

Solid Waste Management in Port-Harcourt Municipality

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ABSTRACT: The current solid waste management practices in Port-Harcourt municipality was reviewed in association with the waste generators perception and involvement. This research was as a result of the absence of notable improvement in solid waste management over a period of 20 years. Waste generators, being the residents living in Port-Harcourt are often thought to be undisciplined, unresponsive and unresponsive to the government's and waste agencies' efforts to achieve optimal solid waste management. Thus, a cross sectional survey was conducted to find out if this was actually so. A total of 1000 questionnaires were distributed randomly at 14 different sample locations in Port-Harcourt municipality and 983 were successfully retrieved. Questionnaire validation was conducted through expert's assessment, pilot test and Cronbach's Alpha analysis (CA). CA analysis using SPSS for 85% of the questions raised in the pilot study was 0.89, which indicated a good internal consistency in the responses. Results indicated that 43% of the residents were actually satisfied concerning the waste services rendered to them, 62% were actively involved in assisting the government manage solid waste, and 55% of the residents were fully aware of the benefits of good solid waste management in their municipality. This clearly establishes the willingness of the residents in the municipality to work hand-in-hand with the government in curbing the menace of poor solid waste management. The onus therefore lies with the government and waste agencies to gun for inclusivity if a positive deviation from the status quo is desired.

KEYWORDS: Solid waste, Management, Port-Harcourt, Review, Practices, Perception, Involvement

I. INTRODUCTION

Solid waste can be classified as domestic, commercial, industrial, construction and agricultural. Its occurrence in places could be in the form of organic, inorganic, combustible, non-combustible, putrescible and non-putrescible fractions, agricultural refuse, demolition waste, industrial waste, mining residues, municipal garbage and sewage sludge. Some examples of solid wastes are tires, sewage sludge, food rejects, body fluids, scrap metal, latex paints, furniture, old toys, garbage, old appliances and vehicles, oil and anti-freeze, empty aerosol cans, paint cans and compressed gas cylinders, construction and demolition debris, asbestos, and so on. Municipal solid waste is the general heterogeneous mass of rejected items or substances from households in the rural or urban community and the homogenous deposits of agricultural and industrial related rubbish [1]. In spite of the improved development of science and technology, solid waste management is still a serious environmental problem for most communities all over the world [2]. The most common method of disposal of municipal solid waste in developing countries is still open uncontrolled dumping [3].

The generation rate of solid waste can be attributed to rapid urbanization and modernization, increase in birth rates, massive migration to urban areas and overpopulation. Also, the preponderance of waste materials which take a long time to biodegrade such as plastics and metallic products add to the amount of generated waste. Improved standards of living and the extent of commercialization in the cities have significantly changed the consumption patterns and thereby the waste composition and production, where a great number of people eat in public eateries, thereby the

increase of food waste. Other sources which generates solid waste include an increase in single-use packaging during shopping, a decrease in product obsolescence age in the electronic equipment industry and the decrease in the cost of materials for replacement of faulty equipment in many other industries. Many developed countries are top producers and manufacturers of processed products. And as such struggle to contend with the waste generated from their products. Developing countries in turn are overwhelmed with the solid wastes that are generated from products largely imported from developed countries. Organics also contribute largely to this waste generation. Keeping pace with these rapid waste generation require commensurate growth in schemes to protect the environment, improve public health and accomplish effective and efficient municipal solid waste management (MSW) [4 & 5]

Municipal solid waste management (MSWM), involving the control of the generation of solid waste, its collection, storage, transfer, processing and final disposal, in such a way that agrees with best principles of public health, economics, engineering, aesthetics and other environmental considerations [6] is therefore a necessity to curb the continual upsurge of this challenge.

The priority of waste management generally, is to protect health and keep the environment stable while conserving resources [7]. But the inability for municipalities to fully understand the intricacy of waste generation and management has resulted in transforming solid waste management to one of the most compelling problems of urban environmental degradation” [8]. The quantity of solid waste generated, as well as its ever-changing characteristics is at an alarmingly increasing proportion.

With an estimated population of 1,865,000 residents [9], Port-Harcourt was reported to generate about two million kilograms of solid waste on a daily basis [10] and a per capita per day waste generation that ranged from 0.66kg to 1.25kg per day [11]. Out of this generated waste, only a fraction is collected for dumping at approved unsanitary dumping sites which are grossly inadequate to contain the massive waste; the rest of the waste are strewn haphazardly along the roads, drains, bushes, river banks and directly into surface waters in the city [13, 14]. This mismanagement has been largely attributed to poor and insufficient solid waste management infrastructure, absence of necessary equipment, untrained and insufficient personnel, inadequate policies, lack of awareness, amongst other handicaps [11, 9, 13, 12].

II. MATERIALS AND METHODS

This paper is a review of the present waste management practices in Port-Harcourt municipality. Sources of information include personal observation, journal articles, questionnaire survey and one-on-one interaction with waste management professionals and residents.

Description of Study Area

Port-Harcourt is the capital of and largest city in Rivers State, Nigeria. The municipality lies between longitude 6°55' and 7°10' east of Greenwich meridian and latitude of 4°47' north of the equator housing, and is bounded by an area of about 2600km with a population of 1,850,020 [14]. It also lies along the Bonny River and is located in the Niger-Delta region. As of 2016, the Port Harcourt urban area had an estimated population of 1,865,000 inhabitants, up from 1,382,592 as of 2006 [15]. Port-Harcourt is comprised of several towns and localities inclusive of Azuabie Town, Abuloma, Amadi Ama, Borokiri, D-line, Diobu, Eagle Island, Elekahia, New GRA, Nkpogu, Nkpolu Oroworukwo, Ogbunabali, Old GRA, Old Port Harcourt Township, Oroabali, Oroada, Orochiri, Orogbum, Orolozu, Oromeruezingbu, Oroworukwo, Oromineke, Rebisi, Rumukalagbor, Rumuobiekwe, Rumuwoji, Tere-Ama and Okuru-Ama (Figure 1).

Port-Harcourt was created in 1912 by the British colonial administration and was a port for coal export and agricultural produce. Initially Port-Harcourt was just 30,000 acres (121.41km²), but with the discovery of oil in 1950 Port Harcourt expanded quickly beyond its original boundaries (which was about 470km²), mainly towards the northern sides, as the eastern, western and southern sides of Port Harcourt are bounded by swamps, creeks and rivers. Access to potential energy from oil and natural gas, in addition to good communication with the outside world through its international air and sea ports, created favourable conditions for Port Harcourt to become one of Nigeria's most important industrial towns, and the economy of the small town rapidly upgraded. This economic change brought in a steady stream of oil and gas companies such as Royal Dutch Shell, Mobil, Chevron Texaco, Totalfina Elf, etc. With this influx, human population increased rapidly within a short space of time. The climate of Port-Harcourt falls within the sub equatorial climate belt, with temperature and humidity high throughout the year. The area is marked by two distinct seasons – the wet and the dry seasons – with 70 percent of the annual rains falling between

April and August, while 30 percent is spread in the three months of September to November. The driest months are from December to March [12, 16] The soil type consists mainly of poorly-drained silt clays mixed with sand, which is geologically classified under the Benin formation.

The proliferation of private companies, different government parastatals, churches, markets, shopping malls and schools are situated in this city, making it a high commercial and

industrial environment. Prior to this oil boom, Port-Harcourt, popularly known as the “garden city”, was a very quiet town with well-arranged infrastructure and beautiful gardens in almost every residential and commercial area. The streets were cleaned timely and properly and refuse disposed as at when due without lapses. Presently, and over the past 20 years, this cosmopolitan city succumbed to what can now best be described as a “garbage city”.

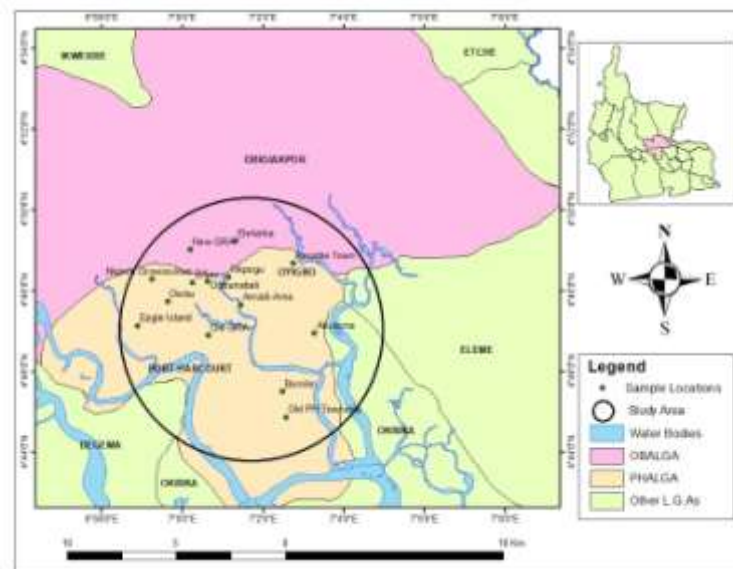


Figure 1. Map of Port-Harcourt Municipality Showing Some Towns

Solid Waste Management in Port Harcourt

[17] listed the challenges of SWM in Port-Harcourt as being attributable to a high generation rate of solid waste from households, industries, abattoirs, hospitals, business centres and markets, bringing the daily waste production to about 2000 tons. To mitigate this problem, the Rivers State government divided the municipality into zones manned by different waste contractors. However, this move was marred by a lack of technical knowhow and adequate coordination, resulting in waste being left for very long periods at the temporal dumpsites, exposing them to natural decomposition which attracts microorganisms, scavengers and animals. The already bad situation is now made worse when rain water and flood waters wash the in-situ waste into gutters, drainages, surface waters, groundwater and soil. In their study of the impact of solid waste on soils and groundwater, [18, 19, 20, 21] established that a major source of soil and groundwater contamination was via infiltration of leachates and leachates runoff from solid waste dumpsites. They discovered high concentrations of iron (Fe), zinc

(Zn), cadmium (Cd), copper (Cu), lead (Pb), manganese (Mn), biochemical oxygen demand (BOD) and chemical oxygen demand (COD) at dumpsites, as well as low pH and a high presence of microbes, namely, total heterotrophic bacteria count, total heterotrophic fungi count, total coliform count and fecal coliform. They also strongly recommended liners for temporal dumpsites to prevent this contamination. Inappropriate methods, untrained personnel and lack of finance were identified as some factors that acted as a cogwheel to the sustainable management of SWM in Port-Harcourt.

In her work concerning flooding and waste disposal practices among residents in Nigeria, [22] pointed at poor waste disposal practices as a major culprit of flooding in Port-Harcourt (Figure 2). Informal settlements located mostly at waterfronts in the metropolis were to be in the habit of disposing their solid waste right into the surface waters close to them. Other persons too who live not too far from them have also adopted this unpatriotic and unsanitary behaviour; even some private waste contractors in the state also

throw huge amounts of waste into these surrounding surface waters. Reasons for this poor behaviour were attributed by the author to be an absence of inclusivity by the government who see these informal settlements as



Figure 2. A Waterside Settlement in Port-Harcourt Surrounded by Solid [22]

Temporal and illegal structures. However, if this be the case, then the government need to realize that the whole state is impacted as the waste dumped into the rivers and streams increases flood risks, defaces the environment, blocks bigger channels, disrupts water transportation and harms the aquatic life. Waste thrown inside gutters or drainages also increases flood risks. The researcher agrees with [12, 11, 23, 16] that there is the absence of very few or no waste receptacles where waste can be temporarily stored before evacuation, which is one major reason why resident indiscriminately litter the surrounding environment with waste. Waste is often thrown out of moving vehicles, along walkways and motor ways, bushes and just about anywhere they can get away with. They encourage penalties to be placed on defaulters by the government to curb this unhealthy attitude. Media education too was seen as a means of awareness for change.

Waste management roles and barriers encountered by solid waste collectors in Port-Harcourt was analysed by [24]. The Port-Harcourt local government area was identified as one of the two major and advanced LGAs in Rivers State. Port-Harcourt was said to have faced several setbacks in achieving a sustainable waste management system for many years. Despite the interventions constructed by the government, the municipality is yet to bring their heads above the drowning river of heaps of solid waste littered almost everywhere in the LGA. The author pointed that some major hinderances to the efforts for a

better managed system are the use of old vehicles/trucks/compactors to evacuate waste from around the city, poor remuneration of waste workers, inadequate personnel training, and the use of mostly manual methods. There is frequent breakdown of the mostly outdated vehicles engaged for evacuation as well. This poses a traffic challenge to other motorists and pedestrians who are prone to near misses and accidents due to traffic disruption.

In the year 2015, Port-Harcourt municipality experienced a major crisis in solid waste management which hampered the economy and normal daily routine of the populace. Heaps of solid waste were observed to cover streets, dual carriage ways, walkways, bush paths; filled gutters and drainages, totally defacing the previous garden city. This dire occurrence was said to be the outcome of a change from an older political office to new elected officers of government. It was discovered that the expired officers left a huge solid waste management debt to the new government, and as such, waste contractors, sometimes called service providers were left financially handicapped to continue evacuating waste from the city to official dumpsites. This resulted in almost all parts of the urban settlement turning to a huge garbage dump. Some roads were even totally blocked since evacuation of the waste was done at the end of almost a month, leaving over 200 tons of waste in-situ and exposed to natural elements. [16, 25 & 26] blamed this setback on the absence of proper policies, lack of adequate infrastructure, inefficient and ineffective SWM structure and political interference. Private investors were seen as able to weather the SWM storm if they are given the opportunity to invest in SWM in the municipality.

[23] described waste management practices in these municipalities as devoid of the techniques that ensures the basic principles of waste management. They said successive governments have made very little efforts at tackling waste management in the area of legislatures and enforcements. That though the Port-Harcourt city authority adopted the waste management pattern of some developed countries like the United Kingdom, they are far from implementing their methods and standards. A good example is the provision of refuse bins to every household. Rather than employing this method, a general bin is assigned to specific areas (and most times these bins are quite few and not enough to serve the areas). The dirt in these public bins, though designated to be collected once or twice a day, are oftentimes neglected for a number of days.

This negligence results in the littering of the dumpsite area with dirt blown by the wind and offensive odour emanating from decomposing biodegradable wastes. They referred to disposal at official borrow pits, open dumping, disposal in water bodies and mass burning as the current waste management practice in Port-Harcourt city. In the area of employing landfill method in managing waste in the city, they stressed the fact that there is no existing engineered landfill in Port-Harcourt city; rather waste contractors as well as the government waste management workers dump solid waste in abandoned borrow pits or designated plots of lands in some city outskirts like Eneka, Rumuokoro and Ada George road amongst other locations. At these “supposed” landfills, the wastes are usually spread out by tractors and covered with clay. Sometimes they are burned. There is the absence of waste liners, wastewater treatment of the resultant leachate and management of emitting gases at these dumpsites, which is in total violation of the guidelines set by the Federal Ministry of Environment (FMEnv).

[11] also reported that solid waste is poorly managed in Port-Harcourt city by the responsible parties. This has resulted to the indiscriminate dumping of uncovered wastes along major roads, street corners and borrows pits. Apart from blaming the government for their poor management of solid waste, the populace was also blamed for their ill attitude towards waste handling. In the same vein, [13] referred to solid waste management in Port-Harcourt as being a monumental project for the state government who are yet to have a breakthrough in managing waste effectively in the Port-Harcourt municipality, despite several methods employed in times past. Some of these methods are the employment of local contractors and agencies to evacuate solid waste from assigned zones, building of receptacle walls to hold refuse where public bins are not available, and the setting aside of the last Saturday of every month for the general cleaning of the environment. It was found that these methods are yet to produce the much-desired result of efficiently tackling the problem, rather solid waste is still being dumped along the road sides, bushes and open spaces, and left to either rot, eaten by animals or washed away into gutters and rivers by the rains. The author stressed the fact that part of the blame of this poor waste management can be attributed to assigning waste management to incompetent and inexperienced contractors who merely see waste management as moving waste from one point to another. Also, to blame is the absence of sanitary inspectors and public health

workers to monitor waste generation and management in the Port-Harcourt metropolis.

[12] attributed waste generation in Port-Harcourt and parts of Obio-Akpor as coming from domestic, commercial, residential and industrial sources. The rate of this generation according to them has been steadily on the increase due to rapid population growth. Heaps of refuse of different kinds are conspicuously strewn on the roads, public places, market places, residential premises, commercial centres, institutions, etc. The resultant effect of these actions is the blockage of road ways and drainages, and the contamination of water sources in the city. They reported that the effective management of this solid waste menace has proved abortive even with the intervention of the Rivers State government, some non-governmental agencies and organizations and the private sector.

Residents Perception

A review was conducted among a number of Port-Harcourt residents in 14 sample locations to ascertain their awareness, satisfaction and involvement in solid waste management in the municipality. Residents satisfactory rate bordered on questions in the area of the government’s responsibility in managing solid waste, their level of management and expected improvement. Resident’s involvement included how interested they were in separating their waste, participation in environmental sanitation, reuse of old items, and their willingness to pay for waste disposal. Resident’s awareness was in the areas of waste minimisation, impact of poor solid waste management, disposal practices and knowledge of the government plans about their waste. A total of 1000 questionnaires were distributed randomly in 14 selected catchment areas in Port-Harcourt municipality. 987 were retrieved.

III. RESULTS AND DISCUSSION

To get residents perception (table 1) about how satisfied they were with the solid waste management services they received, questions were asked about how they perceived the government was managing their waste, the management rate, what level of improvement they expected and the efficiency of house-to-house waste collection in their vicinity. 41% of the residents concurred that the government was doing a good job, 37% believed the management to be poor, 75% of the residents agreed that the government needed to improve in their services rendered, while 20% of the residents actually received house services. An average of 43% rate of residents’ satisfaction was thus gleaned. Questions to ascertain community

involvement bordered on how interested the residents were in waste segregation before disposal, their participation in frequent environmental sanitation, their attendance in community waste management meetings, their reuse of old items, their willingness to pay for waste management services and if they believed waste management was not solely the government's responsibility. Response showed a 62% average of involvement where 41% of the residents were interested in separating their waste before disposal if asked to, 72% participated actively in environmental sanitation, 45% attended waste management meetings, 70% reused old items, 78% were willing to pay for waste management services and 68% of the residents believed waste management was everyone's responsibility and not just the government. Questions asked on how aware the residents were about waste management included if they were knowledgeable about the negative impacts of poor waste management, if the media contributed in this awareness, awareness of safe waste management disposal methods, knowledge of waste minimisation, awareness of waste-to-energy potentials, awareness of final disposal and if they were conversant about their government's plans about waste management. An average percentage score of 55% was recorded. Table 2 shows the detailed outcome.

IV. CONCLUSION

It can be deduced from the study that residents in the Port-Harcourt municipality are satisfactorily involved in waste management activities. About half the populace are waste educated and eager to get more involved in the management alongside the government if mandated. So, despite the poor services rendered presently by the government, there is room for improvement with the positive participation of the waste generators. Inclusivity is key.

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Table 1. Residents Perception

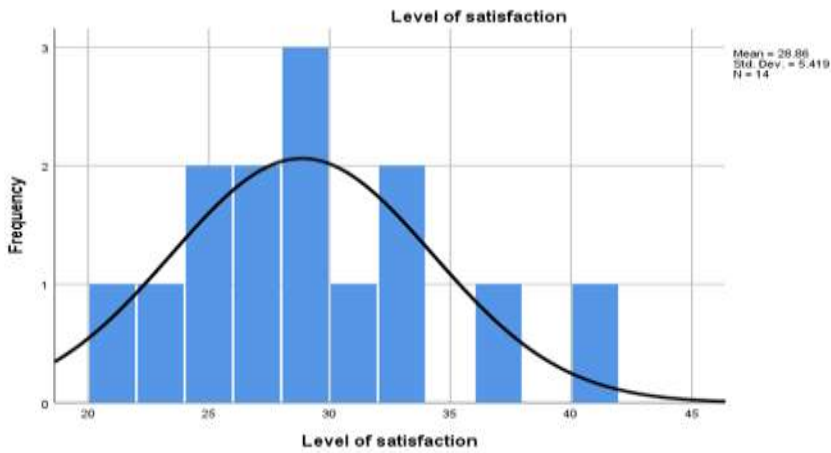
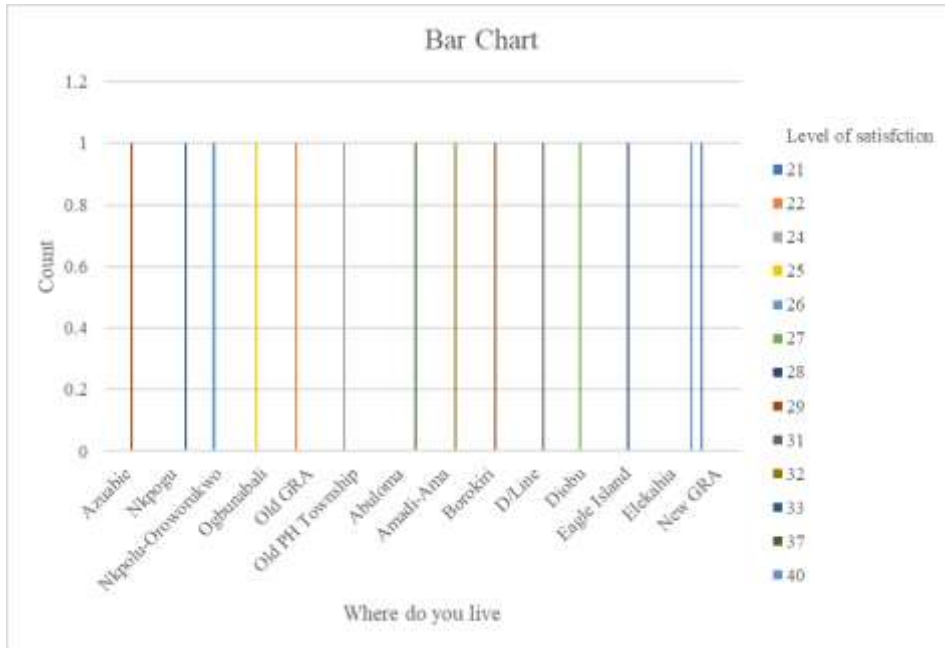
S/N	Questions Asked	% Perception
1	Agree that the government is managing solid waste well.	41
2	Level of the goernment's management	37
3	Level of expected improvement.	75
4	Waste Collection from house-to- house	20
5	Residents interested in waste segregation.	41
6	Participation in general environmental sanitation	72
7	Attend waste management meetings in their communities.	45
8	Reuse old household properties	70
9	Willingness to pay for waste disposal	78
10	SWM not solely the government problem.	68
11	Awareness of negative impact of poor SWM	95
12	Awareness of SWM sensitization by the media	80
13	Knowledge of safe SW disposal practices	66
14	Knowledge of waste minimization	53
15	Awareness of waste-to-energy potentials	41
16	Awareness of final disposal	28
17	Knowledge of government plans about SWM	24

Crosstab

Count	Where do you live	Level of satisfaction												Total		
		21	22	24	25	26	27	28	29	31	32	33	37		40	
	Azabua								1							1
	Bkpogu														1	1
	Bkpogu					1										1
	Ogbunahali				1											1
	Old GRA	1														1
	Old PFI			1												1
	Township															1
	Abuloma												1			1
	Amadi-Ama										1					1
	Banokiri								1							1
	D-Line									1						1
	Diabu					1										1
	Eagle Island								1							1
	Eldekabia														1	1
	New GRA	1														1
	Total	1	1	1	1	1	1	1	2	1	1	1	1	1	1	14

Chi-Square Tests

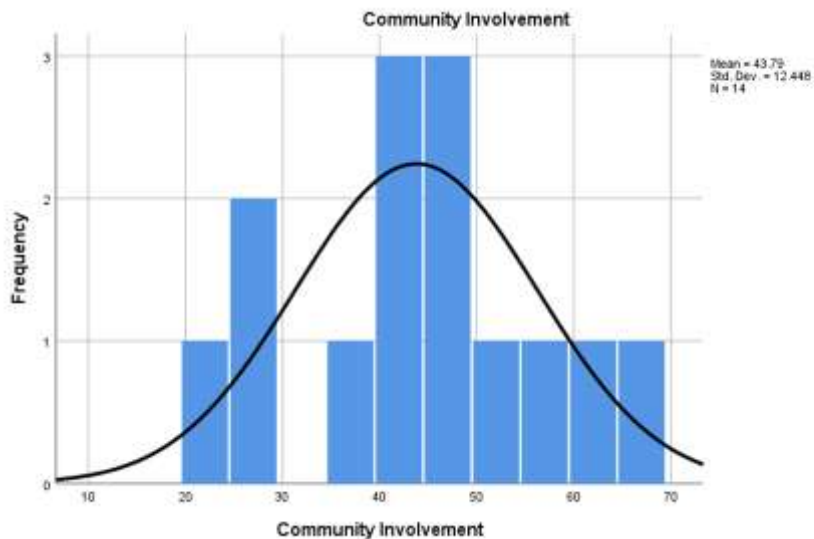
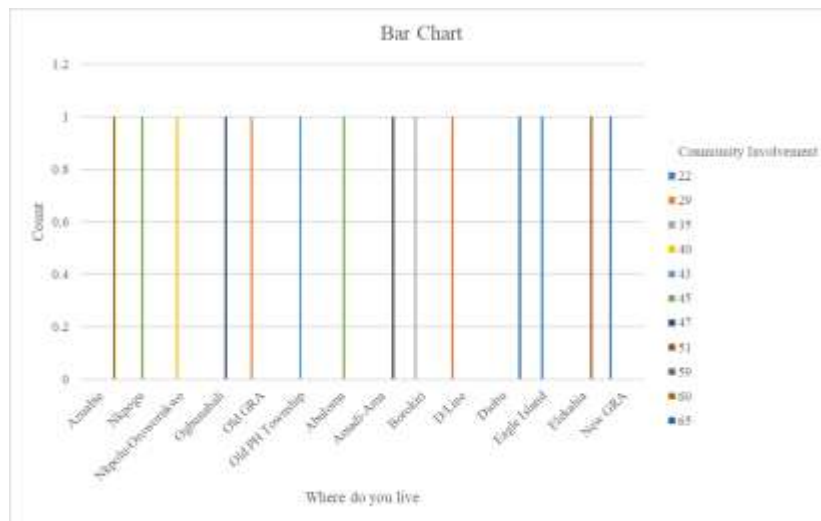
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	168.000 ^a	156	0.242
Likelihood Ratio	71.121	156	1.000
N of Valid Cases	14		



Crosstab

Count	Where do you live	Community Involvement											Total
		22	29	35	40	43	45	47	51	59	60	65	
Azuabie											1		1
Nkpogu							1			1			1
Nkpola-Oroworukwo													1
Ogbunabali										1			1
Old GRA			1										1
Old PH Township								1					1
Abuloma									1				1
Amadi-Ama											1		1
Borokiri					1								1
D/Line			1										1
Diobu												1	1
Eagle Island								1					1
Elekahia										1			1
New GRA		1											1
Total		1	2	1	1	2	2	1	1	1	1	1	14

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	140.000 ^a	130	0.259
Likelihood Ratio	65.576	130	1.000
N of Valid Cases	14		



Count		Crosstab														Total
		Community Awareness														
		17	25	28	32	33	34	36	39	41	44	47	49	57	62	
Where do you live	Azuabie									1						1
	Nkpogu		1													1
	Nkpolu-Oroworukwo						1									1
	Ogbunabali			1												1
	Old GRA														1	1
	Old PH Township												1			1
	Abuloma				1											1
	Amadi-Ama	1														1
	Borokiri							1								1
	D/Line					1										1
	Diobu								1							1
	Eagle Island											1				1
	Elekahia											1				1
	New GRA														1	1
Total		1	1	1	1	1	1	1	1	1	1	1	1	1	1	14

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	182.000 ^a	169	0.234
Likelihood Ratio	73.894	169	1.000
N of Valid Cases	14		

