

## An Assessment of the Variability of Household Income on Volume of Waste Materials Generated in Benin City, Edo State, Nigeria

Agbebaku H. U.<sup>1</sup>, Afolayan O. S.<sup>2</sup>, Ojeifo M. O.<sup>3</sup>, Okhae E. S.<sup>4</sup>, and Abu R. D.<sup>5</sup>

<sup>1</sup>Department of Environmental Sciences, National Open University of Nigeria, Abuja, Nigeria

<sup>2</sup>Department of Geography, Nigerian Army University Biu, P.M.B 1500 Biu, Borno State, Nigeria

<sup>3,4</sup>Department of Geography and Environmental Management, Ambrose Alli University, Ekpoma,

<sup>5</sup>Department of Geography, Federal University of Kashere, P.M.B. 0182, Gombe, Nigeria

\*Corresponding author: [hagbebaku@noun.edu.ng](mailto:hagbebaku@noun.edu.ng)

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### ABSTRACT

*Income variability plays a determinant factor in the volume of waste materials generated. The research examined the variability of household income on the volume of waste materials generated by residents in Benin City. The objective of the study was to examine the variabilities of household income on the volume of solid waste generated in the study area. Primary data were obtained from 25 selected communities which comprise 110 settlements from the 3 Local Government areas that constitute Benin City. A total of 1,781 copies of questionnaires were administered in the 768 pollen unit stations and 192,250 numbers of registered voters were used for this study. The systematic sampling techniques from the selected streets and houses were used for the study. In each of the selected street 2<sup>nd</sup>, middle and 2<sup>nd</sup> to the last households were administered questionnaires. Secondary data were sourced from published and documentary materials. The 2-way ANOVA statistical techniques were used for the study. On examinations, the results revealed that income variabilities, number of persons per household and economic determinants have positive impacts on the volumes of waste materials generated. High-income earners consumed more packaged products and by implication generate a huge volume of waste items and vice versa. The correlations analysis between monthly income and waste materials generation revealed that a 99% level of significance and relationship exists between monthly income and waste materials generation ( $r = 0.82$ ). The Sum of Squares and Mean square between Groups and Within Groups were 3.606 and 1.802 for the former and 3237.861 and 1.994 for the latter respectively. Furthermore, since the P-values are less than 0.5 level of significance, there was no significant variation (0.000) in the variability in household income and volume of waste materials generated among residents of the study area.*

**Keyword:** Assessment, Variability, Household Income, Volume of Solid Waste Materials Generated.

### 1.0. Introduction

Income variability per individual plays a key role in the nature and volume of purchased items and waste materials generated in urban areas. The volume of waste materials generated in Nigeria's urban areas is becoming alarming in recent times and this calls for urgent attention (Agbebaku, 2018). The amount of income variability per individual, number of persons per household and nature of commerce to an extent determines the volume of waste generated by residences and collected by environmental service operators (Agbebaku, 2019). Given this, the volume of waste materials generation to a large extent is a function of the variabilities of income level-per-individuals and the number of persons per household. Studies have shown that places with high-income earnings results to the high standard of living, huge nature of

purchases and the volume of waste materials generated (Paul and Steven, 2010; Ruth 2016; Agbebaku, 2021). The indicator of income variability on the volume of waste material generation is mainly associated with major towns and cities where 30 and above percent of the citizens are engaged in private and public well-paid service jobs such as oil and gas, finance, organizational governance, security, hospitality and commerce among others white-collar occupational jobs engagement in Nigeria. For instance, it has been established that cities with more white-collar occupational jobs for high-income-earners like Lagos, Abuja, Kano, Abeokuta, Port-Harcourt, Yenagoa, Kaduna, Benin, Ibadan, Osogbo, Kano, Warri, Ibadan, Jos and Uyo generate a huge volume of waste materials than towns and cities with less white-collar occupational jobs and low-income-earners. For instance, the volume of waste densities varies from city to city as it ranged from 280 kg/m<sup>3</sup> to 370 kg/m<sup>3</sup> and waste generation rates ranged from 0.44 to 0.66 kg/capita/day (Ibrahim, 2016; Agbebaku, 2018). In the cities of Ibadan for instance, over 300 metric tonnes of solid waste materials were evacuated from indiscriminate dumps of waste materials in public places every month (Ibrahim, 2016). This assertion was also corroborated by the study of Ayo (2015), where he ascertained that in Lagos Island alone over 30 metric tonnes of waste items were evacuated from residential places and associate areas every quarter of the year and Lagos state over 500 metric tonnes are evacuated on monthly basis. In Benin City, over 320 metric tonnes are evacuated on monthly basis (Agbebaku, 2019). The situation does not differ in the cities of Abuja and Kano as their monthly evacuation is tied with over 400 metric tonnes on monthly basis, The city of Port Harcourt evacuated over 450 while Abeokuta and Warri cities evacuate over 360 metric tonnes on monthly basis. These dailies' weekly and monthly collections with an increase in income, human taste and improvement do not differ technology has gradually led to increase in the volume of waste materials generation as witnessed in major cities in Nigeria (Igbinomwanhia and Ohwovoriol, 2011; Ruth, 2016; Agbebaku, 2021; ESWMB, 2022; LASMA, 2022; OGWMA, 2022; KAWMA, 2022).

The volume of waste materials generated ranges from 13 and above and 156 metric tonnes daily and annually. This is because income per individual and household varies from person to person, trade to trade and organization to organization. In addition, the variance in nature of service providers are clear indices of urban configuration for the huge volume of waste materials generated in these cities (Igbinomwanhia and Ohwovoriol, 2011; Ibrahim, 2016; Egbenoma, 2016; Agbebaku, 2019). Furthermore, urban structure and choice of human residents in the metropolitan areas of town and cities in Benin influence the volume of waste materials generated since urban areas constitute urban configurations with large heterogeneous conglomerations (Agbebaku, 2018). These conglomerated areas are inhabited by a large human population and concentration of social and economic activities and as such the huge volume of waste materials is generated on a daily and monthly basis. The aftermath effects of these indices result in huge waste generation, poor aesthetics of urban centers and poor quality of the urban environment as well as ineffective waste management system as observed in most of the towns and cities in Nigeria (Agbebaku, 2019). In recent times, the volume of waste density has been on the increase a crossed the globe, Africa and Nigeria. This is owned to varying variables such as (a)increase in human population, (b)increase in income level; (c)increase in waste generation (d)recent innovation and technology (e)inadequate service providers (f)urban growth and development and (g) seasonality in volume. The situation also varies in degree and characteristics in towns and cities in developed and developing countries owing to variance in income, number of persons per household and purchase of goods and services (Umunna, 2009; Paul and Steven, 2010; Wright and Boorse, 2011; Oyebo, 2013; Cunningham and Cunningham, 2015 Agbebaku, 2021). The studies of Segynola and Ofuokwu (2011) and Agbebaku (2018), showed that the lingering and huge volume of heaps of refuse counts unattended to and dumpsites poorly managed in towns and cities posed some public health problems. However, the situation may differ with some peculiar circumstances as some places with low-income earners and a smaller number of persons per household may generate huge waste items and vice visa. For instance, the variables of (a)delays in worker's salaries

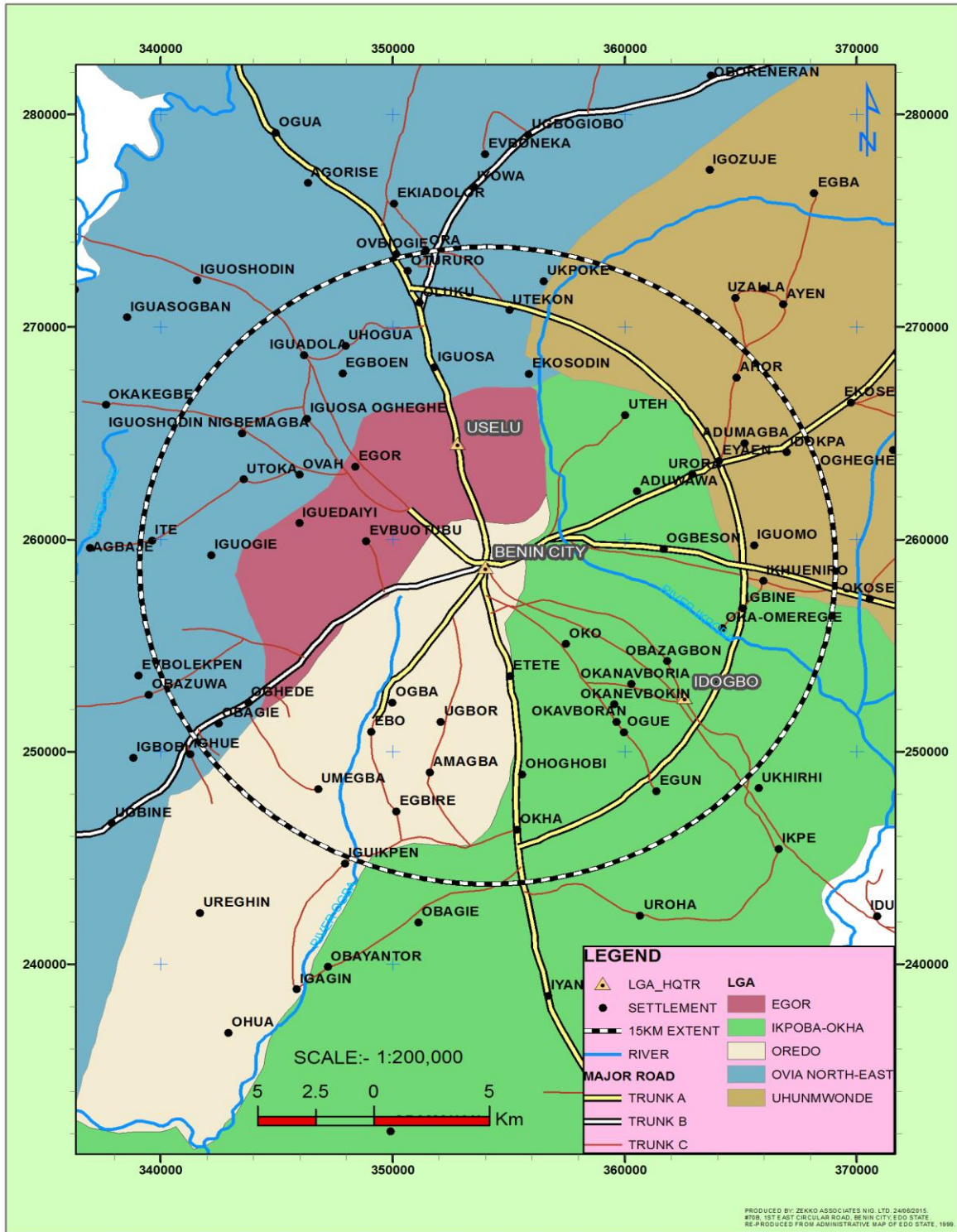
(b)seasonality of the year (c)human taste (d)nature of service providers and (e)nature of food consumption could result in variation in volumes of waste materials generated and disposal (Oyebode, 2013; Agbebaku, 2021). These variables by extension are associated with (a)high number of persons per household and square kilometers, (b)high consumption of processed food and manufactured goods items, (c)high commercial activities and (d)high volume of waste generation (Paul and Steven, 2010; Agbebaku, 2021).

In Benin City, the volume of waste materials generated has been on the increase with the pace of socio-economic activities, urban growth and development and the influx of people for a better life in the cities of Benin in recent times. Furthermore, the activities of service providers can no longer be commensurate with the volume of waste materials generated on daily basis due to the frequent cases of poor and ineffective management. In addition, the purchasing power(s) of persons in the study area has been on the rise to equate with demands and rise in the number of persons per household, hence the aftermath effect on the increase in the volume of waste materials generated (Wright and Boorse, 2011; Igbinomwanhia, 2012; Egbenoma, 2016; Ruth 2016; ESWMB, 2018; Agbebaku, 2021). However, many studies on waste management have been carried out in towns and cities in Edo state but none of these studies have effectively combined the impact of income variability on the volume of waste materials generated in Benin City and this is the research gap of the study. In order to achieve this, the objective of this paper is to examine the variability of household income and the volume of waste materials generated in the study area. The choice of Benin City is pre-determined by a combination of factors such as; the large influx of human population, the rise in the concentration of socio-economic activities and the menace of solid waste disposal in recent times call for this research.

## **2.0. Methodology**

### *2.1. Study Area*

Benin City lies within Latitude  $6^{\circ} 20' 5.9496''$  North of the Equator and Longitude  $5^{\circ} 36' 13.4856''$  East of the Greenwich Meridian. Benin City is administered majorly by 3 Local Government areas of Oredo, Egor, and Ikpoba-Okha and parts of Ovia South-West, Uhunwonde, and Orhionmwon Local Government areas respectively. These 3 Local Government areas are regarded as the hub area coordinating socioeconomic, administrative and political activities of the Benin metropolis. Each of the Local Government areas is densely populated with residential houses where a huge volume of waste materials is generated on a daily, weekly and monthly basis. In addition, the metropolitan towns in these Local Government areas have better white-collar occupational jobs engagement and that income variability plays a determinant factor in the volumes of waste materials generated. These 3 Local Government areas are made up of some selected communities that were used for this study. Each of these Local Government areas is made up of political wards and the wards are made up of settlements.



**Figure. 1:** Benin City: The Benin Metropolis.

**Source:** Ministry of Land and Survey, Benin City, Edo State (2021)

## 2.2 Materials

Materials used for this study include the use of figures, tables and questionnaires administration and these formed the research instruments. The research methods for clarity were categorized into types of data used, sample frame, sample population, sampling method and data analysis. Under types of data, both the primary and secondary data were used for this study. Secondary data were sourced from documentary materials and established sources from academic journals, conference papers, theses, textbooks and map. For the purpose of determining the population size for primary data collection, the number of registered voters in the Polling Units of each settlement was used. Voter registrations of 250 were used per polling unit. The use of

the number of registered voters is predicated upon the unavailability of the 2006 Population Census figure for settlements. For Oredo Local Government area, the number of registered voters from the selected polling units was 89, 250 while in Egor and Ikpoba-Okha, they are 15, 750 and 87,250 respectively. In all 192,250 populations were registered. To get primary data, questionnaires were designed and administered in the field. Wards and settlements of the study area were used as the sturdy frame. A total of one thousand, seven hundred and eighty-one (1,781) copies of questionnaires were administered in selected 25 communities as presented in Table 1.

**Table 1:** Breakdown of Administered Questionnaires in the Selected Wards and Settlements in the 3 Local Governments that Constitutes the Study Area.

S/N	Local Government Area	Questionnaire Administered	Selected Settlements	Selected Wards
1	Oredo	616	(1)Ogbelaka/Nekpenekpen (2) GRA/Etete, (3)Oredo (4)New Benin 2 (5)Ikpema/Eguadase (6)Urubi/Iwehen (7)Ogbe (8)Uzebu (9)Ohogbe/Isekhere/Ice Rd (10)New Benin 1 (11)Unuera/Ogboka and,(12)Ibiwe/Iwegie/Ugbague	1-12 (12)
2	Egor	559	(1) Ugbowo (2) Ogida/Useh and (3) Okhoro.	3,9,10(03)
3	Ikpoba-Okha	606	(1)Gorretti (2)Idogbo (3)Obayantor (4)Iwogban/Uteh (5)Aduwawa/Evbo Modu (6)Ogbeson (7)Oregbeni (8)St. Saviour (9)Ugbekun and (10)Ologbo	1- 10 (10)
<b>Total</b>		<b>1,781</b>	<b>25</b>	<b>25</b>

Source; Fieldwork, 2022

Table 1: Shows the distribution of 1,781 questionnaires administered and the selected settlements and wards in the study area. These selected communities meet with wards with a high number of polling unit stations (PUS) of 20 and above with voter registration of 250, as these areas were assumed to constitute the major towns and cities for the study where huge volumes of waste materials are generated. The 1,781 copies of questionnaires represent the sample size of the population of the study area. Of these number 616 copies of questionnaires were administered in Oredo Local Government area, 559 in Egor and Ikpoba-Okha 606 respectively. In the Oredo Local Government Area, the number of registered voters from the selected polling units was 89, 250 while in Egor LG and Ikpoba-Okha LG, it were 15, 750, and 87, 250 respectively, and in all, 192,250 of the population registered voters were used for this study. Wards with 20 and above polling unit stations (PUS) and with 250 registration numbers of voters were selected in each of the 3 Local Government areas. To ascertain the sample methods, wards with 20 and above polling unit stations (PUS) and with 250 registration numbers of voters were selected in each of the 3 Local Government areas. That is, in Oredo Local Government area with 28 communities, which constitutes of 12 wards; all the communities in the 12 wards were used for questionnaire administration going by the benchmark of 20 and above polling unit station used for this study. These areas constituted the high and moderate human populations. In Egor Local Government area with 20 communities, which constitutes of 10 wards; 3 ward areas were used for questionnaire administration going by the benchmark, while in Ikpoba-Okha Local Government area with 62 communities, which constitutes 10 wards; all the communities in the 10 ward areas were used for questionnaire administration going by the benchmark. The selections were done by systematic random

sampling techniques. In this case, in each of the streets for questionnaire administration, the 2<sup>nd</sup> houses, the middle houses and 2<sup>nd</sup> to the last houses were used. In addition, the first 2 most populous wards, the first 2 medium populated wards and the least 2 populated communities in each of the wards were chosen. The total number of communities to cover therefore was 25. That is 12 wards in Oredo, 3 wards in Egor and 10 in Ikpoba-Okha Local Government respectively.

In addition, the first 2 most populous wards, the first 2 medium populated wards, and the last 2 populated communities in each of the wards were chosen. The total number of communities to cover therefore was 25. That is 12 wards in Oredo, 3 wards in Egor, and 10 in Ikpoba-Okha Local Government respectively. Furthermore, 5% of the total numbers of questionnaires per Local Government area were administered to staff of environmental waste managers which comprises staff from Edo State Waste Management Board (ESWMB) Ministry of Environment and Health Officers and those from the Private Sector Practitioners (PSP) inclusive of the Environmental Free-Lancers. That is 5% of 616 questionnaires for Oredo Local Government area 31. The choice of 5% of the staff of waste managers represents also about 2/3 of the population for this study from questionnaires administration. To this end, 5% of 559 questionnaires for Egor Local Government are 28 and 5% of 606 questionnaires for Ikpoba-Okha Local Government are 30 respectively. The increasing human population of the study area and methods of waste disposal necessitate the study on comparative analysis of service providers of private and government agencies on waste management. The retrieved data from questionnaire administration were collated, tabulated and analyzed descriptively and statistically with the aid of SPSS techniques on the variability of household monthly income and volume of waste materials generated in the study area via, income and household, income and volume of waste materials generated, income and volume of waste materials generated facility and income and waste evacuated.

### 3.0. Results and Discussion

The results from questionnaires administration and tests carried out on an assessment of the variability of household income and waste materials generated in Benin City were summarized and presented in Tables 2 to 15 respectively.

**Table 2:** Number of Persons per Households by Residents

Persons per Households	Frequency	Percent
2-5 Persons	131	8.1
6-9 Persons	205	12.6
10-13 Persons	376	23.1
14-17 Persons	495	30.4
18 Persons Above	420	25.8
<b>Total</b>	<b>1627</b>	<b>100.0</b>

Source: Fieldwork, 2022

The results from Table 2 revealed that the majority of the number of persons per household in the study area are those households with resident numbers between 14 to 17 persons per household and this represents 30.4%. This is followed by the number of persons between 18 and above per household and this represents 25.8%. 23.1% of the responses indicate a number of persons between 10 and 13 per household, while the number of persons between 6 and 9 represents 12.6%. In addition, the number of persons between 2 and 5 represents 8.1% respectively. To this end, it can be deduced that the more the number of persons per household, the likely the more the purchasing power and increase of the volume of goods purchased and the more the volume of waste materials that would be generated owing to the need to equate demands with supplies of these necessary items for human existence and sustainability. This assertion agrees with the study of Agbebaku (2019). Table 2 shows the comparative analysis of the number of persons per household in each of the 3 Local Government areas that constitute the study.

**Table 3:** Comparative Analysis on Number of Persons per Household in the 3 Local Govt. Areas.

Local Area	Govt, 10-13 Persons	13-14 Persons	14-17 Persons	17-18 and above	6-9 Persons	9-12 Persons	2-5 Persons
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Oredo	117	133	103	84	48
Egor	128	126	116	52	39
Ikpoba-Okha	131	237	201	69	44
<b>Total</b>	<b>376</b>	<b>496</b>	<b>420</b>	<b>205</b>	<b>131</b>

**Source:** Fieldwork, 2022.

The result from Table 3 shows the comparative analyses of the number of persons per household in the 3 Local Government areas. From the Table, it was revealed that residents of Ikpoba-Okha have the highest number of persons per household more than other council areas with a high number of persons between 14 to 17 persons per household. This is followed by responses from Egor and Ikpoba-Okha respectively. The reasons for this could be due to a combination of factors such as (a)the low cost of housing facilities they occupied, (b)the low and intermediate income earned to afford a better apartment (c)high level of fertility and (d)consumption of more processed than packaged food items and (e)huge accumulation of refuse counts or waste generation were compared to Oredo and Egor Local Government areas respectively. This assertion agrees with the study of Osaghale (2011).

**Table 4:** Volume of Waste Materials Generated by Households Size

Household Size	Frequency	Percent	Waste Daily (Kg)	Waste Weekly (Kg)	Waste Monthly (Kg)
0-3	138	10.4	21	43	87
4-6	381	20.6	68	132	265
7-10	637	40.1	111	228	458
11-14	285	16.8	48	97	195
15 and Above	186	12.1	25	55	115
<b>Total</b>	<b>1627</b>	<b>100.0</b>	<b>273</b>	<b>445</b>	<b>1120</b>

**Source:** Fieldwork, 2022.

The results from Table 4 revealed residents’ responses to household size and volume of waste material generated on daily, weekly and monthly bases in the study area. From the Table, a greater proportion of waste materials generated were from households with 7-10 persons and these number of persons per household generate waste materials of about 111kg daily, 228kg weekly and 458kg monthly respectively. This is followed by the number of 4-6 persons per household and these persons generate waste materials of 68kg on daily, 132kg weekly and 265kg monthly. In addition, 11-14 persons per household generate 48kg daily, 97kg weekly and 195kg monthly. While 15 & the above number of persons per household generate 25kg daily, 55kg weekly and 115kg monthly.

Furthermore, 0-3 number of persons per household generate 21kg daily, 43kg weekly and 87kg monthly respectively. However, it was further revealed that the volume of waste materials generated per household on daily, weekly and monthly bases varies from ward to ward, community to community and Local Government to Local Government owing to variabilities of income earned, the number of purchases made and size per households. The comparative analyses of the compressed nature of the volume of waste materials generated per Local Government. This assertion agrees with the study of Segynola and Ofuokwu (2011). Table 4 shows the volume of waste materials generated per household by residents while Table 4 shows the comparative analyses of volumes of waste materials generated in the 3 Local Government areas.

**Table 5:** Comparative Analysis per Local Government on Volume of Wastes Generated per Household by Residents

Local Government Area	Household Per Size 7-10	Household Per Size 4-6	Household Per Size 7-10	Household Per Size 15-Above	Household Per Size 0-3
Oredo	201	95	70	76	48
Egor	210	115	96	64	52
Ikpoba-Okha	226	171	119	46	38
<b>Total</b>	<b>637</b>	<b>381</b>	<b>285</b>	<b>186</b>	<b>138</b>

**Source:** Fieldwork, 2022

The result from Table 5 revealed residents’ responses on the volume of waste materials generated per household. From the result, the study revealed that residents from Ikpoba-Okha Local Government area generate the highest number of household waste materials than other residents from Egor and Oredo

Local Government areas respectively. The reasons for these could be due to a combination of the variables of (a)the size of the number of persons per household, (b)high purchases of processed goods, (c)ineffectiveness of service providers to do the needful (d)poor attitude of the person within these areas and (e)the methods and facilities of waste disposal given priority per Local Government area. This assertion agrees also with the study of Segynola and Ofuokwu (2011).

**Table 6:** Responses of Residents on Waste Collection by Environmental Waste Managers

Wastes Collection	Frequency	Percent
Daily	18	1.1
Weekly	613	37.7
Every Fortnight	643	39.5
Once a Month	169	10.4
Once in Two Months	62	3.8
Whenever they Like	122	7.5
<b>Total</b>	<b>1627</b>	<b>100.0</b>

Source: Fieldwork, 2022

Results from Table 6 show that waste collection from every fortnight represents 39.5%, this is followed by weekly 37.7%. The collection once a month represents 10.4% while collection whenever they like, represents 7.5%. Once in two months represents 3.8% and that on daily evacuation represents 1.1% respectively. Findings from personal interviews revealed that there are major anomalies and selective service providers in some quarters and communities in the study area. This results in cases of overflows of storage facilities and poor sanitary conditions as observed in strategic places in Benin City. For instance, the period August 2018 – March, 2019 witnessed the ban of service operatives in the study area. The study further revealed that delay in collection of storage facility could be part of the reasons for the threat and poor aesthetics of refuse matters in Benin City. This assertion agrees with the study of Agbebaku (2019). Table 6 shows the comparative analyses of waste collection by environmental waste managers of the 3 Local Government that constitutes the study area.

**Table 7:** Comparative Analysis of Residents Responses on Waste Collection by Environmental Waste Managers

Local Government Area	Weekly (Kg) Collection	Every (Kg) Fortnight Collection	Once a Month (Kg) Collection	When Ever They Like (Kg)	Once in two Months (Kg)	Daily (Kg)
Oredo	215	235	66	29	15	8
Egor	201	216	54	30	13	6
Ikpoba-Okha	197	192	49	63	34	4
<b>Total</b>	<b>613</b>	<b>643</b>	<b>169</b>	<b>122</b>	<b>62</b>	<b>18</b>

Source: Fieldwork, 2022

Results from Table 7 showed the comparative analysis of the responses on waste collection by Environmental Waste Managers in the study area revealed that wastes collection weekly, every fortnight and once a month was highly evacuated in Oredo than in any other Local Government areas. This is followed by a collection from Egor and Ikpoba-Okha Local Governments respectively. The reasons for this could be due to the level of sensitization, functionality and administrative and coordinating services at Oredo than in any other councils of the study area. Furthermore, the study revealed that the collection of waste materials by Environmental Waste Managers in Egor and Ikpoba-Okha was not as effective if compared to that of Oredo Local Government. The reasons could be the low level of patronage and poor service provider in these Local Government areas by Environmental Waste Managers if compared to Oredo council area. Others order waste materials collected from the study area are wastes collected whenever they like, once in two months and daily collection with Oredo having the highest collected. This is followed by waste from Egor and Ikpoba-Okha Local Government areas respectively. This assertion agrees with the study of Ruth (2016) and Agbebaku (2021).

**Table 8:** Monthly Income Earned by Residents Outside Government Establishments

Monthly Income	Frequency	Percent
Less than N18,000	102	6.3
N19,000-N39,000	302	18.6
N40,000-N60,000	309	19.0



N61,000-N81,000	590	36.3
N82,000-N102,000	164	10.1
N103,000-N123,000	103	6.3
N124,000 Above	57	3.5
<b>Total</b>	<b>1627</b>	<b>100.0</b>

**Source:** Fieldwork, 2022

Results from the study show the variance in monthly incomes earned by residents outside government establishments. The results from Table 8 revealed that the monthly income earned by residents between N61, 000 - N81, 000 represents 36.3%. This is followed by income earned between N40, 000 - N60, 000 and this represents 19.0%. Furthermore, income earned between N19, 000 - N39, 000 represents 18.6%, while income earned between N82, 000 - N102, 000 represents 10.1%. In addition, income earned between N103, 000 - N123, 000 and less than N18, 000 were tied and these represent 6.3% respectively. While income earned from N124, 000 and above represents 3.5% respectively and these analyses cut across the 3 Local Government areas. In addition, the study revealed that income earned has a positive impact on economic growth and the associated effects on the volumes of waste materials generated. From the Table analysis, we can deduce that high-income earners have more purchasing power to buy more packaged products that generate more waste items than their fewer counterparts. This assertion agrees with the study of Paul and Steven (2010) and Agbebaku (2019).

**Table 9: Monthly Income Earned by Residents Working with Government Establishments**

Monthly Income	Frequency	Percent
Less than N18,000	283	21.7
N19,000-N39,000	323	22.9
N40,000-N60,000	258	20.5
N61,000-81,000	224	10.8
N82,000-N102,000	248	14.5
N103,000-N123,000	114	6.0
N124,000 Above	97	3.6
<b>Total</b>	<b>1627</b>	<b>100.0</b>

**Source:** Fieldwork, 2022

The results from Table 9 revealed the monthly income earned by residents working with government establishments in the study area. From the Table, 283 of the responses which represent 22.9% earned between N19,000 to N39,000. This is followed by 258 of the responses which represent 21.7% that earned less than N18,000. In addition, 238 which represent 20.5% earned between N40,000 to N60,000. 228 of the responses which represent 14.5% earned between N82,000 to N102,000 while 97 which represent 3.6% earned N124,000 and above respectively. The study further revealed that there are inequalities of social status among residents from the private and government-owned establishments and this could be an added factor to the variance in purchasing powers of residences in the study area. This assertion agrees with the study of Paul and Steven (2010) and Agbebaku (2019).

**Table 10: Comparative Analyses of the Responses on Monthly Income Earned by Residences per Local Government Areas**

Local Government Area	Less Than N18,000	N19,000 - N39,000	N40,000 - N60,000	N60,000 - N81,000	N82,000 - N102,000	N103,000 - N123,000	N124,000- above
Oredo	43	105	103	219	64	40	20
Egor	29	101	102	199	42	31	19
Ikpoba-Okha	30	96	99	172	58	32	18
<b>Total</b>	<b>102</b>	<b>302</b>	<b>309</b>	<b>590</b>	<b>164</b>	<b>103</b>	<b>57</b>

**Source:** Fieldwork, 2022

Results from Table 10 show the comparative analyses of monthly income earned per Local Government area from both private and public servants in the study area. From the Table, it was revealed that differentials in income were adequately high from responses from Oredo than in other council areas. This is followed by responses from Egor and Ikpoba-Okha in that order respectively. Furthermore, the differential in cadres of senior personnel was more in numbers with the public sector management if

compared with those from the private sector. However, the study revealed that staff from Oredo LG earned a monthly income of N19,000 - N39,000 more than any other council areas. This is followed by staff from Oredo and Ikpoba-Okha respectively. Staff that earned between N40,000 – N60,000 were tied in Oredo and Egor council areas respectively. Findings from the study revealed that the majority of staff from Ikpoba-Okha earned the least monthly income if compared to other council areas. Other differentials in income level were those which earned between N82,000 - N102,000, N61,000 - N81,000, N103,000 - N123,000 and N124,000 - above. The reasons for this could be those residents from Oredo engaged in more and better job prospects or business patronage than other councils' areas. More so that monthly income is fixed for civil servants across all the 3 Local Governments within the state. This assertion agrees with the study of Osaghale (2011) and Agbebaku (2019).

**Table 11:** Variables Used to Compute the Hypothesis on the Variability of Household Income and Volume of Waste Materials Generated.

Local Government Area	Number of Person Household	Volume of Waste Generated (kg)	Common Waste Generated Facility	Waste Evacuation Rate	Common Storage Facility per Household
Oredo	485	35	591	32	654
Egor	461	30	504	28	433
Ikpoba-Okha	682	18	534	23	540
<b>Total</b>	<b>1628</b>	<b>83</b>	<b>1629</b>	<b>83</b>	<b>1627</b>

Source: Fieldwork, 2022.

Table 11 shows the comparative analysis of the variables used to compute the tested hypothesis on household income and volume of waste generated in the study area using the technique of 2-Way Analysis of Variance. The stated hypothesis states that there is no significant variance in monthly income and waste materials generated among residents of Oredo, Egor and Ikpoba-Okha in Benin City. Table 11 shows the computed results of the 2-Way Analysis of Variance on monthly-income-earned while Table 12 shows the 2-Way Analysis of Variance on monthly income and waste generated among residents of the study area.

**Table 12:** Computed Result of 2-Way Analysis of Variance on Monthly Income

Monthly Income	Sum of Squares	Df	Mean Square	F	Sig.
Between Group	3.604	2	1.802	.904	.405
Within Groups	3237.861	1624	1.994		
<b>Total</b>	<b>3241.465</b>	<b>1626</b>			

Source: Fieldwork, 2022

The result from Table 12 shows the 2-Way Analysis of Variance in monthly income. From the computation, the Sum of Squares and Mean squares between Groups and Within Groups were 3.606 and 1.802 for the former and 3237.861 and 1.994 for the latter respectively. In addition, a Standard Deviation (df) of 2, Frequency of .904 and Level of Significant of .405 were derived. In a nutshell, this is an indication that monthly income varies significantly (0.4) and determines the rate of waste generation. That is, the higher the income the higher the rate of waste generation and vice versa. This is an indication that monthly income varies significantly (0.4) and this determines the rate of waste generation. That is the higher the income, the higher the rate of waste generation and vice-versa.

**Table 13:** Computed Result on Monthly Income and Volume of Waste Generated

Monthly Income and Volume of Wastes Generated	Sum of Squares	Df	Mean Square	F	Sig.
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Income and Household	Between Groups	2155.973	6	359.329	2.043E3	.000
	Within Groups	284.951	1620	.176		
	<b>Total</b>	<b>2440.924</b>	<b>1626</b>			
Income and Volume of Wastes Generated	Between Groups	282.261	6	47.044	1.029E3	.000
	Within Groups	74.039	1620	.046		
	<b>Total</b>	<b>356.300</b>	<b>1626</b>			
Income and Wastes Generation Facility	Between Groups	242.651	6	40.442	447.388	.000
	Within Groups	146.441	1620	.090		
	<b>Total</b>	<b>389.092</b>	<b>1626</b>			
Income and Common Solid Wastes Storage Facility per Household	Between Groups	222.832	6	37.139	1.036E3	.000
	Within Groups	58.069	1620	.036		
	<b>Total</b>	<b>280.901</b>	<b>1626</b>			
Income and Wastes Evacuation Regularity	Between Groups	2019.423	6	336.570	3.020E3	.000
	Within Groups	180.516	1620	.111		
	<b>Total</b>	<b>2199.939</b>	<b>1626</b>			

Source: Fieldwork, 2022

The results from Table 13 show a 2-Way ANOVA of the sum of squares and mean square for: (a) Income and Household between Groups were 2155.973 and 359.329 respectively and Within Groups was 284.951 and .176 respectively. (b) Income and Volume of Wastes Generated between Groups were 282.261 and 47.044 respectively and Within Groups were 74.039 and .046 respectively. (c) Income and Wastes Generated Facility between Groups were 242.651 and 40.442 respectively and Within Groups were 146.441 and .090 respectively. (d) Income and Common Solid Wastes Storage Facility per Household between Groups were 222.832 and 37.139 respectively and Within Groups were 58.069 and .036 respectively, and (e) Income and Wastes Evacuation Regularity Between Groups were 2019.423 and 336.570 respectively and Within Groups were 180.516 and .111 respectively. Standard deviation (df) was constant Between Groups 6 and Within Groups 1620 for all the variables from *a* to *e* respectively. But there were variations in the values of the frequency column of the computed Table. In view of this, the test is significant and the same applies to the income and persons per household, income and volume of waste generated and income and waste evacuated in the study area. Furthermore, since the P-values are less than 0.5 level of significance, there is no significant variation (0.000) in the variability in household income and volume of waste materials generated among residents of the study area. Table 14 shows the correlation analysis of 2-Tail-ANOVA on monthly income and volume of waste materials generation among the three Local Government Areas of Oredo, Egor and Ikpoba-Okha in Benin City.

**Table 14:** Correlation Analysis of 2-Tail ANOVA on Monthly Income and Volume of Waste Materials Generation among the 3 Local Government Areas

Monthly Income and Waste Materials Generation		Monthly Income	Types of Waste Materials
Monthly Income	Person Correlation	1	817***
	Sig (2-Tailed)		000
	N	1627	1627
Type of Waste Materials	Person Correlation	817***	1
	Sig (2-Tailed)	000	
	N	1627	1627

Source: Fieldwork, 2022

\*\* Correlation is significant at the 0.01 level (2-Tailed).

This indicates that at a 99% level of significance, a relationship exists between monthly income and types of waste generation ( $r = 0.82$ ). That is a positive and very high correlation. In addition, the correlation analysis of 2-Tail ANOVA on monthly income and volume of waste generation among the three Local Government Areas of Oredo, Egor and Ikpoba-Okha in Benin City is revealed as follows in Table 13.

**Table 14:** Student's T-Test between the Monthly Income and Types of Waste Generation

Student's T-Test	Mean	N	Std. Deviation	Std. Error Mean
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Pair 1	Monthly Income	3.58	1627	1.412	035
	Types of Waste Materials	3.09	1627	789	020

**Source:** Fieldwork, 2022

#### 4.0. Conclusion

The number of persons per household and the nature of job and services determines to a large extent the volume of waste generated. Income of person(s) and nature of services render play determinant factors in the volume of waste generated. This is to say the higher the income, the higher the rate of waste generation and vice-versa. The study revealed that there is a positive correlation between income earned and the volume of waste generated. The study revealed that the volume of waste generated is not evenly generated in the 3 Local Government areas and is relatively high in some quarters than others and causing lots of threats mostly in public places (markets, hospitals, institutions and roadsides) than from household areas. Furthermore, the study revealed that waste generated is not in proportion to household income.

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