Original Research Article

Urban Sustainability and Management: Critical Evaluation of Garbage Collection and Disposal in Port Harcourt Municipality

Abstract

Garbage management is an organised and systematic channelling of garbage through the pathway to ensure that they are disposed of with good public health and environmental safety. The study aimed to critically evaluate the garbage collection and disposal in Port Harcourt Municipality to achieve urban sustainability and management. The objectives are to identify the methods of garbage collection and disposal in the study area, evaluate the efficiency of the method of garbage collection and disposal in the study area, identify the challenges faced in garbage collection and disposal in the study area, and identify sustainable physical planning measures for the collection and disposal of garbage in the study area. The study employed a Mixed Methods Research (MMR) approach and sequential explanatory design. The study employed stratified and simple random sampling techniques. The study identified 25 neighbourhoods in the study area and was grouped into three strata using a stratified sampling technique (high, medium, and low densities). 1 neighbourhood in each stratum (density) was selected randomly for sampling, including Diobu, D/Line and Old GRA, respectively. Taro Yamane's formula was applied, and 100 respondents were selected for sampling using a simple random sampling technique. The study found that most garbage generated in the study area was plastic, metal/can, and paper/cartons stored in plastic bags, containers, and metals. The study revealed that garbage is collected by truck pushers/scavengers and government agencies and disposed of in designated authorised dumping sites, bush and burning. The study found that the strategies employed for garbage collection and disposal are efficient. The challenges faced in garbage collection and disposal from the study include indiscriminate dumping of garbage at unauthorised sites, non-compliance to schedule time for garbage disposal, lack of finance, inadequate human resources, and lack of an operational vehicle. Accordingly, the study recommends that; the waste management agency carry out a periodic survey of garbage collected and disposed of in their area of operation. The government should abolish the open dumpsite method of garbage disposal by households and eliminate indiscriminate dumping of garbage along streets. The waste management agency should ultimately adopt a house-to-house garbage collection in the neighbourhoods to achieve resource recovery and recycling and monitoring team that will ensure strict adherence to garbage collection and disposal regulations.

Keywords: Urban Sustainability, Management, Garbage, Collection, Disposal, Port Harcourt Municipality

Introduction

The rapid increase in the urban population has recently increased the pressure on urban planning and management (National Geographic, 2021; Masoumeh, 2012). This population increase has contributed significantly to poor air and water quality, high energy consumption by the urbanites, insufficient water supply, increased housing demand, traffic congestion, and waste management challenges (National Geographic, 2021). Cities and towns in Africa are equally experiencing this phenomenon, as their population has increased to 43% in 2020 (Ramanah, 2019; WEF, 2021). One significant challenge facing urban areas in recent times is the issue of efficient waste collection and management as the urban population is increasing. African urban areas are not divorced from this problem, including Nigerian urban areas, as garbage is conspicuously littering the cityscape of various segments of residential neighbourhoods.

Garbage collection and disposal are parts of the process of waste management. It is the transfer of garbage from the point of generation and disposal to the point of treatment or final disposal (Conserve Energy Future, 2021). Waste management includes the activities and actions required to manage waste from its generation points to its final disposal points (Conserve Energy Future, 2021). This process includes collecting, transporting, treating, and disposing of waste and monitoring and regulating the waste management process. Garbage is waste that is generated as a result of daily activities by humans from domestic premises. Garbage can be in solid, liquid and gas forms, which requires different methods of collection and disposal (handling procedure), including household, hazardous, liquid, non-liquid, construction, and electronic wastes (Core Mini Bins, 2019).

Waste management practices are not uniform among countries (developed and developing nations); regions (urban and rural areas) and residential and industrial sectors can all take different approaches (Davidson, Gary June 2011). Hence, handling garbage in an unfriendly manner has led to public health, safety, poor hygiene, and sanitation and further degrading the environment. Urban areas have ample human assets, and their population is dynamic (United Nations Human Settlements Programme (UN-Habitat), 2007); it requires caution in the handling of garbage generated from their activities as households and businesses must know these essential facts (Chang, 2021). Garbage collection and disposal management continue to be a significant challenge in urban areas, particularly in the rapidly growing cities and towns of developing economies. As identified by Singdha (1998), the contributing factors such as the high rate of population growth and increasing per capita income have resulted in the generation of an enormous volume of waste, which poses a severe threat to human health and environmental quality. In 2015, the United Nations (UN), through its Sustainable Development Goals (SDG) 6 and 11, sued for “Clean Water and Sanitation” and “Sustainable Cities and Communities”, respectively (United Nations Department of Economic and Social Affairs (UNDESA, 2015). This gesture has created more enlightenment in making our settlements more sustainable and friendly, which waste management is anchoring upon for a better living urban environment.

However, poor garbage collection and disposal could lead to various diseases, infections and infestation, and these include fly-transmitted diseases like myiasis, diarrhoea, typhoid, and cholera; rodent-transmitted diseases like Lassa fever plague, leptospirosis, murine typhus; mosquito-borne diseases such as malaria, yellow fever, filariasis, and dengue haemorrhagic fever. Also, gases like methane, carbon dioxide, hydrogen sulphide and mercury vapour emitted from landfill sites can constitute air contaminants and pollution (Brenner, 2017).

Regardless of the content, hazard, or potential, garbage must be managed systematically to ensure environmental best practices. As garbage collection and management is a critical aspect of environmental hygiene, it must be incorporated into environmental planning. The Port Harcourt Municipality is rapidly increasing in population and densification, giving concern to urban planners, environmental professionals and households. This population increase in the municipality’s neighbourhoods has created garbage management problems concerning the households and agencies responsible for waste management. This study evaluates garbage collection and disposal methods in Port Harcourt Municipality, Rivers State, to provide an efficient mechanism to improve quality of life and urban sustainability and management.

Aim and Objectives of the study

The study aims to critically evaluate the garbage collection and disposal methods in Port Harcourt Municipality to achieve urban sustainability and management.

The specific objectives of the study are to:

i. Identify the methods of garbage collection and disposal in the study area;
ii. Evaluate the efficiency of the method of garbage collection and disposal in the study area;
iii. Identify the challenges faced in garbage collection and disposal in the study area;
iv. Identify sustainable physical planning measures for collecting and disposing of garbage in the study area.

Scope of the Study

Geographically, the study area covered Port Harcourt Municipality, Rivers State, Nigeria (see Fig. 1). However, the content scope covers identifying the methods of garbage collection and disposal in the study area. It also evaluates the efficiency of the current garbage collection and waste disposal methods in the study area, identifying the challenges faced in garbage collection and disposal in the study area and identifying sustainable physical planning measures for the collection and disposal of garbage in the study area.

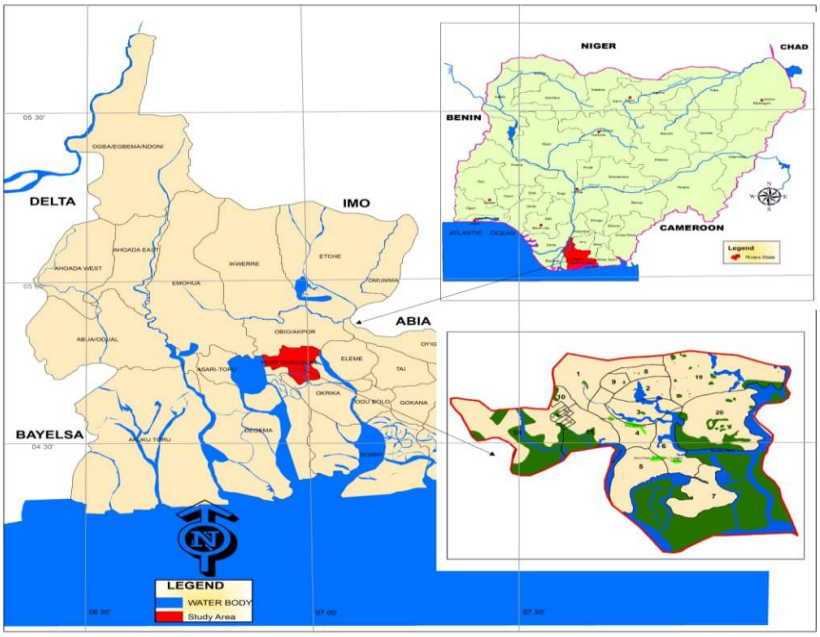

Figure 1: Map of Nigeria Showing Rivers State and Port Harcourt Municipality
Source: GIS Lab, Department of Urban and Regional Planning, Rivers State University, Port Harcourt, 2021

Literature Review

Methods of Garbage Collection and Disposal

Municipal authorities and urban managers have adopted several methods for sustainable garbage management in urban areas across the globe. Garbage management in urban areas begins with garbage handling from the generation point to the final disposal point (Denton, 1994). These methods must be environmentally friendly to the garbage generators to the disposers in the stream of sustainable garbage management through sorting from the generation point into the proper packaging containers (Leblanc, 2020). Practically, there are methods for garbage collection in urban residential neighbourhoods from the generators, including households and businesses. The methods include plastic bags, metal containers and

rubber bins. The use of any of these methods depends on the type of garbage and technology available for garbage disposal in the urban area by the agency responsible for garbage management. However, they must all show good public health, sanitation and hygiene practices, environmental sustainability principles, and character during handling operations (Sensa Network, 2018).

There are also methods employed for garbage disposal in urban areas. Isam, Razi, Hasan, Hasan and Alam (2013) noted that many urban areas have adopted one of the most popular garbage disposal methods, the landfill method. This method involved the burying of garbage in a prepared site. The landfill sites are often located in abandoned or unused burrow pits used for mining or quarrying. The landfill method is inexpensive and efficiently designed and managed, though with hygienic and environmental pollution problems if not well handled. It can also generate effects such as littering, vermin attraction, leachate, methane and carbon dioxide emissions that can contribute to the greenhouse effect (Isam *et al.*, 2013). Another method of garbage disposal is the incineration method. This method involves the combustion of garbage through the application of high temperature and conversion of the garbage into gas, heat, steam and ash. Though, this method has pollution concerns as gaseous materials are emitted into the environment during combustion, affecting human health and other living organisms in the environment (Kumar & Jyothsna, 2013). There is the plasma gasification method, a newer garbage disposal method. It is a highly ionised or electrically charged gas. The gasifier vessel utilises proprietary plasma torches operating at +10,0000F (5,5400C) (the surface temperature of the sun) to create a gasification zone of up to 3,0000F (1,6500C) to convert solid or liquid wastes into a syngas. Plasma gasification offers states new opportunities for waste disposal and, more importantly, for renewable power generation in an environmentally sustainable manner (Moustakasa, Fattab, Malamisa, Haralambousa & Loizidoua, 2005). Another popular method of garbage disposal that favours the principle of sustainability is the recycling method. The method encourages the separation of garbage from generation point to disposal point, where the garbage is recycled for reuse by another producer. For example, can, paper, glass and electronics are recycled for reuse. This method promotes conservation and renewal in the production and consumption of resources (circular economy) and eliminates environmental pollution problems (Villalba, Segarra, Fernandez, Chimenos & Espiell, 2002).

Challenges Faced in Garbage Collection and Disposal

Garbage management is essential for municipal authorities, urban planners and urban dwellers. Several researchers and garbage management agencies in urban areas have highlighted several challenges faced in garbage collection and disposal. McAllister (2015) identified some factors responsible for ineffective garbage management, including lack of adequate funding, rapid increase in population, lack of trained and professional waste managers, lack of effective monitoring and control, the peculiarity of the households' attitude towards the environment, lack of employment of modern technology in the implementation of efficient waste management methods. Inadequate funding is another essential factor militating or acting as a significant waste disposal problem. The cost of labour, purchase and maintenance of vehicles and other types of machinery involved in the collection and disposal of garbage are keys to achieving an efficient system in garbage management (Agunwamba, 2003).

Another challenge faced by garbage management agencies is the methods employed in collecting and disposing of garbage in neighbourhoods. Some urban areas in developing economies adopt open dump sites and landfill methods which are not adequately managed and expose the environment to public health and hygienic problems (Olukanni, Akinyinka, Ede, Akinwumi & Oluseyi, 2010). Olukanni *et al.* (2010) further

identified that some unfriendly environmental methods are also used in dumping garbage into gutters, drains and roadsides. In addition, there are issues of improper garbage storage from the generation points by households and other activities that generate garbage during their business. Omang, John, Inah and Bisong (2021) noted that there is a severe health hazard from the improper collection and disposal of garbage in the environment leading to percolation to pollute groundwater supplies, the breeding ground for such annoying and disease-bearing organisms, such as rats, cockroaches and flies. This situation has further resulted in urban degradation and the outbreak of diseases like cholera, malaria, typhoid, and bronchial disorders (Uchegbu, 2002). Therefore, educating the urban dwellers about the importance and impacts of human activities is crucial to managing garbage to achieve urban sustainability. This process requires different approaches to increase public awareness of the dangers of not handling garbage in an environmentally friendly manner (Ferronato & Torretta, 2019).

Nwufo (2010) noted that the non-implementation of the available extant environmental policies and legislations are some challenges in managing garbage in urban areas. They further argued that a weak institution and framework might impede the efficient management of garbage, as the government may not prioritise this aspect in dealing with garbage (Ayotamuno & Gobo, 2004). This challenge is aggravated by the corruption and mismanagement of all resources available to the enforcement and management agencies because of political influence (Ezeah & Roberts, 2013). Often, the policies and legislations are ambiguous to clearly define the goals and objectives for the responsible agencies to implement (Ayotamuno & Gobo, 2004). In addition, inappropriate technology application in garbage collection and disposal, such as in uncontrolled landfill sites (Ogwueleka, 2009).

Methodology

The study adopted a Mixed Methods Research (MMR) approach using a sequential explanatory research design to obtain the relevant data and information to achieve the study's aim and objectives. The study employed stratified and simple random sampling techniques to determine and select neighbourhoods in the study area. The neighbourhoods were stratified into three (3) strata: high, medium and low-density neighbourhoods, including Diobu (Mgbundugwu - Miles 1 & 2), D/Line (Oromenike) and Old GRA (Orije Layout) neighbourhoods were selected to represent each stratum, respectively. To get the quantitative data for this study, Slovin formula at a 10% precision level was used to determine a total of one Hundred (100) households (respondents) which were randomly selected and interviewed (see Table 1). Simple descriptive statistics was used to express the outcome of the questionnaire. Subsequently, the qualitative data of the study was obtained through key informant method through the interview of relevant stakeholders and professionals in the subject matter. These stakeholders were drawn from the Rivers State Waste Management Agency (RIWAMA), Rivers State Ministry of Environment (RSMoE), Rivers State of Ministry of Physical Planning and Urban Development (RSMPPUD), Public Health and Environmental Officers and Town Planners, to seek their opinions and expertise on the subject matter. Also, physical observations and photographs were used to characterise the current garbage collection and disposal conditions in the study area.

Table 1: Determination of Sample Size for the Study

Density	Neighbourhood	1991 Population Sample	2021 Population Projection (6.5% Growth Rate)	Household Size (5 Persons per Household)	Sampled Households
High Density	Diobu (Mgbundugwu – Mile 1 & 2)	55,682	368,281	73,656	67
Medium Density	D/Line (Oromenike)	21,377	141,387	28,277	25
Low Density	Old GRA (Orije Layout)	6,482	42,872	8,574	8
Total	**Total**	**83,541**	**552,540**	**110,507**	**100**

Source: NPC 1991; NPC 2018; NBS, 2016; Researchers' Computation, 2021

Results and Discussion

Identified Methods of Garbage Collection and Disposal

The study from data collected identified the types of garbage generated by households in the study area. The respondents in Table 2 reported that the modal type of garbage generated from households was paper/cartons and plastics account for 45.7% and 32.1%, respectively. According to the respondents, other types of garbage generated were metal and glass, representing 17.1% and 5% of the distribution. This information indicates that paper/cartons and plastic materials were the most generated type of garbage in the study area.

The type of garbage generated by households equally determines the methods adopted by the households to store their garbage when generated for collection. As displayed in Table 3, the most popular methods adopted by households in the storage of garbage were plastic bags and plastic containers, represented by 41% and 31%, respectively. These methods accounted for 72% of households' responses. As indicated, households employed other methods were wooden baskets and metal containers, which accounted for 19% and 9%, respectively. The methods of garbage collection as identified in the study were truck pusher/scavenger and government agency (RIWAMA) accounted for 68% and 32%, respectively, of the responses (see Table 4). The truck pushers mostly attended households in the Diobu and D/Line neighbourhoods in the municipality. In addition, some respondents in the Old GRA neighbourhood arranged with some private firms to collect their garbage. However, the study found from key informants that the RIWAMA has also contracted the collection of garbage in the study area to some private contractors to carry out the garbage collection task to make the work easy for them.

Table 2: Types of Garbage Generated by Households

Types of Garbage	No.	%
Metal	24	17.1
Glass	7	5
Paper/carton	64	45.7
Plastic	45	32.1
Total	**140**	**100**

Source: Researchers' Survey, 2021

Table 3: Methods of Garbage Storage by Households

Method of Storage and Collection	No.	%
Plastic bag	41	41
Metal container	9	9
Plastic container	31	31
Wooden basket	19	19
Total	**100**	**100**

Source: Researcher's Survey, 2021

Table 4: Methods of Garbage Collection

Method of Storage and Collection	No.	%
Truck pusher/scavenger	62	62
Government agency (RIWAMA)	32	32
Private firm	6	6
Total	**100**	**100**

Source: Researchers' Survey, 2021

Figure 2: Method of Garbage Disposal by Households
Source: Researchers' Survey, 2021

The identified garbage disposal methods in the studied neighbourhoods are shown and analysed in Table 5. The study revealed that 51% of the respondents disposed of their garbage by dumping them on the roadside. Also, those that dumped their garbage on authorised dumping sites and house-to-house accounted for 27% and 13%, respectively. At the same time, 9% of the respondents dispose of their garbage by burning them. Also, in the garbage disposal, the study found that RIWAMA has contracted the disposal of garbage responsibility to the private firms that collect garbage from the households in the neighbourhoods studied in the municipality.

Table 5: Methods of Garbage Disposal by Households

Methods of Garbage Disposal	No.	%
Authorised dumping site	27	27
House-to-house	13	13
Dig and bury	0	0
Burning	9	9
Dumped in the bush	0	0
Dumped into the waterbody	0	0
Dumped on the roadside	51	51
Total	**100**	**100**

Source: Researchers' Survey, 2021

Figure 3: Dumping of Garbage along Ikwerre Road (Mile 2)
Source: Researchers' Survey, 2021

The Efficiency of the Methods of Garbage Collection and Disposal

The study found that the frequency of garbage collection by the agency responsible for collecting garbage generated by households daily accounted for 90% of the responses, while 10% of the respondents said their garbage is collected twice a week, and the remaining options were not responded to (see Table 6). The study also revealed the methods used by the responsible agency for garbage collection. As indicated by the respondents in Table 7, the modal method is the designated centralised collection point in the neighbourhood, accounting for 77% of the responses, followed by the truck (tipper) used by the collecting agency represented by 16% of the responses. In comparison, house-to-house collection by the agency was 7% of the responses. The collection frequency and methods revealed by the respondents indicated the rating of the efficiency of garbage collection in Table 8. The data revealed that 77% of the respondents rated the garbage collection method "efficient", which accounted for 77% of the distribution, followed by those that rated the method "very efficient", represented by 13%, while the remaining respondents rated the method "fair" accounted for 10%. The reasons given by the respondents for their ratings are that the agency is consistent, prompt and always on time for garbage collection in their neighbourhoods.

Table 6: Frequency of Garbage Collection by the Agency

Frequency of Garbage Collection	No.	%
Twice daily	0	0
Daily	90	90
Twice a week	10	10
Weekly	0	0
Monthly	0	0
None	0	0
Total	**100**	**100**

Source: Researchers' Survey, 2021

Table 7: Methods Used by the Agency for Collection of Garbage

Methods Used in Collection of Garbage	No.	%
Designated centralised collection point	77	77
House-to-house collection by agency	7	7
Truck (tipper)	16	16
Compactor	0	0
Total	**100**	**100**

Source: Researchers' Survey, 2021

Table 8: Rating of Methods of Garbage Collection

Rating of Methods	No.	%
Very efficient	13	13
Efficient	77	77
Fair	10	10
Inefficient	0	0
Very inefficient	0	0
Total	**100**	**100**

Source: Researchers' Field Survey, 2021

The study revealed that garbage disposal methods employed by the agency were disposed of in government-approved landfill sites, and recycling dumped sites accounted for 76% and 24% of the responses. There were no responses for disposed into a waterbody and disposed into the bush (see Table 9). These methods employed for garbage disposal by the agency have also determined the rating of the efficiency of garbage disposal in the study area. As rated by the respondents, the efficiency of garbage disposal methods indicated that 50% rated the garbage disposal methods "efficient", followed by those that rated the methods "very efficient accounted for 36%". In comparison, the remaining 14% rated the methods used as "inefficient" from the distribution in Table 10; the reasons for their rating of the disposal methods employed by the agency were that the activities were carried out during the night hours between 6 pm-10 pm.

Table 9: Methods Used by the Agency for Disposal of Garbage

Methods Used in Disposal of Garbage	No.	%
Disposed in government approved landfill site	76	76
Recycling dumped site	24	24
Disposed into waterbody	0	0
Disposed into bush	0	0
Total	**100**	**100**

Source: Researchers' Field Survey, 2021

Table 10: Rating of Methods of Garbage Disposal

Rating of Methods	No.	%
Very efficient	36	36
Efficient	50	50
Fair	0	0
Inefficient	14	14
Very inefficient	0	0
Total	**100**	**100**

Source: Researchers' Survey, 2021

Challenges Faced in Garbage Collection and Disposal

The study found the challenges of garbage collection methods employed by the agency in the studied neighbourhoods. Table 11, as presented and analysed, showed the modal challenge was indiscriminate garbage disposal accounted for 33.8%, followed by the challenges of lack of finance and non-compliance to schedule a time for garbage disposal of 10 pm-6 am daily accounted for 26.1% and 24.2%, respectively. Other challenges identified by the respondents (households and key informants) were inadequate human resources and lack of operational vehicles (equipment), represented by 8.2% and 7.6%, respectively. From the agency, the quantity and quality of staff carrying out this task are overwhelmed because the required equipment is insufficient to collect the quantity and types of garbage disposed of by households. The garbage collecting agency also identified attitudinal problems from the public in how they handle their garbage by sometimes not packaging them, which has increased the health problems of operators through infectious diseases.

The study revealed in Table 12 that the challenges of garbage disposal methods employed by the agency are almost the same as that identified in the collection methods employed. The data presented in the Table 12 revealed that 60% of the responses identified depositing garbage indiscriminately, followed by lack of finance accounted for 19%. In comparison, non-compliance to schedule time for garbage disposal and lack of operational vehicles (equipment) accounted for 16% and 6%, respectively. These situations, as revealed in the study, indicate several problems faced by the agency and firms involved in garbage disposal in the study area that needs to be addressed by the government and authorities. The interview key informants also agreed with the respondents (households) that garbage is disposed of indiscriminately, which makes the disposal process difficult for the agency and its contractors. They also identified the inadequate provision of proper sanitation facilities such as waste bins and incinerators as contributing factors to inefficient garbage management in the study area.

The assessment of the garbage collection and disposal methods employed, including their challenges, revealed the evaluation of the garbage management process in the study area. Table 13, from rating by respondents from evaluation of the garbage management process, showed that 48% of the respondents rated the process as "fair" this was closely followed by those that rated the process as "unsatisfactory" and "satisfactory" accounted for 28% and 13%, respectively. In the distribution, other respondents rated the process as "very unsatisfactory" and "very satisfactory" as 7% and 4%, respectively. Also, the key informants in their evaluation of the garbage management system rated it as "fair", taking cognisance of the challenges observed faced by the responsible agency for garbage collection and disposal in the studied neighbourhoods.

Table 11: Identified Challenges of Garbage Collection Methods Employed

Identified Challenges of Garbage Collection	No.	%
Inadequate manpower	13	8.2
Lack of finance	41	26.1
Noncompliance to schedule time to garbage disposal	38	24.2
Depositing of garbage indiscriminately	53	33.8
Lack of operational vehicles (equipment)	12	7.6
Total	**157**	**100**

Source: Researchers' Survey, 2021

Table 12: Identified Challenges of Garbage Disposal Methods Employed

Identified Challenges of Disposal Methods	No.	%
Lack of finance	19	19
Noncompliance to schedule time to garbage disposal	15	15
Depositing of garbage indiscriminately	60	60
Lack of operational vehicles (equipment)	6	6
Total	**100**	**100**

Source: Researchers' Survey, 2021

Table 13: Rating of Garbage Collection and Disposal

Rating of Garbage Collection and Disposal	No.	%
Very satisfactory	4	4
Satisfactory	13	13
Fair	48	48
Unsatisfactory	28	28
Very unsatisfactory	7	7
Total	**100**	**100**

Source: Researchers' Survey, 2021

Identified Measures for Improvement of Garbage Collection and Disposal

The respondents in the study area suggested that measures to improve the garbage collection system should include a house-to-house collection method, and the key informants also agreed with this suggestion. This pattern should be made so that the approved receptacle will not be used and avoid indiscriminate dumping along the neighbourhood streets. The respondents also suggested that garbage disposal should be carried out through landfill and recycling methods. The respondents suggested that the workforce should be increased, and more equipment should be purchased for operation. The study revealed that centralised collection points should be established in strategic locations in the neighbourhoods.

Conclusion

Garbage collection and disposal management encompasses all activities and actions required to manage garbage from its generation point to its final disposal point. Effective garbage management in the study area is the very evident reason that the households and the responsible agencies (public and private firms) that are involved in the collection and disposal process are consistent despite the different challenges identified by the households and agencies ranging from financial, operational, compliance and workforce challenges. It is evident that the majority of the respondents strongly agreed that poor strategies for raising environmental awareness are the problem in managing garbage collection and disposal methods. The garbage collection and disposal management problem will persist in Port Harcourt Municipality if sustainable planning measures for garbage collection and disposal are not taken seriously. The findings

have also indicated that those in charge of the managing the garbage collection service providers are expected to have in their employment some skilled manpower who would oversee the field operations and ensure that the right and best practices are followed even as resources are scare to access at times like these. The study has also added to the existing body of knowledge on garbage collection and disposal and provided opportunities for further studies on the subject matter.

Recommendations

i. The waste management agency should conduct a regular survey of garbage collected and disposed of to evaluate the quantity and quality of garbage generated from the neighbourhoods. This process will enhance the methods employed in the garbage collection and disposal process;

ii. Government should abolish the open dump site method of garbage disposal by households and eliminate indiscriminate dumping of garbage along streets;

iii. Government should provide adequate funds for sustainable garbage management that will enhance the efficient and effective collection and disposal in the study area;

iv. Government should collaborate with public health officers and environmental activists to enlighten residents on the importance of adequately bagging garbage from generation points to disposal points to improve the garbage management process in the neighbourhoods;

v. Pay-as-you-thrash policies should be introduced to consumers for the volume of garbage they generate and nothing or a minimal fee for recycling. This system will provide a financial incentive for recycling while reducing garbage;

vi. House-to-house garbage collection in the neighbourhoods should be entirely adopted by the waste management agency to achieve resource recovery and recycling in the study area. It will enhance urban sustainability and management; and

vii. Government should establish a monitoring team that will ensure strict adherence to the regulations of the Rivers State Waste Management Agency for garbage collection operators and residents of the neighbourhoods.

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