

Environmental Crises in Government-controlled Municipal Solid Waste Management in Rivers State, Nigeria

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Abstract

This paper investigated and evaluated the crises that rocked municipal solid waste management (MSWM) in Port Harcourt, the capital city of Rivers State, Nigeria, as the State transitioned from one governmental regime to another in 2015. The city witnessed unprecedented increase in waste heaps at every nook and cranny, that were unattended to for a relatively long time. The investigation used field data and literature information from various stakeholders, including personal interviews and participant observations. Field reports and interview responses were analysed using simple mathematical relations and global best environmental practices. It was found that overbearing political interests and deficiency of funds elicited the crises. The critical aspects of MSWM in the metropolis are undertaken by contractors who depend almost entirely on government funding, making the processes not self-sustaining, hence a transitional defect in the State jolted the stability of the MSWM fabric. The existing practice of simply collecting waste from streets and disposing has not encouraged self-funding for the waste management sector. Formulation and implementation of appropriate policies and creation of incentives for green management; and introduction of friendly advance disposal fees may be feasible options in the solution to the challenges of MSWM in the metropolis.

Keywords: Environmental crises, municipal solid waste, political interest, government-controlled, transition

1. Introduction

The subject of the management of municipal solid waste (MSW) in Port Harcourt metropolis, Nigeria has featured prominently at various times in several national and international discourses, to the point of wearying readers and even publishers of journals. What is there to be said more about it? Ayotamuno and Gobo (2004) had lamented the poor management of the MSW in the city, leading to an imposing filthiness that was hitherto unknown to it and, thereby, converting the otherwise 'garden city' into a 'garbage city'. Igoni (2006) and Igoni et al (2007) have characterized the MSW in Port Harcourt and enumerated the dangers associated with improperly managed MSW in the metropolis. Agwu (2012) investigated the influence of the background of residents in Port Harcourt on their disposition towards MSW management. He found that, despite the knowledge of the individuals about the adverse effects of the waste on their environment, they displayed poor waste management habits, influenced by their sex, social class and age. Tamunobereton-ari et al (2012) also observed the poor management of the MSW and especially its effect on public health and the environment. Very recently, Igoni (2016) decried the unsatisfactory approach to managing the MSW in the city; that, in spite of the huge waste load generated in the metropolis, which he puts at 1,947 tonnes per day for a per capita waste generation rate of 1.11 kg/day, the management of the waste is at best a mere collection and disposal of the waste, which are also improperly done. So, obviously, so much has been done and said about this matter in research space, but so little has changed, if anything at all. This is easily attributable to ineffective synergy between research developments and prescription and practical implementation.

Municipal Solid Waste essentially refers to different kinds of non-flowing waste originated in a municipality, exclusive of hazardous wastes. Its sources include household and office, markets or generally commercial centres, construction and demolition debris as well as non-hazardous industrial waste. Conventional management of MSW involves a systematic procedure for the effective collection, transport, processing and final disposal of the MSW using the best environmentally practicable option. The generation of MSW all the world over has attained frightening levels, at an annual rate of 1.3 billion tonnes, with a projection of 2.2 billion tonnes by 2025 (Hoorweg and Bhada-Tata, 2012). This may not be unconnected with increasing populations, as, of course, it is the humans and their activities that generate the waste. For this reason, the management of MSW has taken centre stage globally in recent decades; and in spite of the numerous efforts, the situation does not seem to be abating, especially in developing countries. Khatib (2011), stated that population growth and urbanisation give rise to increased generation rates and complexity of MSW, putting pressure on existing waste management facilities. These, together with the attendant adverse effects of improperly managed MSW on public health and the environment, are some drivers for the continued desire to ensure safe and efficient management of this waste stream.

Many developed countries have employed advanced technologies such as incineration with energy recovery; sanitary landfilling; and more recently, anaerobic digestion; environmentally sound composting; and plasma gasification, as well as developed best practices for dealing with MSW (Ezeah and Roberts, 2012;

UNEP_GEAS, 2013). In contrast, many developing countries, including Nigeria, are still struggling to come up with measures and technologies to effectively handle their MSW. This has been attributed to a myriad of reasons including inadequate funding for waste management infrastructure, 'inappropriate' technology, lack of or ineffective implementation of government policies, behavioural patterns of the population, and lack of awareness (Adamu et al., 2014; Agunwamba, 1998; Agwu, 2012; and Ezeah and Roberts, 2012;).

In Nigeria, MSW management is still toddling. Many cities are yet to have any defined structure for handling MSW. In cities that do, operations are barely beyond deposition at roadsides, collection, transportation and disposal in borrow pits. Open dumping, dumping at sea and burning are still common place. The current structure in Port Harcourt is not any different from that described above; nonetheless, it reduces the volume of waste seen on the streets during the day.

Although the business of collection and disposal of MSW in Port Harcourt has been reported to be improperly executed, there was a period between May and June, 2015 when there was a complete breakdown in the management of MSW in Port Harcourt. The breakdown led to the abandonment of even the epileptic services of collection and disposal, resulting to massive accumulation of unprecedented heaps of the waste at every nook and cranny of the city. Virtually every road was impassable; drains were completely blocked; vehicular and human traffic impeded, with all the attendant adverse consequences on public health and environmental aesthetics. It is in this connection that this paper investigated and appraised the immediate and remote causes of such crises in the MSW management regime in the city, with a view to avoiding a recurrence. It is believed that this will not only enhance environmental quality, but be beneficial to the government and waste management agency in their overall planning and policy formulation for MSW management in the metropolis and indeed the state at large.

2. Materials and Methods

2.1 Description of Study Area

This study was carried out in Port Harcourt, the capital city of Rivers State, Nigeria. Port Harcourt is a coastal city that lies along the Bonny River in the southern geopolitical zone of Nigeria, otherwise called the Niger Delta region of Nigeria, with coordinates: 4° 49' 27" N 7° 2' 1" E (Wikipedia, 2016). Over time the centrality of Port Harcourt in the scheme of government's activities has continually extended its administrative boundaries. The main city of Port Harcourt is the Port Harcourt city in the Port Harcourt local government area, consisting of the former European quarters now called Old Government Reserved Area (Old GRA) and new layout areas. The Port Harcourt Urban Area (Port Harcourt metropolis) is made up of the city itself and parts of Obio-Akpor Local Government Area (Ogbonna et al, 2007). Currently, by statute of the state parliament, a Greater Port Harcourt urban area has been created to span over eight local government areas namely Eleme, Ikwerre, Obio-Akpor, Ogu-Bolo, Okrika, Oyigbo, Port Harcourt, and Tai. In this paper, Port Harcourt city would be considered as the entire urban Port Harcourt metropolis covered by the waste management agency. The locations covered consist of about four local government areas: Port Harcourt and Obio/Akpor as a whole and parts of Eleme (Akpajo). Figure 1 is a map of Port Harcourt metropolis, showing the areas covered in this study. The estimated population of these areas basing on the 2006 national census (Wikipedia, 2016b) at annual growth rate of 5% (Obinna et al, 2010) is 2,149,286; and an aggregate coverage area of 755km². They are comprised of private companies, government agencies and parastatals, several markets, supermarkets and shopping malls, schools and churches. In other words, it is a densely populated and highly commercial area with majority of the populace being civil servants, employees of private companies and business people. Port Harcourt is characterized by a tropical wet climate with long period of heavy rains and very short dry season. Only the months of December and January truly qualify as dry season months in the city (Wikipedia, 2016a).

As the capital city of a state that is part of the federating states in Nigeria, Port Harcourt metropolis is under the democratic governance of the Rivers State government. The city, called Port Harcourt City Council, is headed by a Mayor as the executive head, with twenty-two Councillors in the local legislative Assembly, except in times when elections have not been conducted and a caretaker committee is constituted to oversee the affairs of the Council, as presently obtains as at May, 2016. By statutory prescription, the responsibility for managing MSW in Nigeria falls within the purview of the council (Ogu, 2000), but because of the inability of the council to effectively and efficiently keep the city clean, and the metropolis being the face of the state, the state government took over the responsibility.

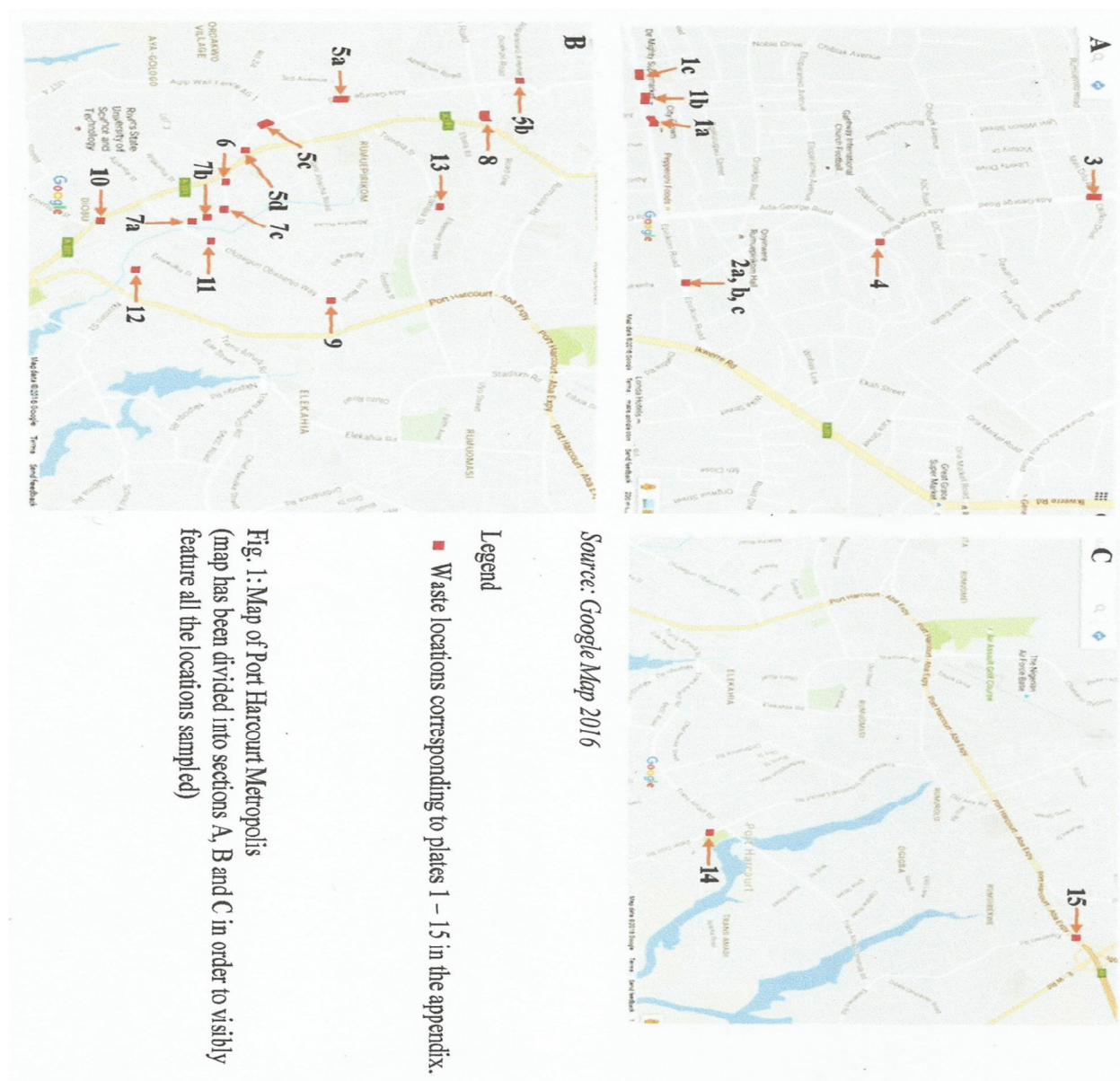


Fig. 1: Map of Port Harcourt Metropolis (map has been divided into sections A, B and C in order to visibly feature all the locations sampled)

2.2 Data Collection

Qualitative data for this study was obtained through primary and secondary sources. Primary data were obtained through participant observation and stakeholder interviews. Through these methods field information was obtained *in situ*: measurements and observational estimates were made; still photograph snapshots and video recordings were taken; extensive discussions were held with officials of government, especially in the Ministry of Environment, which is the unit responsible for formulating policies for regulating environmental activities in the state, and the agency in-charge of waste management in the state. Secondary data were obtained through literature and the website of the Rivers State Waste Management Agency (RIWAMA).

2.3 Estimation of Waste Load

A typical profile of the waste as discarded on the streets is presented in Fig. 2. Because of the irregular shape of the waste heap, Simpson's rule for the estimation of volumes (equation 1), as adapted by Igoni *et al* (2007), was used to estimate the volume of waste deposited in the areas presented in plates 1 – 15 in the Appendix. The area under the curve of the top profile of the waste bounded by two adjacent strips is approximated as a trapezoid and estimated using equation (2).

$$V_d = (d/3)(A_1 + 4A_2 + 2A_3 + \dots + 4A_{n-1} + A_n) \tag{1}$$

$$A = [(a + b)/2] \times h \tag{2}$$

Where: V_d - volume of waste discarded, m^3

A - cross sectional area between adjacent strips, m^2
d - distance between ordinates, m
n - total number of ordinates
a, b - lengths of parallel sides while, m
h - vertical distance between the parallel sides of the trapezoid, m

3.0 Results and Discussion

3.1 Structure of MSW management

Figure 2 shows the typical MSW management structure operational in Port Harcourt metropolis. The management of MSW within the metropolis is the responsibility of RIWAMA. The Agency was set up in line with the Rivers State Waste Management Law 2014, as a replacement for the Rivers State Environmental Sanitation Authority (RSESA). The major focus of the Agency is managing waste and sanitary habits of the populace with the aim of maintaining cleanliness within Port Harcourt and its environs (Tide Newspaper, 2014). The Agency employs the services of private waste contractors (called service providers) to collect and transport waste to final disposal sites. To do this effectively, the entire metropolis is sub-divided into zones, and respectively assigned to the various service providers. Currently there are thirty one zones respectively handled by thirty one service providers (www.riwama.com.ng), whose major qualification for recruitment is the possession of at least two compactors and some other sundry requirements. There are also service providers who are not necessarily assigned to zones but serve as contractors to mostly industries producing MSW, as well as some households who utilize their services, for a fee. However, these contractors are still required to formally register with the Agency to be so recognized.

In addition, RIWAMA is responsible for mapping out and management of designated final disposal sites, co-ordinating waste collection and general sanitation exercises, stipulating disposal times for waste generators and performing sundry duties pertaining to MSW management. The Agency retains some compactors and ancillary equipment for intervention works.

3.2 Current MSW management practices

The current practices associated with MSW management in Port Harcourt include deposition of the waste by its generators; and its collection, transportation and final disposal by the service providers, both the ones employed by the Agency and the private practitioners, and where required, by RIWAMA interventionist services (Fig. 3). RIWAMA requires MSW generators to bag their waste before deposition. There is no specification for the type of bag to be used, but there is a common black refuse polyethylene bag that is readily available in the market and also commonly used by some persons. However, because of cost, the refuse generators who bother to use bags, use any kind of bag. Since the wastes are not sorted and are deposited in their composite form, they contain sharp materials like bottles, wood and metals that easily pierce and tear the bags. Most other depositors do not even bother to bag the waste, especially when the official deposition time stipulated by the Agency is between 7.00pm and 12.00am daily, when it would have been sufficiently dark to shield any wrong doer; more so, neither the Agency nor its contractors has monitors to track defaulters.

The deposition of the waste is at roadsides and medians, as there are no formal and well-developed receptacles for that purpose. What obtains is that wastes are deposited indiscriminately at any location across the entire length of the roadside and median, without bothering whether there is any officially recognized location. In fact, the trend now is that as people begin to see pockets of waste building at any particular location along the road, those around that vicinity also begin to deposit theirs at that site and it becomes another roadside 'receptacle'. This is how majority, if not all, of the roadside deposition sites came into existence and gradually acquired official recognition, as the service providers would be constrained to identify such a place and evacuate the wastes. The Agency has a cogent reason why there are no receptacles for waste deposition. By the RIWAMA law, the service providers are supposed to collect the wastes from households, who would in turn pay for the services. But this is not operational at the moment and yet no receptacles. So, individuals do not pay any fee for waste management; except those who retain the services of private operators; and those who operate small businesses and shops that are made to pay sanitation fee and procure waste bin annually. Also property developers pay sanitation fee, as part of the property development surcharges. Industrial waste generators are responsible for the collection and disposal of the waste they generate. They are only required by the RIWAMA law, to use approved waste management companies for that purpose.

Service providers are responsible for collection, transportation and disposal of waste within their zones. Usually, they resume collection at 7:00 pm and are required by the Agency to ensure that by 6:00 am daily, all deposited waste in their zones has been collected, transported and disposed of at appropriate dumpsites. The timing of the Agency is to ensure that waste activities do not impinge on the daily activities of the citizenry, especially to guarantee free flow of traffic and avoid unsightliness of waste litters. This expectation had never materialized, as frequently the service providers continue well beyond 10.00am, at times into the afternoon.

Even the night work from 7.00pm, with big compactors covering a sizable portion of the road, without adequate lightings and caution signals/indicators portend so much of danger for road users.

There are four government approved disposal sites in Port Harcourt namely Rumuolumeni, Oyigbo, Igwuruta and Rukpokwu, where the service providers finally dispose of the collected waste. These disposal sites are disused borrow pits from where lateritic soil was excavated for road construction works. So, there is no disposal site that has been specially developed for that purpose; and, therefore, no engineered landfill. At the final disposal sites there are RIWAMA officials and dumpsite contractors who do the spreading and compaction of the wastes at the dumpsites. However, at the Oyigbo dumpsite some cover material is spread on the waste and compacted. There are individual scavengers at the different dumpsites picking mostly recyclables such as plastics and metals. Only used car tyres are officially collected separately for recycling.

3.3 *The MSW management crises*

Between mid-May and early June 2015, residents of Port Harcourt were faced with an inundation of MSW. Nearly every street and road in the city was filled with waste. The volume of waste on the streets attained unprecedented disastrous proportions. There was no evacuation of waste from the roads for upwards of three weeks; the whole city became a dumpsite with the associated stench and discomforts. The absence of receptacles and transfer stations became more obvious, as some roads were completely blocked to traffic, while others were partially blocked. Economic activities came to a near halt in the intensity of the traffic congestion that ensued. This was in addition to the un-estimated effect on public health and environmental quality. The development was a complete embarrassment to everyone, especially the new government that assumed office by the 29th of May, 2015. Plates 1 to 15 in the appendix are just a few of the sites that could be featured here for reason of space.

Table 1 shows the estimated waste load for each of the locations captured in plates 1 to 15. The waste density as discarded was taken as 171.4 kg/m³ as estimated by Igoni (2006). The extent of the waste loads, in length and height, could not be adequately captured on the ordinary still camera because of the excessive length of the waste. Plates 1a, b, and c constitute a long stretch of waste extending from City Crown Hotel to beyond Total Child Bus-stop along a popular major road, called Iwofe road, leading to so many institutions and organisations, including the Ignatius Ajuru University of Education. The waste length was over 300m with height that varied from 0.3m to 1.2m and covered the entire 1.2m width of the road median, with some extensions into the road. Actually, at some point more than three-quarter of one carriage of the road was blocked, but that photograph was lost to damaged camera. From Table 1, at a per capita generation of 1.11 kg/day, for plate 1a, it implies that approximately 4,076 residents deposit their waste within that stretch of the road. At this rate, after 16 days (15/05/2015 – 04/06/2015), the waste load should amount to 72,399.36 kg. However, the estimated waste load for 1b and 1c amounts to 35,845.62 kg, meaning that only an average 2, 347.11 kg of waste was collected per day following the skeletal services provided by the remaining service providers.

Plates 2a, b, and c are somewhat dramatic. This site was monitored regularly as the waste load progressed from one level to another; unfortunately, there is not enough space to feature the progression in the daily increase of the heap. Plate 2a is when the waste heap had blocked about 6m of the 7.2m Elioparanwo road and extended into, and blocked up to half of the major Iwofe road. The average height of the waste was about 1m, covering a length of about 15m. Plate 2b shows vehicles competing to use the remaining portion of the road as access, while Plate 2c is when the waste heap was being burnt by residents, who by this time were frustrated by the mountainous level of the waste and the associated inconveniences. The waste heap in Plate 3 was along the popular Ada George road by Okilton junction. It was in upwards of 50m in length, 3m width and 0.8m height. Plate 4 is waste heap blocking Ikeguru Street, a major by-pass leading from Ada George road through Kala road to Ikwerre road, a major six-lane dual carriage road. Plates 5a, b, c and d show waste heaps at various points on the entire stretch of the Median on Ada George road from the NTA, Mgbuoba road junction to the Ikwerre road end, a distance of about 4.5km. Again these are just typical locations.

As can be noticed, the waste heap in Plate 6 had begun to ooze out offensive odours that irritated passers-by. It was located at Ikwerre road by Mile 3 building materials shops opposite the roundabout in front of the Rivers State University of Science and Technology. It got to a height of about 1m, length of about 8m and covered about 3.5m of one carriage way of the dual carriage 'building materials' road. Still at the Mile 3 axis, Plates 7a, b and c show a long stretch of over 200m of waste heap on the median of building materials road by Ikoku/Olu-Obasanjo road. This got to a height of about 1.2m and covered the entire 1.2m width of the median. Plates 8 to 15 are different locations of waste heaps in the city, ranging from the populous Diobu area to the low-density GRA, Trans-Amadi Industrial Layout and outskirts of the city at Aba road. These are all strategic city centres. There are yet many other locations that could not be featured here. The whole of the metropolis was literally covered by waste heaps. Table 1 shows MSW load for the various locations.

Table 1: MSW load for the locations captured in Plates 1 – 15 in the Appendix.

Plate Number	Location	Date of capture	Volume of MSW (m ³)	Waste load (kg)
1a	Along Epirikom (Iwofe) road, by City Crown Hotel.	12/05/2015	26.4	4,524.96
1b	Along Epirikom (Iwofe) road, from City Crown Hotel up to Salvation Ministries.	04/06/2015	203.30	34,845.62
1c	Along Epirikom (Iwofe) road, beyond Salvation Ministries up to Total Child junction.			
2a	Elioparanwo Community road entrance	04/06/2015	26.67	4,571.24
2b		07/06/2015	n/a	n/a
2c				
3	Along Ada George road,	02/06/2015	70.83	12,140.26
4	Ikeguru Street, by Ada George road	02/06/2015	5.20	891.28
5a	Along Ada George road	02/06/2015	207.67	35,594.64
5b	Along Ada George road, by Elioparanwo Avenue	29/05/2015		
5c	Along Ada George road, by Agip junction	04/06/2015		
5d	Along Ada George road, by Ikwerre road	29/06/2015		
6	Building materials road, opposite RSUST roundabout, by Ikwerre road, Mile 3 Diobu.	03/06/2015	24.00	4113.60
7a	Building materials road by Ikoku/Olu- Obasanjo road.	05/06/2015	161.33	27,651.96
7b				
7c				
8	Epirikom (Iwofe) road, by Ikwerre road junction.	02/06/2015	3.64	623.90
9	Olu-Obasanjo road, by Evo road junction	29/05/2015	8.58	1,470.61
10	Ikwerre road by Emenike junction, Diobu.	15/05/2015	0.72	123.41
11	Olu-Obasanjo road, opposite the Divisional Police Headquarters.	05/06/2015	10.62	1,820.27
12	Kaduna street, beside Winners Chapel, D/line.	05/06/2015	14.39	2,466.45
13	Tombia street/Diriyai street, New GRA.	29/05/2015	5.95	1,019.83
14	Peter Odili Road, by Zoo roundabout, Trans Amadi.	16/05/2015	4.14	709.60
15	Aba/Port Harcourt express way, after Eleme Junction.	07/06/2015	5.85	1,002.69
Total			779.29	133,570.32

The development seemed to have been engendered by service providers who could no longer perform their duties because of continued indebtedness by the state government for upwards of about four months. Prior to this time most of the service providers had operated with loans from banks on the promise by government that they would be paid; but up until the twilight of the outgoing administration towards the end of May there didn't seem to be any hope in sight. So, by this time most of the service providers were unable to fund their operations as they already had huge debts burden. For instance, a compactor cost about N40,000.00 to hire per day; so, if a contractor who was already in debt needed to continue his work with about six compactors, he would have needed a minimum of N240,000.00 daily in addition to fuelling, repairs, staff and other ancillary payments. On the overall, only an insignificantly few service providers could continue working, but as would be expected, their collection efficiency was as insignificant as their number, compared to the generation rates. Under normal circumstances, when all the contractors worked at all times, they had not been able to cope with the rate of generation/deposition. So, what this situation amounted to is imaginable.

Evidently, the new government inherited a 'garbage' city upon assumption of office on the 29th of May, 2015 and this led to the immediate appointment of a Sole Administrator and an Executive Director for RIWAMA. However, by this time the harsh economic realities in the country had begun to dawn on everybody, individuals and the state, especially just coming out from election expenditures. The state revenue had dwindled and government was not able to pay the outstanding debts immediately. This is in addition to the fact that government also needed to verify the claims of the service providers before paying any outstanding money. Therefore, the Sole Administrator resorted to appealing to the contractors to go back to work as they would be paid all outstanding debts, but some of the contractors complained of non-availability of funds to continue work. As a result of the non-compliance by some contractors with the Sole Administrator's directive to continue work, all the contracts with all service providers were terminated, also as political sabotage was suspected. Interested service providers were asked to come and register their services afresh. Upon re-registration some take-off funds were then released to the service providers which enabled them resume work. The resumption was quite epileptic, as some of the zones had to contend with using open trucks in the absence of compactors. This took us several years back when we had contended that with open trucks as waste transport vehicles, the waste is

substantially redistributed on the way to the dumpsite. However, all this is now history as, at least, normalcy has been restored

3.3 *Health and Environmental Impacts of the MSW management crisis*

The waste heaps were quite mountainous and pose varied health, safety and environmental hazards. Some social impacts of the crises are destruction of environmental aesthetics; blocking of drains; effusion of offensive odours, typically captured on Plate 6; invasion of the city by vultures, flies, mosquitoes, rats and cockroaches and obstruction of human and vehicular traffic, as evident on Plate 2. People who needed to cross over to the opposite side of roads had to trek several miles to get to a point where the waste would not pose threatening obstruction. This was energy-sapping and time-consuming. Leachate contamination of surface is a major environmental concern. Igoni *et al* (2008) and Babatunde *et al* (2013) had reported that MSW within the metropolis comprises of 67% and 65% organic component respectively. The heavy rains in the metropolis within the period under consideration (May – June) facilitates rapid degradation of the organic matter; and leachate formation and transport into surface and ground waters results in contamination of the receiving water bodies. Also, open burning of the waste releases emissions that are damaging to the atmosphere; cause respiratory diseases such as asthma and bronchitis in humans. Burning chlorinated waste at low temperatures as can be seen in Plate 2c releases toxins such as dioxins and furans which are carcinogenic.

It may not be known immediately how many persons may have had health issues arising from the filthiness of this waste management crisis. It is worthy of mention that the eventual outbreak of lassa fever in the city some few months after this incident may not be unconnected with this development and needs further investigation. Added to all these is that this waste accumulation was during the rainy season, so that the whole place was completely marshy, with the attendant microbial infestation and flooding of neighbourhoods.

3.4 *Analysis of the crises*

This crisis was predicated on the relationship between the service providers and government. For the four months of non-payment, the service providers believed the promise of the out-going administration, and possibly hoped that they would still be safe with a new administration, but became disillusioned by emergent political interplays. At the time, the leadership of the out-going administration, which was of a different political party from the incoming administration, was engaged in serious political altercation with that of the incoming. This probably sent wrong signals to the refuse contractors, who may have decided to tread gently and be a bit more cautious with their expenditure of funds. From this perspective, while lack of funds may subsist as a reason for abandoning their responsibilities, the issue of sabotage is also quite germane.

Politics has a huge influence on the structure and function of RIWAMA. Typically, the incumbent governor appoints a Sole Administrator of his/her choice, usually with political considerations. Similarly, the Sole Administrator would most likely engage the services of contractors for political patronage. Hence, considering the degree of antagonism between rival political parties (a situation where an out-going governor deliberately neglected to hand over the reins of government to the in-coming governor) it is most understandable the foot-dragging by the service providers recruited by the previous government. They had a mistrust for the system, given a seeming uncertainty about retaining their services and paying their debts

Henry, *et al* (2006) and Okot-Okumu (2012) opine that political interference in MSW management is a common phenomenon in Africa. But a sustainable MSWM system must endure successive socio-economic and political transitions (Igoni, 2015). Reports show that in many cases the responsibility of managing MSW is vested with urban waste management agencies (Athena Infonomics, 2012 and Okot-Okuma, 2012). In Nigeria generally, the management of MSW is statutorily vested on the Local Government Councils. However, the generation rates have overwhelmed these councils. Consequently, in many states of the federation, including Rivers, the state governments set up interventionist agencies to oversee the management of MSW especially in the metropolis within their states (Adamu *et al*, 2014; Amuda *et al*, 2014 ; Emelumadu *et al*, 2016; and Nzeadibe *et. al*, 2010). It is evident therefore, that the major source of funding for the management of MSW is the government.

Another contributory factor to the crisis is the inefficient and ineffective management structure for the MSW. Presently, a service provider only needs to have at least two compactor vehicle to be registered. The only job requirement is for service providers to go to the roadside dumps to collect the waste deposited and transport same to the designated final disposal sites. There is neither provision nor persuasion for service providers to undertake waste processing. The only MSW component collected separately for recycling are tyres. Every other waste stream goes to the final disposal sites which are merely borrow pits, not even originally intended for that purpose. Consequently, with delayed funds release from government, the daily collection of waste also stopped because the service providers are not oriented to generating funds from the waste management business.

Generally, the problem of adequate collection, processing and safe disposal of MSW has been a great challenge to many developing countries. In some cases, the government does not even appreciate inappropriate

management of MSW as a problem worth any serious attention. Some others who understand the magnitude of the problem and its implication rather use it as occasion expend public funds with minimal result. Anestina *et al* (2014) report that most of these countries spend between 20-50% of their annual budget and achieve only 20-80% of waste collection. This is why Igoni (2015) advised that waste management agencies/governments of developing countries should stop considering the business of waste management as a political goldmine. Yet there are those that have recognized the need to pay adequate attention to MSWM, but have genuine financial challenges and, therefore, unable to appropriate sufficient funds to address the MSWM problem, especially as the issue of waste management is usually on the lower rungs of the scale of preference in their budgets. All these are in addition to the high cost of MSW management infrastructure, lack of appropriate government policies, inaccurate records of generation rates and waste components, which make proper planning and investment in this sector difficult (Simelane and Mohee, 2012; UNEP_GEAS, 2013).

3.5 *Proposal for resolution of the crises*

It is possible that the cost of using sophisticated MSW management infrastructure may be directly unaffordable by most governments in developing countries, but with proper policies and an enabling environment that will attract investors and/or promote public private partnership (PPP), substantial progress could be achieved. A typical example is the South African case, as reported by Lincoln (2011), which has moved from merely collecting and disposal in landfills to employing the waste management hierarchy in managing its waste. Lincoln (2011) and Simelane and Mohee (2012) state that the key legislative driver for this South African success is the *Integrated Pollution and Waste Management Policy* and the *National Waste Management Strategy* established by the Department of Environment Affairs and Tourism in 1999 and 2000 respectively. Significant progress has been recorded so far, with provinces like Durban already generating electricity from landfill gas (Lincoln, 2011). Similar initiatives are also in place in India (Athena Infonomics, 2012). This PPP initiative aligns with the view of Amuda *et al* (2014), who also prescribes effective involvement of all tiers of government in the waste management venture.

The Rivers state government can take a cue from the South African example. Alternative sources of funds such as having waste generators pay for the waste they generate can be adopted. This can be achieved by some form of advanced waste disposal fees collected periodically by the waste management agency. By so doing, the system will not run entirely on government funds, thus shielding it from crises of this nature. In addition, there should be concerted efforts to make the entire MSW management system private sector driven rather than the present overdependence on the public sector. Igoni (2015) had said that the government should view and run the management of MSW as a business, with sincerity of purpose, instead of an avenue to make quick money and settle political loyalists. It is also important that the Agency facilitates the implementation of door to door collection of waste as prescribed in the law that set it up; this will forestall the incidence of waste littering the streets of the metropolis. Door to door practice has proved effective, achieving a success of over 50% in some other cities in Nigeria, like Lagos and Calabar (Iruuaga, 2012). There should be adequate and regular education and public enlightenment of the populace on the various programmes of government on waste management and the applicable extant laws. This is similar to the prescription by Igoni (2015). With appropriate policies, effective monitoring and implementation as well as incentives for greener waste management options, service providers will be encouraged to delve into other viable waste management options including recycling. This will attract investors and create much needed employment opportunities for locals in the waste sector. The role of the waste management agency should be more regulatory and supervisory.

4. Conclusion

This study reveals that the major cause of the municipal solid waste management crises experienced in Port Harcourt metropolis during the period of transition in government between May and June 2015 was unavailability of funds and lack of trust for the incoming government occasioned by the uncertainty of political developments. Most of the service providers were unable to cope with the financial burden of maintaining their staff and equipment without continued funding by the government, as the government was already greatly indebted to them. The situation was exacerbated by the fracas between the leaderships of both the outgoing and incoming governments, which unsettled the entire political landscape at the time and induced fear in the service providers, who then resorted to withdrawing their services; and the service providers being aligned to one political interest or the other. Also, lack of adequate infrastructure for effective collection and transport of the waste contributed to the crises. To prevent a recurrence, there should be an independent waste management body. Furthermore, measures such as introduction of advanced waste disposal fees, appropriate government policies and incentives for greener MSW management options should be explored

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Appendix

Snapshots of Waste Heaps on the Streets of Port Harcourt Metropolis



Plate 1a. Waste heap along Epirikom (Iwofe) road at City Crown Hotel



Plate 1b. Continuing waste heap from City Crown Hotel to Salvation Ministries Church



Plate 1c. Waste heap from City Crown continuing beyond Salvation Ministries



Plate 2a. Waste heap blocking Elioparianwo Community road entrance



Plate 2b. Waste heap at Elioparianwo road preventing vehicular access



Plate 2c. Waste heap at Elioparianwo road extending into Iwofe road being burnt by frustrated residents



Plate 3. Waste heap along Ada George road by Okilton junction



Plate 4. Waste heap blocking Ikeguru street, by Ada George road



Plate 5a. Waste heap on the median along Ada George road



Plate 5b. Continuing waste heap along Ada George by Elioparanwo



Plate 5c. Continuing waste heap along Ada George by Agip junction



Plate 5d. Waste heap on the median/road at Ada George by Ikwerre road



Plate 6. Waste heap at Mile 3 building material road opposite RSUST roundabout, by Ikwerre road



Plate 7a. Waste heap on Mile 3 building material road by Ikoku/Olu-Obasanjo road



Plate 7b. Continuing waste heap along Mile 3 building material road by Ikoku/Olu-Obasanjo road



Plate 7c. Continuing waste heap along Mile 3 building material road by Ikoku/Olu-Obasanjo road



Plate 8. Waste heap on the median along Iwofe road immediately by Ikwerre road junction



Plate 9. Waste heap along Olu-Obasanjo road by Evo road junction, New GRA



Plate 10. Waste on the median of Ikwerre road by Emenike junction, Diobu



Plate 11. Waste heap along Olu-Obasanjo road, opposite the Divisional Police Headquarters



Plate 12. Waste heap along Kaduna Street, beside Winners chapel, D/Line



Plate 13. Waste heap at Tombia Street/Diriyai Street, New GRA



Plate 14. Waste heap at the along Peter Odili road by Zoo roundabout, Trans-Amadi



Plate 15. Waste along Aba/Port Harcourt Expressway after Eleme junction