the one that will not cause damage to the biophysical environment and the ecosystems of the surrounding space. Also, the economic factors and geomorphologic features must be considered during site selection for solid wastes. Most local governments in developing countries are unable to deliver services effectively and dumping of municipal solid waste (MSW) on undesignated areas such as open dumps is a common practice, resulting in a strain on the environment (Practical Action, 2006). Obviously, landfill is the most cost-effective system of solid waste disposal for most urban areas especially in developing countries, including Nigeria. Uncontrolled disposal of waste is detrimental to human health because it creates unsanitary environments that have adverse impacts on the urban residents.

In Nigeria, the urban environment is characterized by a proliferation of squatter settlements, a breakdown of waste disposal, air pollution, water pollution, inadequate water and power supply and squalid condition of environmental sanitation (Kharlamova, et al. 2016). Increased urbanization and expanded use of disposable products in the past decades have generated greater demand for landfill space (Arimah 1996). It is important to know if and to which extent proximity to waste disposal sites or treatment plants have some negative impacts on residential buildings for many reasons. Whether as a measure of the impact of the sites on health and general welfare of the resident, or to ascertain the degree of monetary depression that would be suffered by property investors or even for future physical planning, it is imperative to know how these sites impact on the lives of the

residents. Waste is associated with virtually all human activities and it is inseparable from life because as long as man is alive he stores, uses and disposes off materials. Moreover, the complexities of waste which modern civilization produce is directly related to the living standards, socio-economic and cultural attributes of that particular environment (Hoornweg, 1999). Solid waste streams could be characterized by their sources, type of waste (solid, liquid, or gaseous states) produced as well as generation rate and composition. Waste according to Huang, (2008), is classified into eight namely: residential, industrial, commercial, institutional, constructional and demolition, municipal services, process and agriculture. Huang, (2008) however sees solid wastes as solid or semisolid materials resulting from human and animal activities that are useless, unwanted, or hazardous.

According to Oyekanmi, (2018), Lagos state is the most populous state, also the largest commercial hub of Nigeria and the seventh in the world, including that of solid waste generation. Lagos accounts for about 22 million of the nation's estimated 140 million people and are projected to rise to about 40 million by the year 2020, has to grapple with over-stretched infrastructure and other facilities. Obviously, Lagos population is increasing; waste generation is also escalating simultaneously. Lagos State generates over 13,000 tons of waste every day; 1.2kg per person is generated per capita and expected to increase to 1.42kg in the next 15 years. Waste management infrastructure remains the fundamental lifeline in the economic development of the State, and the lack of an effective collection and disposal process has contributed significantly to environmental epidemics such as Lassa fever and perpetual flash flooding which has worsened in the last decade. Solid waste generation rate in Lagos state continues to increase faster than the infrastructure available to handle it (Proshare, 2018).

The attendant problems of this phenomenon include great pressure on existing physical infrastructure and public service delivery, including improper solid waste management and the need to safeguard the health and living standard of the people and the environment. In view of the endemic poverty situation, poor urban governance, and general lack of systemized application of interdisciplinary approach to the application of management of the urban environment, local threat to the home environment often becomes severe.

Megacities around the world generate a total of 1.3 billion tons of solid waste per year, and by 2025, this is expected to increase to 2.2 billion. Delhi, India, generates 11,500 tons per day at 0.5kg per person per capital; and Seoul, London and Tokyo generate waste at 1.08, 1.45, 1.03kg, respectively (Proshare, 2018). While many cities around the world struggle with waste management problems due to increasing population and changing lifestyle, Tokyo remains one of the cleanest cities, using an advanced waste incineration technology, which is efficient and environmentally friendly. Approximately nine million people in Tokyo generate about 8,000 tons of household waste per day and with a garbage collection rate of 100% waste is collected within a day and transported to its 19 waste incineration plants.

However, in comparison with other developed countries, the effective collection and disposal of all types of waste (residential, industrial, commercial, medical, etc.) has been a struggle in Lagos State. Of the 13,000 tons of waste generated per day, less than half was being collected and disposed. Between 2007 and 2013, a total of approximately 78 million tons of waste was generated, with collection rate at 27.7% resulting in extreme cases of fly tipping, blocked drainages and waterways, leading to environmental epidemics such as the flood disaster in 2011. The casualty of this incident was significant, claiming over 25 lives and displaced approximately 5,393 households, destroying almost N100 billion worth of property (Proshare, 2018).

Faced with the rapidly increasing problems of waste management in Nigerian cities, there is need to embark on practical programmes to deal with the situation. The use of landfills is one of the oldest practices used by man, with the aim of achieving sustainability in overall waste management. Within the context of integrated sustainable waste management, proper landfill design, operations and management are quite important. It is in light of this, the research study examines the socio-economic and environmental implications of the proximity of landfill site to residential buildings in Olusosun community, Ojota Lagos.

1.1 Description of the study area

Olusosun dumpsite is located within Longitude 6° 35' 50"E to 6° 36' 30"E and Latitude 3° 22' 45"N to 3° 23' 30"N and covers an area of 42 hectares. It is surrounded by residential, commercial and industrial neighbourhoods. Originally, this dumpsite was on the outskirts of the metropolis but due to rapid urban development the site is presently within developed locality of the metropolis. It is about 18 metres deep, occupying a large valley (likely artificially made) within the Oregun Industrial Estate. Historically, Olusosun is a spontaneous Auto-ignition burning (auto-ignition) dumpsite. It is the largest of all existing dumpsites in Lagos State in terms spatial coverage (LAWMA, 2004).

The wastes brought from different parts of Lagos are dumped on the site to progressively fill up the depression. This site receives far more wastes than any other landfill in Lagos. According to Apollo Mapping, (2014) on average, 1.1 million metric tons of wastes are dumped at Olushosun each year or about 8,000 to 11,000 metric tons per day. The site also receives electronic waste from 500 container ships per day. The Nigerian government has estimated the waste stream at Olushosun comprised of four main categories: vegetation (59% of the total), paper products (17%), plastics (12%) and metals (8%). At one time, Olusosun was located on the outskirts of Lagos, but

with the increase in population, adding an estimated 300,000 residents per year, the landfill is now surrounded by residential and commercial properties.

Olusosun landfill has over the years become a source of revenue to a number of waste pickers (scavengers) who besiege the site daily for plastics and other items that could either be recycled or reused by manufacturing industries. It has been in existence since 1992 and has the longest life span (Lavalin, 1992 and Environquest 2008) as its closure plan is still some four (4) years away, i.e. Year 2022. This Dumpsite is within the Onigbongbo Local Development Authority (LCDA) of the Ikeja Local Government Area (L.G.A). A location and schematic presentation of Olusosun Dumpsite is given in Figure 1. It is bordered to the East by Ikorodu Road wherein lies contiguous to the dumpsite: Total Filling Station and Bus Park. Olusosun is bounded to the West by the Oregun Industrial Estate (Housing companies like Dangote Salt, UAC, Mr. Bigg's, etc.) and to the North by LAMATA Office (Motorways House) and Seven-Up Bottling Company and to the South by the Kudirat Abiola Way on which lies many residential as well as industrial/commercial facilities.

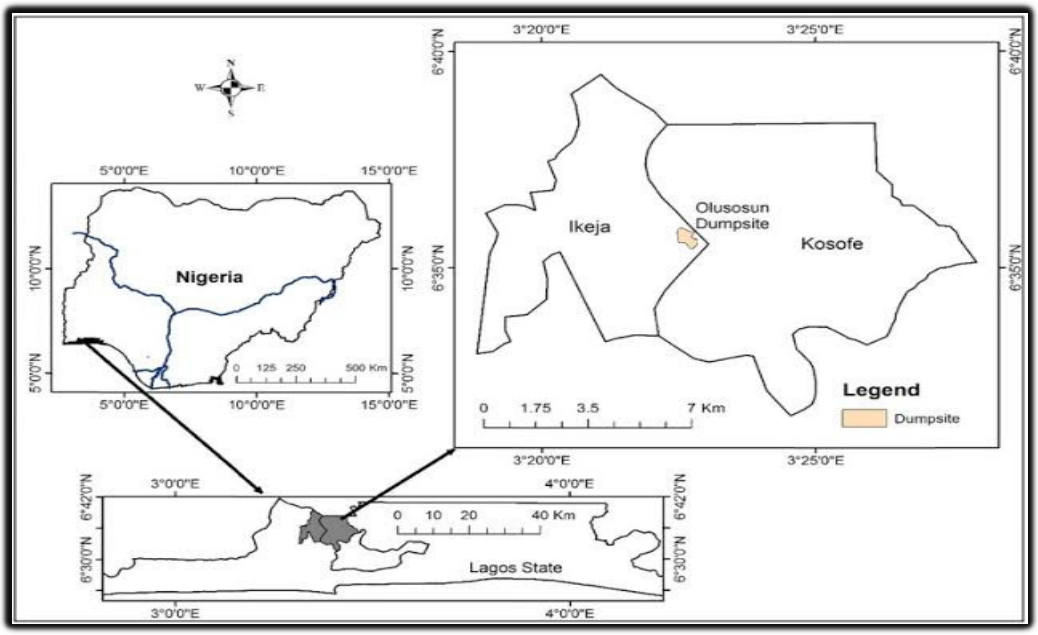

Figure 1: Schematic Image of the Study Area
Source: Olatunji et al. (2016)

1.2 Historical overview of Olusosun dumpsite

The Olusosun dumpsite is the largest of all dumpsites in Lagos State and is at the centre of Lagos Metropolis. Olusosun landfill was first identified and used by the Nigeria Military in the 1960's and 70's as a Shooting Range for Condemned Armed Robbers and Coup Plotters alike. The site was later excavated and turned into a soil mining site to provide filling materials for roads and foundations of new building development. The Olusosun Dumpsite is traversed by a large burrowed pit which resulted from the long term uncontrolled excavations and mining by most developers from all parts of Lagos Metropolis. This site was later identified and selected by LAWMA for a Landfill site and dumping of refuse as well as scavenging of recoverable refuse had been going on there since 1992.

The dumpsite has been recognized by the World Bank as a landfill that attracts desirable attention for upgrading under the World Bank-Assisted Programme Lagos Metropolitan Development and Governance Project (LMDGP). The proposed upgrading of Olusosun Dumpsite and capturing of Olusosun landfill gas under the design, build, and operate (DBO) arrangement is one of the listed intervention areas of the LMDGP in the overall Lagos state solid waste management plan. The others are: clearance of the backlog of refuse heaps in Lagos, construction of twenty-five (25) communal waste depots (CWDs) and the construction of two (2) transfer loading stations (TLS). In furtherance, the LMDGP had engaged a Consultant (Messers Environquest Limited) to prepare the resettlement policy framework and the Environmental and Social Impact Assessment (ESIA) Report on the Olusosun Dumpsite, amongst others such as Solous and Abule Egba. This is with a view to envisage, cataloguing and planning a mitigation/minimization of all likely negative impacts that could arise from the proposed upgrading.

In a recent development, with the view to ensure environmentally friendly and sustainable waste management system, the Lagos state Government through the Lagos Waste Management Authority (LAWMA) proposed to upgrade the Olusosun Dumpsite under the Solid Waste Management of the World Bank-Assisted Program and Lagos Metropolitan Development & Governance Project (LMDGP). However, some five hundred and seventy-

eight (578) Waste Pickers of various demographic and cultural affiliations are currently operating on this dumpsite with various materials of interest. Therefore, the need to properly, effectively and indeed voluntarily relocate these Waste Pickers in a hitch-free manner necessitated the constitution of a Resettlement Committee and the attendant development of Resettlement Action Plan for the site in question.

1.3 Aim and objectives of study

The aim of this study is to examine the socio-economic and environmental implications of residential buildings in proximate distance to landfill site. Precisely, the possible hazards of residential buildings and dwellers close to landfill will be discussed with special focus on the Olusosun dump site, in Ojota area of Lagos. However, the objectives of this study are to;

a. examine the socio-demographic characteristics of the residents living in close proximity between 200-500 metres to the landfill site,
b. identify the health and environmental hazards experienced by residents in the study area,
c. examine the condition of residential buildings between 200 - 500 metres to the landfill site in the study area and to
d. evaluate the relationship between the distance of landfill site and condition of buildings in the study area.

2. Literature review & conceptual framework

In practice, waste dumps or landfills are generally safely constructed to minimize any form of negative effects or hazards, (e.g. pollution of ground water via leaching) to the surrounding areas. According to Environmental Research Foundation (2011); "A secure landfill is a carefully engineered depression in the ground (or built on top of the ground, resembling a football stadium) into which wastes are put. The aim is to avoid any hydraulic (water-related) connection between the wastes and the surrounding environment, particularly groundwater. Basically, a landfill is a bathtub in the ground; a double-lined landfill is one bathtub inside another." There are three (3) main types of landfills namely: secured or sanitary landfills, controlled landfills and open dumps. Secured or sanitary landfills are types of landfills that are highly lined at the base to prevent infiltration by percolating liquids (leachate). On the other hand, controlled landfills are waste dumps where the refuse is merely covered with soil, while in open dumps there is no standard for refuse dumping (Gouveia & do Prado, 2010).

2.1 Existing waste management system under the Cleaner Lagos Initiative Scheme (CLI)

With the aim of improving on the existing waste management system, the Lagos State Government established the Cleaner Lagos Initiative (CLI) as an extensive and sustainable waste management system in the State. Cleaner Lagos initiative was informed by the need to correct the flaws of the old waste management system mainly operated by the private sector partnership (PSP) and to introduce modern technology into the management of solid waste. The old scheme was characterized by lack of proper waste management compared to the CLI whereby Lagosians get more value for their money in terms of effective waste management system. Obviously, as Lagos population is increasing, waste generation is also escalating while revenue generation by PSP is not increasing. It should be noted that Lagos is one of the largest waste producers in the world accounting for about 13,000 tons per day UN-HABITAT (2010).

The key factor of the initiative is to explore conversion of waste to energy as well as recycling. The new initiative preaches a departure from the old waste management system as it geared towards safeguarding the health and living standard of the people and the environment, also the scheme focuses on improving the environment by making it cleaner, safer and healthier for all residents while upgrading the operational efficiency in waste management, hence Visionscape currently in a public private partnership with the Lagos State Government is set to provide waste management services for CLI. The new waste management policy apart from creating the enabling environment for the private sector to harness international best practices will also address existing challenges in solid waste management in the State. However, in other climes, solid waste management has shifted from just collection and disposal to making viable use of solid waste. Many economies of the world have benefited immensely from waste without compromising the sustainability of the environment.

Already, the Lagos State Government has put in place measures to curb the menace of improper waste disposal. No doubt the measures deployed to take waste from the roads have not yielded the expected results. In view of this, the investor, Visionscape is expected to build three (3) engineered sanitary landfills; two (2) in Epe and one (1) in Badagry to ensure proper waste management. The Visionscape will also provide refuse bags and bins for houses to aid regular collection. More so, the new scheme will address the current problem of irregular waste collection which led to non-payment by residents. It also proffers solution to inadequate transfer loading stations and other facilities that have been ignored. It is however important to note that dumping of refuse by the road shows uncleanliness and carelessness in disposal of waste on residents' side. It is expected that Lagosians imbibe the culture of proper waste disposal so as to enjoy the new face of solid waste management initiative by Cleaner Lagos (Oyekanmi, 2018).

2.2 The potential hazards of residential buildings close to landfill

Building on or close to a landfill site is faced with a number of potential hazards both during and after redevelopment. These may be broadly divided into three main hazards: landfill gas production, chemical contamination or attack on building materials, and subsidence. Landfill gas is composed mainly of methane (cu. 65%) and carbon dioxide (ca. 35%) when released from a mature landfill undergoing anaerobic decomposition of waste (Emberton & Parker, 1986).

When the concentration of methane in air is in the range 5-15%, an explosion may occur if a source of ignition is present. Even a slow rate of methane production may result in explosive concentrations of gas building up in confined spaces, especially in buildings erected on, or close to, a landfill site. In some situations, the strata in which landfills are situated are permeable or contain permeable bands so that lateral migration of landfill gas may occur if gas pressures within the waste are sufficiently high. Such migrating gas has been detected over 400 m from its landfill source. Intentional withdrawal of gas may lead to landfill fires (Stearns & Petoyan, 1984a).

There has recently, been some concern over the potential toxicity of some minor components present in landfill gas. Very little research has been carried out into the toxicity of complex mixtures of landfill gas components. It is known, however, that some compounds, such as vinyl chloride, may exist in concentrations which exceed their toxicity thresholds when measured in undiluted landfill gas given off from decomposing domestic refuse. However, Emberton & Parker, (1986) opined that such concentrations are rarely, if ever, encountered by landfill operatives due to the dilution factors involved when the gas is released into the atmosphere. It is most likely, therefore, that building workers, or members of the public will be exposed to a toxic hazard when encountering landfill gas during, or after redevelopment of old completed landfills. In this situation, dilution factors of between 104 -106 would be expected to apply. This assumes, of course, that any gas present will not be allowed to concentrate in structures erected on site.

The third potential problem due to landfill gas production is related to the odourous nature of the gas. This odour may vary widely from relatively to bitter and acrid. The odour produced is due to the relative proportions of odourous compounds within the gas, such as esters and organosulphurs. These will vary in relation to the nature and age of the waste as well as the composition of the bacterial community present in the waste. As with the toxicity hazards, the odour of landfill gas should not pose a problem on the type of site which should be considered for redevelopment, because of the relatively low levels of gas being generated and the high dilution factors applying.

The waste into, and onto, which potential structures are erected represents a highly chemically aggressive environment. The waste and, more importantly, the interstitial fluids and leachates may contain numerous acids, strong alkalis, organic and inorganic ions which are corrosive to many building materials. The materials at highest risk are those which are buried within the fill, namely concrete, metal reinforcing and pipework, plastics in pipes and rubber sealing. Over 60% of the concrete used in buildings is used in foundations (Nixon et al, 1980). The need to protect concrete from the effects of acids and inorganic ions, particularly sulphate is well known. The Building Research Establishment (BRE, 1981) recommends grades of concrete to be used under certain conditions of groundwater contamination by sulphate. The mechanisms of chemical attack on concrete have been classified into the three types described by O'Brian, (1977) includes the following:

a. leaching of soluble materials;
b. degradation of the binding capabilities of cement by chemical change; and
c. disruption caused by expansion of reaction products.

Finally, the last problem considered is that of waste ignition. Landfill fires are one of the most difficult potential problems to identify and control. This was what occurred at the Olusosun landfill site recently, where the inferno destroyed properties worth millions of Naira. Stearns & Petoyan, (1984a) considered that the retention of heat generated by aerobic bacterial waste decomposition may increase the rate of chemical oxidation of the refuse. Continued chemical oxidation could then raise temperatures further until the point of spontaneous combustion is reached. The present authors think that such an occurrence is during redevelopment of the type of site considered in this paper. However, waste ignition is likely if direct contact in pyrolysing material or ignition of generated landfill gas occurs. This would happen if fires are lit, calor gas stoves used (e.g. in roofing) or smoking allowed on site.

2.2.1 Health and social-economic implication of landfill

Apart from the environmental impacts, landfills are sources for several socio-economic impacts like public health issues due to the exposure to landfill gas and to the ground and surface water contaminated by landfill leachate. Although modern landfill sites are well designed to reduce emissions, the emissions from landfills continue to give rise to concerns about the health effects of living and working near these sites, both new and old. The exposure to contaminants and emissions can be via direct contact, inhalation or ingestion of contaminated food and water. Drinking water contamination has been identified as the source of exposure to harmful substances in many studies (Griffith, et al and Adami, et al. 2001) Those studies revealed that congenital malformations, birth weight, prematurity and child growth and cancers have a significant impact on landfill emissions. In a multi- site study of

residents of New York State, a 12% increased risk of congenital malformations in children born to families within one mile of hazardous waste sites were reported (Geschwind, Stolwijk, & Bracken). Fielder, Poon-King, Fielder, et al. (2000) & Vrijheid, Dolk et al. (Vrijheid, et al. 2002) also found an increased risk of congenital malformations in populations live near landfill sites. A multi-site European study called EUROHAZCON discovered a 33% increase in non- chromosomal birth defects among the residents living within 3 km of the 21 hazardous waste landfill sites studied (Dolk, et al. 1998). This conclusion was confirmed by the study conducted by Elliott, Briggs et al. & Elliott, et al.

In Ghana for instance, Coffie, (2010) examined the effect of the Oblogo waste landfill site on the people living around those communities and found that due to the location of the landfill sites and how it is being managed in the communities, there is high prevalence of infectious diseases like malaria, cholera, diarrhoea, typhoid fever among others. Also, at the Dompoase Landfill in the Kumasi Metropolitan Authority of Ghana, it was found that there is increased prevalence of self-reported health symptoms such as fatigue, sleepiness, and headaches among residents near the landfill site were consistently reported (Owusu-Sekyere et al. 2013a).

A number of studies revealed that there is a higher risk of developing cancer among the people near landfill sites and the elevated risks were observed for cancers of the stomach, liver and intrahepatic bile ducts and trachea, bronchus, lung, cervix and prostate (Goldberg, et al. 1999) In addition to the health issues, landfills create considerable impacts on land value, land degradation and land availability. Various researches conclude that landfills likely have an adverse negative impact upon housing values depending upon the actual distance from the landfill (Ready, 2005, Akinjare et al. 2011 and Reichert, Small, & Mohanty, 1992). Potential hazards such as flies, odour, smoke, noise and threat to water supplies are cited as reasons why the public do not want to reside close to the landfills. Reichert, Small et al. Reichert, Small, & Mohanty revealed that 40% of participants to their survey reported odour and unattractiveness as the most severe nuisance while 35 % reported about the toxic water runoff and methane gas emission.

On the socio-economic context, study conducted by Akinjare & Ayedun et al. (2011), concluded that landfills have a negative impact of 5.5% - 7.3% of market value depending on the distance to landfills. The study established that all residential property values increased with the distance away from landfill sites at an average of 6%. Ready, (2005) performed a meta-analysis that included all available hedonic price studies of the impact of landfills on nearby property values. It showed that landfills that accept high volumes of waste (500 tons per day or more) depresses the value of an adjacent property by 12.9% while a low volume landfill depresses this value only by 2.5%. Furthermore, occupation and requirement of the enormous space for landfills contribute to land scarcity for the development of human society and eco systems. Similarly, a recent WHO report suggested that any potential exposure is likely to be limited to 1 km from landfill sites by the air pathway, and 2 km by the water pathway (WHO, 2000). The buyer of any house around a landfill area will presumably be less risk averse than the seller, and will be prepared to accept a modicum of risk in return for paying a lower price (Rachel A. B et al, 2000). On a larger scale, if the entire community feels that the landfill poses a threat, housing prices in the community as a whole potentially may decrease which in turn translates to a lower tax base and eventually leads to a lower level of services in such areas.

2.3 Benefits of landfill site to residents

Despite the enormous health and environmental effects of landfill site to inhabitants around, it offers some form of benefits. For instance, in Olusosun, the site has been described as a “blessing” for some group of people because it is considered the most economically feasible option from the point of view of costs and level of environmental impacts (see figure 2). One group of people who also derive their livelihood from dumpsites are the scavengers. Scavenging is the uncontrolled picking through waste to recover useful items although, their activity is still considered illegal by LAWMA. In most cases, scavenging is done by either people who live close to the dump site or people who have moved to settle in makeshift tents near the dump and earn their livelihood through the sale of recyclable materials. Scavengers therefore play an important role since they collect reusable and recyclable materials, increasing the longevity of the dumpsite and thereby reducing the pressure on urban land use (Adu-Boahen, 2012).

Scavenging has been and still is a common activity that takes place in the informal sector in many developing countries although in some developed countries like Nigeria, it is strictly prohibited (Oduro, 2004). Scavenging for plastic wastes and scrap metals have become a lucrative business for many residents at Olusosun and the surrounding communities as a result of the monetary incentives that come along with it (Owusu-Sekyere et al., 2013b). Several companies have been established around the area, to recycle plastic wastes and scrap metals and they depend largely on scavengers for raw materials. As the case may be, scavenging is unavoidable at dump sites/landfill sites in developing countries and therefore should be rather organized as an auxiliary activity. For aesthetic reasons, scavenging can be confined to a specific area of the waste dump facility so that they do not interfere with normal operations going on in the landfill site. Most people around the Olusosun dumpsite obtain certain economic benefits from the dumpsite and considered the site as beneficial to their livelihood. The major

benefit found here is scavenging. Majority of the residents indicated that they have seen many people pick items (mostly plastics and metals) from the dumpsite. Here, substantial numbers of the scavengers are males who earn an average daily income of ₦600 and ₦1,000 from plastic and metal items respectively picked from the dumpsite.

2.4 Conceptual framework

The cogent problem this study sought to address was to investigate the implications of residential buildings in proximate distance to landfill site. Here, there is need to ascertain the reason(s) why people choose to live very close to dumpsites regardless of the numerous environmental and health implications they experience. Conceptually, this research sought the theoretical foundation for the study and based it on environmental stress and coping theory (Lazarus & Folkman, 1984) as identified by Olorunfemi, (2009). It has been argued that the environmental stress and coping literature is closely connected to the risk perception literature vis-à-vis the mechanisms (i.e. perceptual processes) used to appraise the threats involved (Taylor et al. 1993).

Psychosocial impacts research focused on psychosocial impacts of exposure to environmental contaminants (Elliott & Taylor, 1996). The scope of such research is based on: (a) the awareness and prevalence of psychosocial impacts of exposure; (b) the relative absence of theory and empirical evidence to explain their determinants; and (c) uncertainty as to ways to intervene to effectively reduce their adverse effects on individual and community wellbeing. While past researches has concentrated mainly on the physical health effects of exposure to environmental contaminants (e.g. cancer and adverse reproductive outcomes), increasing attention is now being turned to the psychosocial impacts of exposure defined as a complex of distress, dysfunction and disability manifested in a wide range of psychological, social and behavioural outcomes, as a consequence of actual or perceived environmental contamination (Baum et al. 1985; Elliott, 1998).

On the other hand, Baumann et al, (1985) define environmental stress as "a process by which environmental events threaten, harm or challenge an organism existence or wellbeing and by which the organism responds to this threat". A useful psychosocial model of response to environmental stress is that provided by Lazarus & Folkman (1984). It contends that response to environmental stress is divided into two stages: primary appraisal, whereby the individual perceives an environmental stressor as a threat, harm, or a challenge; and secondary appraisal, whereby one of two coping strategies is selected:

i. Problem-focused coping (e.g. joining citizens action group); or
ii. Emotion-focused coping (e.g. adjusting attitudes towards the stressor).

The occurrence of environmental stress is the experience of psychological effects, and the choice of coping response are dependent upon four types of mediating factors, relating to the stressor (Evans & Jacobs, 1982, Sims & Baumann, 1983), the individual (Evans & Jacobs, 1982; Sims & Baumann, 1983), the social network (Edelstein, 1988), and the wider community system (Edelstein, 1988). In addition, it involves an interactive process whereby the mediating factors not only influence psychological effects and responses but also each other. Psychological reactions to environmental contamination and in this case to waste disposal facilities have been found to occur within community systems (Elliott et al, 1993). They are socially and culturally mediated in complex ways which are to some degree unique to the particular study setting.

Table 1: Health risks for waste pickers and communities

Risks to Waste Pickers

Informal waste pickers, who most often operate without any protective measures, are exposed to a wide range of health risks such as:

- HIV (due to handling of hospital waste)
- Tetanus (due to handling of jagged metals)
- Respiratory problems (due to exposure to smoke)
- Neural damage (due to lead)
- Injuries
- Premature drinking
- Stress
- Skin and gastric problems

Risks to the Communities

- There is a significant increase in the incidence of sickness among children who live in households where garbage is dumped or burned in the yard.
- Uncollected solid waste clogs drain and causes flooding and subsequent water-borne diseases.
- People living downwind of a burning dumpsite will likely suffer from respiratory diseases.
- Contaminated liquids or leachate, leaking from dumpsite could pollute city's drinking water supplies.
- Waste dumps potentially serve as breeding ground for Malaria, thus having implications in achieving Millennium Development Goals (MDGs).

Source: Gunn, (2009), UN-HABITAT (2009), with modifications

3. Materials and Methods

There are more than one thousand (1,000) dwelling units in the whole of Olusosun community generally. However, for the purpose of this study, focus was on the household heads/landlords of residential buildings in the study area. Precisely, the population of Olusosun community according to National Population Census (NPC), 1991; in the report on community infrastructure upgrading programme for metropolitan Lagos by Agboola & Agunbiade, (1995) was Five thousand one hundred and four (5,104). The population was projected to the present year (2018) using the annual growth rate of 3.2% for Lagos state (Lagos State Bureau of Statistics, 2016). Presently, Olusosun community has the population of about 11,947. Therefore, the target population for this study is the present population (projected figure) of Olusosun community which is 11,947.

The sample frame includes the affected residents (households) within 200-500 metres radius of the landfill site, precisely residents in Olatunji Street, Alhaji Abayomi Adelaja Drive and Pacific Close were targeted for the survey. The reason for this was because the chosen areas were in close proximity with the landfill site and also part of the highly populated areas of Olusosun community. Others sampled for this study include: LAWMA Officers, Scavengers and the Cart-pushers. Importantly, in order to establish a robust research results, the researcher targeted the household heads in each residential building. However, as posited by Fasakin, (2000), in Nigeria, the minimum number of people that makes up a household in high density neighbourhood is seven (7). Therefore, from the present population of Olusosun (11,947) divided by the minimum number of household of seven (7), which equals to 1,707 households. Thus, the sample frame for this study is 1,707 households in Olusosun community. Hence, 5% was taken from the total household heads (1,707) in the study area, totalling eighty-five (85). The sample size formed the number of questionnaires administered for this research survey.

The purposive and stratified random sampling method was adopted in carrying out the research survey. Here, Olusosun community was divided into three (3) strata by the researcher using distance from the dumpsite and population. These strata include; Alhaji Abayomi Adelaja Drive, Pacific Close and Olatunji Street. Precisely, seventy-five (75) questionnaires were equally divided amongst the three (3) neighbourhoods. Precisely, twenty-five (25) questionnaires each were administered to the respondents in Alhaji Abayomi Adelaja Drive, Pacific Close and Olatunji Street. While the remaining ten (10) questionnaires were administered to: LAWMA Officers (two questionnaires), Scavengers (four questionnaires) and Cart Pushers (four questionnaires). In all, eighty-five (85) questionnaires were administered for the purpose of this study. Consequently, eighty-two (82) questionnaires were retrieved from the respondents, out of the total eighty-five (85) structured questionnaires administered. The retrieved number of questionnaires formed the basis for the survey analysis.

Therefore, the probability method was adopted in administering the questionnaires to the sampled respondents,

since the target population for this research study exist in different categories of heterogeneous units. As earlier mentioned, the probabilistic sampling technique (stratified random sampling) was adopted using 3% interval. Thus, questionnaires were administered to the household heads/landlords in the 3rd, 6th, 9th, 12th and so on to the last (nth) building. The modality employed for picking the first building to be sampled is by beginning the survey from the Baale's Palace (Traditional ruler).

4. Results and Discussion

This study sought to examine the phenomenon of residential buildings in close proximity to the Olusosun landfill site in Ojota area of Lagos state. As stated earlier, the study adopted both the quantitative and qualitative methodologies to obtain the primary data. First, the quantitative approach of the survey was conducted through structured questionnaire administering to the household heads (landlords) of residential buildings as well as to the LAWMA Officers, Scavengers and Cart pushers who were affected by activities of the landfill in the study area. Secondly, the qualitative approach involved an in-depth interview of some LAWMA Officers, Scavengers and Cart pusher. Some of the Landlords and Squatters were also engaged in focus group discussions.

4.1 Questionnaires retrieval

The table below revealed the summary of analysis on how the questionnaires were administered and retrieved from the respondents. Out of the eighty-five (85) questionnaires administered to the respondents of the study area. 25 questionnaires were administered equally to the residents of Olatunji Street, Alhaji Abayomi Adelaja Drive and Pacific Close. On the other hand, only 2 questionnaires were administered to the LAWMA Officers, while 4 questionnaires each were administered to the scavengers and cart pushers respectively. On the retrieval level of questionnaires, 25, 24 and 24 questionnaires were retrieved from the residents of Olatunji Street, Pacific Close and Alhaji Abayomi Adelaja Drive, respectively. Generally, the percentage of questionnaires retrieved from the respondents was 96.5%. This clearly indicates that the percentage of questionnaires that were retrieved back from the respondents was considerably high.

Table 2: Questionnaires retrieval survey

Sampled Areas	No. Adm.	No. Retrieved	Percentage
Olatunji Street	25	25	100
Pacific Close	25	24	96
Alhaji Abayomi Drive	25	24	96
LAWMA Officers	2	1	50
Scavengers	4	4	100
Cart-Pushers	4	4	100
Total	**85**	**82**	**96.5**

Source: Field Survey, 2018

4.2 The socio-demographic characteristics of respondents

The socio-demographic analysis of the sampled respondents shows that majority of them were artisans and traders. However, on their income level, most of the sampled respondents (50%) indicated that they earn between ₦18,000 - ₦25,000 monthly. This simply means that most of the sampled respondents in the community are considerably low income earners. Also, education was found to be a significant factor influencing the occupation of the resident. Most of the respondents were secondary school leavers. Similarly, substantial percentage of the respondents was living within 301 – 400 metres from the dumpsite, where they had lived in community for more than 10 years.

4.3 Reasons for living close to the dumpsite

The results show that some of the respondents were living in the study area before the place was turned into a dumpsite, while others came to stay after the area has been turned into a dumpsite. Interestingly, 57.3% of the respondents were staying in the vicinity before the place was converted into a dumpsite. The remaining 42.7% came to live in the area having a prior knowledge that it was close to a landfill site. The main reasons given by

those who relocated to settle close after the place has been turned to a dumpsite was that accommodation is affordable in the area, the place is close to their place of work, and that they are living there on a temporary basis. Other reason was that they had their house/land there before the place was turned into a dumpsite and they were born there.

The analysis on the gender distribution revealed that the men folk constituted a large percentage of the scavengers, and cart pushers who also reside almost on the landfill site. Majority of the respondents (70.7%), feel very uncomfortable living close to the dumpsite due to the effects of the dumpsite on their lives and that of other members of their household. But as low as 14.6% respondents also indicated that they feel comfortable and these are those who live a bit far away from the dumpsite. This is probably because the place is close to their place of work and they are not much affected by the dumpsite. Due to the effects of the dumpsite on the livelihood of the residents, majority of the residents (especially those living close to the dumpsite) have intentions to leave in the future if nothing is done about it.

4.4 Benefits of the dumpsite

Despite the complaints about the effect of the dumpsite on the livelihood of residents around, the findings revealed that residents around the dumpsite obtain a certain benefit from the dumpsite, majorly scavenging. Majority of the respondents indicated that they have seen many people pick items (plastics and metals) from the dumpsite. A large percentage of people who scavenge for items from the landfill clearly show the lucrative nature of scavenging to people. 61% respondents stated that, at least below ₦2,000 was earned on a daily basis for scavenged items. Usually, money is paid in exchange for scavenged materials, depending on the weight (kilogram). Precisely, about ₦60 and ₦100 is paid per kilogram for plastic and metal items respectively.

Figure 2: The activities of some of the cart pushers and scavengers on Olusosun dumpsite
Source: Field work, 2018

4.5 Risks associated with living close to landfill

Although, the dumpsite is profitable to the livelihood of some of the residents and even non-community residents, more than half of the respondents (54.9%) indicated that the dumpsite is a threat to the community as its activities severely affect them. In addition, they noted that they feel threaten living close to the dumpsite. The issues that were cited as putting their health at risk were pollution of the air due to smoke, fire, and odour from the landfill site and the presence of mosquitoes and other infectious insects. Other health hazards were contamination of water bodies due to leachate from the site, the presence of reptiles such as snakes and the contamination of food items as a result of disease carrying vectors.

Figure 3: Environmental nuisance caused by tick and hazardous smoke emanating from the Olusosun dumpsite leading to serious air pollution

Source: Field work, 2018

Due to several hazards that are associated with the dumpsite, there are some common sicknesses that were attributed to the presence of the landfill. The commonest amongst them was malaria, typhoid and cholera which are very prevalent in the community. Respiratory diseases, diarrhoea and cardiovascular diseases were other disease attributed to living close the dumpsite. 30.5% of the respondents indicated that a member of their household or themselves have been a victim of these sickness (especially typhoid fever). However, with the view to evaluate the current status of seeking medical attention by respondents, almost equal proportion percentage indicated that they fall sick either once in every month or above three months.

An assessment of the extent to which residents were affected by the dumpsite indicated that certain environmental nuisances such as odour from the site, pest (flies, vermin etc.), fire and smoke, poisonous gases, and litter or rubbish from the landfill severely affect the livelihoods of the residents. Also, the study sought the perceptions of the respondents as to the implication of the landfill on their buildings and the community at large. The analysis revealed several planning implications associated with the proximity of landfill to residential buildings, these include: thermal discomfort, low rental value, poor aesthetic value, poor socio-economic value etc. while on the community scale, the several implications include: impediments to the provision of basic infrastructures, depreciated environmental beauty, health and environmental impacts etc.

4.6 Condition of residential buildings close to landfill area

There are existing building types around Olusosun Landfill. These buildings are mainly mixed development (industrial, residential and commercial). The highways and primary routes surrounding these buildings give them access to the local routes. Most residential buildings that are closer to the landfill are shack type informal structures but as development moves away from the landfill, they are higher in quality and standard. This survey was achieved using a check list to rate the condition of buildings in the study area. However, 37.8% and 34.1% buildings fell under the buildings in fair and good condition respectively. As low as 12.2% of the buildings were in a very good condition, while 9.8% buildings were in poor condition, lastly 6.1% of the buildings were in a very poor condition. This simply pointed to the fact that most of the buildings in the study area were in fair condition as the presence of landfill may have negative effect on the physical condition of buildings on a long term basis.

The study was able to establish the fact that the effects of landfill on building condition may not be immediate and its impact is subject to distance and size of such landfill site. These effects occur due to the percolation of leachate into the soil and high concentration of landfill gas (methane) in the atmosphere, consequently leading to explosion and causing instability in foundation of building which eventually result to gradual weakening of building material/components, thus structural failure may occur.

Figure 4: A cross-section of substandard residential buildings in unhygienic environment around the Olusosun dumpsite
Source: Field work, 2018

4.7 Measures to mitigate the challenges residents experienced living near the dumpsite

One of the interviewed officers of Lagos State Waste Management Authority (LAWMA) confirmed that the residents have been facing many challenges, especially those who live close to the dumpsite. This was because the site is not an engineered site and therefore makes it difficult to effectively manage it. Overtime, some of the measures LAWMA had put in place, especially to curb and eradicate the problems posed by Olusosun landfill include; increasing the number of equipment and labour force, educating periodically the scavengers and those whose livelihood depends on the dumpsite on certain safety measures to prevent any form of accidents, organizing a working committee comprising the community representatives and LAWMA officers to brainstorm on the solution to the problem. All these efforts have not fully achieved the desired output for an effective sustainable solution. Due to the increase of residential buildings around the site, and the continuous health and environmental threat; the site can be relocated (site reclamation) to the outskirt area of the city. Also, as a means of reducing the impacts of smokes and odours, proper spraying should be done frequently on the site, the landfill should be fully upgraded to an engineered landfill.

4.8 The relationship between the proximity of landfill site and the condition of residential buildings in the study area.

Statement of Hypothesis:

There is no significant relationship between the proximity of landfill site and the condition of residential buildings in the study area.

Table 3: Distance of residential building to landfill site * Do you agree the landfill has any implication on your building condition? (Crosstabs Analysis)

		Do you agree the landfill has any implication on your building condition?					Total
		Strongly Disagree	Disagree	Undecided	Agreed	Strongly Agreed	
Distance of residential building to landfill site	Less than 100 metres	0	3	0	5	4	12
	101 – 200 metres	1	2	1	3	3	10
	201 – 300 metres	0	2	2	6	6	16
	301 – 400 metres	1	5	2	6	9	23
	Above 401 metres	1	4	3	5	8	21
Total		3	16	8	25	30	82

Table 4: Chi-Square Tests Analysis

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	6.051[a]	16	.988
Likelihood Ratio	7.831	16	.954
Linear-by-Linear Association	.014	1	.906
N of Valid Cases	82		

a. 20 cells (80.0%) have expected count less than 5. The minimum expected count is .37.

- **Decision rule**

Since the calculated value i.e. the p – value is greater than the chosen significance level i.e. alpha value ($\alpha = 0.05$), then the null hypothesis is not rejected. Rather, it can be concluded that there is no enough evidence to suggest an association between distance of landfill to residential buildings and building conditions. Thus, based on these results, it can be stated as follows:

- The test statistics showed that at 0.05 level of significance (X^2 cal. = 6.051, X^2 tab. = 0.988). The test concluded that there is no significant relationship between the proximity of landfill site and the condition of residential buildings in the study area.
- The two variables were interdependent of each other and there was no significant statistical relationship between these categorical variables.

5. Conclusion and recommendation

The findings from this study suggest that, living conditions in Olusosun landfill is characterised with environmental injustice resulting from dumping of household and industrial waste, poverty and poor housing that lack proper public infrastructure. Also, it is evident from the findings that there are multi-faceted reasons why people are found living close to dumpsite. The study revealed that, people had settled in the community before the place was turned into a dumpsite. Others had already purchased their lands therefore before the place was turned into a dumpsite and other settle there because it is close to their places of work. Despite all these reason, the study has also clearly shown that the Olusosun landfill site is posing significant threat to the environment and health of the residents including the condition of buildings in the area, which is largely due to the improper management of the site. The number of people recently living close to the landfill is increasing and this calls for proactive measures to be taken, else in the next few years, the situation will turn out to be an outbreak of endemic with high casualties. However, the present condition of the Olusosun landfills and elsewhere in Lagos state has resulted to an eyesore that needed urgent attention.

The study, however posits that residential developments are viewed as a strategic land use for stimulating socio-economic growth, while at the same time improving the living conditions of the residents, then the siting and management of landfills needed a more serious level of attention. In a recent development, due to the hazardous nature of the landfill site to the community, the state government ordered for the site to be shut down due to the inferno that occurred on the site recently, destroying properties worth millions of Naira. However, plans to rehabilitate the landfill site into park is on the way and this will include harnessing the methane emission from the site as an alternative energy source for the city and improve the country's electricity shortage. However, with the view to reduce these possible risks residents living close to the dumpsite are exposed to; below are the recommendations made:

i. ***Proper monitoring and robust waste management strategies:*** It is evident from the research findings that the bane of poor waste management in Lagos state is the absence of proper waste management and monitoring mechanisms to check and coordinate solid waste generation, collection and disposal. In view of this, LAWMA should fully exercise its monitoring and sanctioning roles adequately through a systematic process of checking, observing, inspecting, regulating or otherwise controlling key parameters and characteristic activities at the dumpsite to ensure compliance with specific standards or other performance requirements to measure progress toward reduction of health and environmental risks.

ii. ***Social inclusion:*** Resource recovery should rely heavily on informal workers on the landfill site, who collect, sort, and recycle 15% – 20% of generated waste. Waste management projects should target and address waste picker livelihoods through strategies such as integration into the formal system, as well as the provision of safe working conditions, social safety networks, child labour restrictions, and education.

iii. ***Promote health and safety:*** Government should look into municipal waste management to improve public health and livelihoods of people (especially those whose livelihoods depend on the landfill site) by reducing open burning, mitigating pest and disease vector spread, and preventing crime and violence which is most common in the study areas.

iv. ***Harnessing other waste disposal methods:*** Consideration for the use of other methods of waste disposal such as waste reduction strategies. Reduction strategies use food waste and other organic components of waste to generate compost for use in agriculture and incineration.

v. ***Providing legal structures and institutions on waste management:*** Provision of a sound policy measures and coordinated institutions for municipal waste management sector, whereby government introduces market instrument where necessary, to widen the polluter pays principle in waste management where waste generators are made to pay for the disposal cost of the waste they generate by volume in the municipality. This will be a very useful waste management mechanism which when properly applied can generate sustainable funds while creating economic incentives for waste minimization at source.

vi. ***Citizen engagement:*** Behavioural change and public participation is key to functional waste management system. LAWMA should support incentives and awareness systems to motivate waste reduction, source-separation and reuse which can be achieved through a vigorous campaign for waste segregation at source. Since reusable or recyclable items are not waste and can be used repeatedly before discarding. This can commence with institutions such as educational institutions, government agencies and ministries, and in offices.

vii. ***Climate change mitigation and safeguarding the environment:*** LAWMA should ensure environmentally sound waste disposal system to support greenhouse gas mitigation through food loss and waste reduction, organic waste diversion, and the adoption of disposal technologies that capture biogas and landfill gas. Waste Management projects should also support resilience by reducing waste disposal in waterways and safeguarding infrastructure against flooding, which is more pronounced in Lagos state especially during the raining season.

viii. ***Increase awareness:*** Government at all levels (federal, state and local government authority) should make full use of the media (print and electronic) to intensify the awareness and education on environmental cleanliness. Forums and public lectures should be organized for identifiable stakeholder groups to increase awareness on the health hazards associated with poor solid waste disposal.

ix. ***Providing support infrastructure:*** The Government should provide capital investments to build or upgrade infrastructures for waste management system, such as; waste sorting and treatment facilities, close dumps, construct or refurbish landfills, and provide bins, dumpsters, trucks, and transfer stations through LAWMA. As a matter of urgency, government should take necessary steps to ensure the construction of a sump for leachate collection which can be harnessed for other valuable use.

x. ***Adequate funding:*** serious attention should be given to waste management through adequate funding because of the complex problems associated with it. Therefore, with a bid to totally eradicate the problems associated with the study area, the state government should adequately fund the agency saddled with the responsibility of managing solid waste in the state (LAWMA) to construct an engineered sanitary landfill somewhere at the outskirt of the city and reclaim the Olusosun landfill site for other beneficial development. This will ensure a sustainable solution to the persisted problems peculiar to Olusosun landfill site.

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