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Original Research Article

Assessment of the activities of scavengers and their economic impacts in waste recovery in Warri metropolis, Delta State Nigeria

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This study analyzed the informal activities carried out by scavenger/waste handlers around open waste dumpsites in the Warri Metropolis. Onsite assessments were made to the dumpsites and data generated were analyzed using descriptive statistics, percentages and graphs. The study revealed that though co-operatives exist in each of the dumpsites, they are not formally registered with the local government authorities. Scrapped metals, plastics, polyethylene, and cans were the main types of waste recovered. Recovered items are sold onsite or moved to nearby popular markets where there exist big retailers, while scrapped irons are recycled at the Delta Steel Company. Some of the smaller plastic bottles are sold in the popular local markets for individuals and private people like peanut seller, juice and bottle water distributors and local/native medicine dealers called "agbo". It was observed that although less than five percent of dumped wastes were recovered, each of the waste dumpsite has in its employment more than fifteen households working all year round. Results showed that scavengers have an important role in the informal solid waste management especially in term of waste reduction, minimization and material recovery. For effective waste management, government and policy makers are advised to legalise waste scavenging, merge them into recognised co-operatives, enforce safety sanitary conditions and implement voluntary waste segregation at source by household, industries, companies and government establishment.

Key words: Waste, dumpsites, households, scavengers, Warri metropolis.

INTRODUCTION

According to Adeyemi (2001), wastes are things considered as unfit, unwanted and discarded due to economic reasons or ignorance of alternative technologies to re-use them. Waste management is considered as one of the most serious environmental problems facing the world today. In recent years, solid waste generation in metropolitan cities had increased extraordinarily. Zimring (2005) identified increased population and consumption as one of the problems linked to the amount of waste generated. Solid waste constitutes a major urban environmental paralysis; a clog on the wheel of progress in terms of urban environmental purity and sanitation (Ayotamuno and Gobo, 2004). Solid waste causes pollution and contributes to global warming which in turn has a negative impact on man and environment (Akpofure 2009; Boldrin et al., 2009; Adejobi and Olorunnimbe 2012; Ayuba et al., 2013; Papargyroponlon et al., 2015; Asibor et al., 2016). The presence of undisposed waste in a place causes different types of diseases, filth and unsightliness of the environment which affect the lives of human, animals and aquatic organisms. Concerns for effective and proper management of solid waste generated in urban cities in Nigeria have continued to increase (Table 1) due to its environmental and health implications (Longe and

Table 1. Generated Solid waste for some cities in Nigeria

S/N	City/Town	Population	Tonnage /month	Density (kg/m3)	Kg/person /day	Agency
1	Lagos	8,029,200	255,056	294	0.63	LAWMA
2	Ibadan	307,840	135,391	330	0.51	Oyo state environmental protection commission
3	Ado-Ekiti	241,200	9,518	-	0.71	
4	Akure	369,700	-	-	0.54	
5	Abeokuta	529,700	-	-	0.66	
6	Nsukka	100,700	12,000	370	0.44	Enugu state environmental protection agency
7	Onitsha	509,500	84,137	310	0.53	
8	Aba	784,500	236,703	-	0.46	
9	Port-Harcourt	1,053,900	117,825	300	0.60	Rivers state environmental protection agency
10	Warri	500,900	66,721	-	-	DELSEPA
11	Uyo	102,400	20,923	-	-	
12	Abuja	159,900	14,785	280	0.66	Abuja Environmental Protection Agency
13	Markurdi	249,000	24,242	340	0.48	Urban Development Board
14	Ilorin	756,400	-	0.43	-	
15	Kano	3,248,700	156,676	290	0,56	Kano State Environmental Protection Agency
16	Kaduna	1,458,900	114,433	320	0.58	Kaduna State Environmental Protection Agency
17	Maiduguri	971,700	850,000	-	-	
18	Onitsha	509,500	84137	310	0.53	Anambra State Environmental Protection Agency

Source: Ogwueleka (2009) and Adeoye et al. (2011)

Williams, 2006; Agwu 2012).

Some of the problems associated with solid waste management in Nigeria are; unwillingness to pay for the services, poor access road to designated dumpsites, poor infrastructural support, etc. (Agunwamba et al., 1998; Longe et al., 2009; Nabegu, 2012). According to Thirarattanasunthon et al. (2012); Butu and Mshelia (2014), studies have also shown that uncollected waste have contributed to flooding, breeding of insects and rodents vectors which spread diseases such as cholera, typhoid fever, lassa fever, diarrhoea, dysentery, schistosomiasis, etc. (Asbor and Edjere, 2016).

Virtually all agencies of tiers of government in Nigeria are confronted with the management of solid wastes. This is due to volume of wastes generated which continues to increase at a faster rate than the ability of the agencies to manage them. The deterioration of the urban environment in terms of irresponsibly dumped and accumulated solid wastes is most apparent in our urban lives and has caused a blighted environment (Ayotamuno and Gobo, 2004; Ikechukwu 2015).

In most the metropolis, huge heaps of waste can be found along many major roads besides those wastes that are scattered in abandoned buildings, street corners and side roads (Efe, 2013). Some of these wastes found their way into gutters, blocking drainages systems leading to flooding. The volume of solid waste generated has over whelmed the urban administrator's capacity to plan for their collection and disposal. Recently, Delta State Government in Nigeria reached an agreement with some waste collectors to assist in collection and disposal of these wastes but minimal attention is paid to the reuse or recycling of these wastes (Oteh, 2016).

The system of waste salvaging, reclaiming or recycling is fast gaining ground in most cities today (Bisong and Ajake, 2001). This paper, therefore, focuses on the activities of scavengers of solid wastes within the Warri metropolis. Waste scavenging has become a serious business i.e. a source of income and employment generation for the teeming Nigeria youths and in some cases, a whole family is engaged. It is also a source of raw materials for the construction industry, bottling plants and plastic manufacturers. According to a World Bank report (Medina, 1997; Medina 2000), about 2% of the third world population survives through scavenging and cities like Bangkok, Jakarta, Karachi, and Manila have been saved about $3 million each year by the activities of scavengers (Aljaradin et al., 2015). Due to the activities of scavengers, waste collection centers are gradually springing up in some of the Nigerian metropolis, where collected scavenged wastes are segregated, bulk together according to types and sold to end-users. It is in the light of the foregoing that this research wishes to investigate the activities of scavengers with the aim of knowing the amount of waste collected per day, level of employment generation, health hazards and the ratio of recycled/recovered waste from some selected dumpsites in Warri Metropolis.

MATERIALS AND METHODS

Area of Study

Warri is one of the towns geographically located within the western Niger Delta of Nigeria. It is situated some few

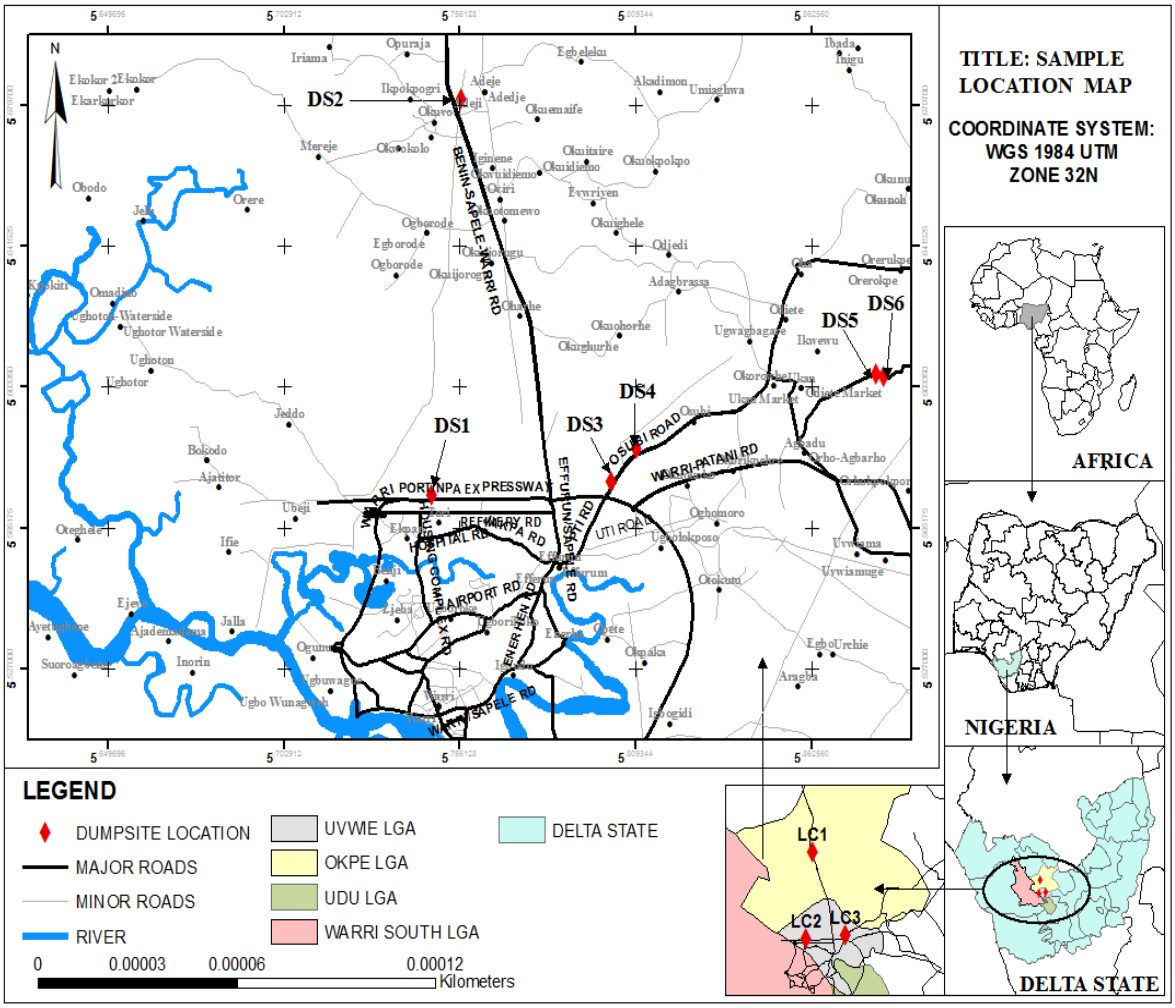

Figure 1: Map of Warri Metropolis showing the investigated waste dumpsites

kilometres away from the Atlantic Ocean. The Warri Refinery and Petrochemical Company (WRPC), Nigerian Gas Company (NGC) and some other oil and gas companies are located in the Metropolis, thus making it one of the two major oil cities in Nigeria. It is the most populated metropolis in Delta State. The Metropolis comprises of Warri South, Uvwie, Okpe, Udu and parts of Ughelli South Local Government Areas (Figure 1) with a population of about 800,000 (NBS 2009). Details of the investigated waste dumpsites are summarised in Table 2. The waste type from each of the dumpsites consists of organic, non-organic, hazardous and non-hazardous. These wastes may have originated from domestic, agricultures, industrial and electronic wastes.

Data Collection and Analysis

Primary and secondary data used for this research were obtained by the administration of the questionnaire, field survey and oral interviews of personnel working and living within the vicinity of the dumpsites. Oral interviews include face to face discussion with the scavengers' at each of the centers sampled. A questionnaire consisting of closed-ended questions which address the current status of types of waste deposited, number and types of trucks used, a number of scavengers, types of wastes scavenged, etc. was developed. This was designed to answer the following questions; the social demographic characteristics of the scavenger; age, sex, level of education, marital status, number of years in the trade, estimated income generated, and then the source, amount, type and place of the waste collected, purpose and benefits of the collected waste and the negative effect of working with waste on their health. It was administered to ninety-six scavengers. The data collections targeted scavengers at work, on transit, and at home.

The analytical technique used in the analysis of data for this research is the descriptive statistics which includes meaning, standard deviations, tables, frequencies, and charts respectively using the Palaeotological Statistics

Table 2. Summary of the investigated dumpsites

S/N	Dumpsite Name/ Description	LGA	Dimension (m)	Year Established	Types of Waste	Remark
1	Niger Cat along NPA Expressway	Uvwie	400x200	2011	Municipal & household	No Control
2	Don Parker Benin Expressway	Okpe	600x800	2011	Municipal & household	Managed
3	Osubi by Osubi Slaughter	Okpe	400x200	2012	Municipal & household	Managed
4	Osubi along Osubi Road	Okpe	600x400	2014	Municipal & household	Managed
5	Ewhere 1	Ughelli South	400x100	2012	Municipal & household	No Control
6	Ewhere 2	Ughelli South	500x200	2013	Municipal & household	Managed

Figures : 2, 3, 4 and 5: Heaps of recovered wastes by scavengers awaiting buyers

(Hammer et al., 2003), Statistical Package for Social Sciences (SPSS) Software package and Statistical Ecology (Ludwig and Reynolds, 1988).

RESULTS AND DISCUSSION

The scavengers are involved in both on-site and off-site waste recovery. They recover reusable and recyclables materials like plastics, aluminum, glass, paper, scraps metal, tins, cans, cables, animal wastes like a horn, bones etc. Some go from door-to- door to recover waste, while majority limit their operation to the waste brought to the disposal sites. Some of the recovered wastes are processed before they are sold to the end-users, resource merchants or recycling industries. The processes include washing, burning, etc. to add more value to sales. The majority of the scavengers often times spend part of their life in makeshift houses built on and around the disposal sites like. It is a common sight around the dumpsites to see heaps and mountains of recovered materials waiting to be purchased or transported to the resource merchants or recycling companies (Figures 2, 3, 4 and 5).

The results obtained using the structured questionnaire and oral interviews are summarized in Tables 3, 4 and 5. In Tables 3 and 4 show the socio-economic characteristic of the respondents and scavengers (sex, age, marital status, educational levels, occupation and the average income of the scavengers as well as the years they have been in the business).

Socio-economic characteristics of scavengers

Data gathered from ninety-six scavengers with regards to socio-economic characteristics shows that 75% of the scavengers are resident around the dumpsites while 25% are itinerant who scavenges from one waste dumpsite to another. On age of respondents, 17% are in the age bracket

Table 3. Socio-Economic Characteristics of the Scavengers

Socio-economic characteristics		Stations												Total	
		1		2		3		4		5		6			
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Age	Under 20	2	25	2	15	3	42	2	13	3	37	5	11	17	18
	20 – 29	3	37	5	38	2	29	3	20	2	25	15	33	30	31
	30 – 39	2	25	4	32	2	29	5	34	2	25	18	41	35	35
	40 – 49	1	13	2	15	0	0	3	20	1	13	3	7	10	10
	50 – 59	0	0	0	0	0	0	2	13	0	0	2	4	4	4
	60 +	0	0	0	0	0	0	0	0	0	0	2	4	2	2
Sex	Male	5	62	10	77	3	43	3	20	5	62	30	67	56	58
	Female	3	38	3	23	4	57	12	80	3	38	15	33	40	42
Marital status	Single	2	25	3	23	3	43	2	13	2	25	18	40	30	31
	Married	3	37	5	38	3	43	8	54	3	38	20	45	42	44
	Divorced/ Separated	1	13	2	16	1	14	3	20	2	25	2	4	11	11
	Windowed	2	25	3	23	0	0	2	13	1	12	5	11	13	14
Educational Level	Non-formal education	2	25	3	23	2	29	2	13	1	13	18	41	28	29
	Primary	4	50	5	38	4	57	8	54	4	49	15	33	40	42
	Post Primary	2	25	4	31	1	14	3	20	3	38	10	22	23	24
	Post Secondary	0	0	1	8	0	0	2	13	0	0	2	4	5	5
Occupation	Trading	2	25	2	15	2	29	5	33	3	38	13	29	27	28
	Farming	1	13	2	15	2	29	1	7	2	25	2	4	10	10
	Driving	0	0	1	8	0	0	1	7	0	0	0	0	2	2
	Civil Service	0	0	1	8	0	0	0	0	0	0	1	2	2	2
	Artisan	4	49	5	38	3	42	6	39	2	25	21	47	41	44
	Retired	1	13	1	8	0	0	1	7	0	0	0	0	3	3
	Others	0	0	1	8	0	0	1	7	1	12	8	18	11	11
Average Monthly Income in Naira (N)	<10,000	0	0	0	0	0	0	0	0	1	12	0	0	1	1
	10,001-20,000	1	13	1	8	3	43	2	13	2	25	4	9	13	13
	20,001-30,000	2	25	1	8	1	14	1	7	3	39	5	11	13	13
	30,001-40,000	2	25	3	22	2	29	5	33	1	12	15	33	28	30
	40,001-50,000	3	37	4	31	1	14	4	27	1	12	12	27	25	26
	Above 50,000	0	0	4	31	0	0	3	20	0	0	9	20	16	17
No. of years in the business	<1 Year	2	25	1	8	2	29	3	20	1	12	8	18	17	18
	1-5 Years	3	38	6	46	3	42	4	27	4	50	12	27	32	33
	5-10 Years	2	25	5	38	2	29	5	33	3	38	18	40	35	37
	10-15 Years	1	12	1	8	0	0	2	13	0	0	5	11	9	9
	15-20 Years	0	0	0	0	0	0	1	7	0	0	2	4	3	3
	Over 20 Years	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: $1=N350

less than 20 years, 36% are in the age bracket 20 - 29 years, 17% are in the age bracket 30 - 39 years, 10% are of the age bracket 40 - 49 years, 6% are of age bracket 50-59 years and 15% are in the age 60 years and above. This shows that most scavengers in the area are youth, and perhaps engages in such practice because of lack of employment. Another reason for the high number of those at the peak of their productive years is because scavenging is labor intensive and the elderly may not be able to withstand the stress.

Data collected on the sex of respondents' shows it is male dominated (58%) and are mostly married (44%). In the same vein, data on the employment status of respondents indicate 67% are artisans, traders and unemployed and scavenge either full-time or part-time, while some of the respondents are their wards or students, and resort to waste scavenging after school hours.

In terms of educational status, a majority of the respondents have primary school certificate or secondary school (66%). In the high competitive nature of employment in Nigeria, most may not be able to find a job in the formal sector and therefore resort to this type of profession. Because of the low level of education of many of the scavengers, awareness of the negative health effects from working with waste is very low. Most work in a very primitive way without any protective measures for health and safety they could be exposed to hazards which they are not aware of.

Table 4. Percentage Composition of Recovered Wastes per month in tonne (T)

S/N	Waste Type	Locations												Total	
		Niger Cat		Don Parker		Osubi Slaughter		Osubi Rd		Ewhere I		Ewhere II			
		T	%	T	%	T	%	T	%	T	%	T	%	T	%
1	Polythene products	1.88	7.98	2.18	7.20	1.16	8.50	2.06	8.94	1.00	4.99	4.44	9.04	12.72	7.97
2	Plastic Bottles	0.96	4.07	1.30	4.30	0.32	2.35	1.12	4.86	0.98	4.89	1.84	3.75	6.52	4.08
3	Glass Bottles	0.98	4.16	2.84	9.39	1.42	10.41	1.21	5.25	1.68	8.37	3.22	6.56	11.35	7.11
4	Scrap metals	6.42	27.25	8.44	27.89	4.12	30.21	6.35	27.57	6.22	31.01	14.84	30.21	46.39	29.05
5	Tins & Cans	4.88	20.71	4.68	15.47	1.48	10.85	2.02	8.77	2.12	10.57	4.28	8.71	19.46	12.19
6	Aluminium Products	1.02	4.33	1.42	4.69	0.42	3.08	0.12	0.52	0.88	4.39	2.12	4.32	5.98	3.75
7	Wood	0.28	1.19	0.84	2.78	0.42	3.08	1.01	4.39	0.44	2.19	0.88	1.79	3.87	2.42
8	Paper	0.42	1.78	0.98	3.24	0.14	1.03	0.11	0.48	0.84	4.19	1.04	2.12	3.53	2.21
9	Ceramics	0.88	3.74	0.18	0.59	0.12	0.88	0.08	0.35	0.42	2.09	0.84	1.71	2.52	1.58
10	Textile materials	0.48	2.04	0.86	2.84	0.12	0.88	0.09	0.39	0.26	1.30	0.38	0.77	2.19	1.37
11	Vegetative/organic materials	0.48	2.04	0.08	0.26	1.04	7.62	0.82	3.56	0.34	1.69	1.22	2.48	3.98	2.49
12	Others (batteries, foams, etc.)	4.88	20.71	6.46	21.35	2.88	21.11	8.04	34.91	4.88	24.33	14.02	28.54	41.16	25.78
	TOTAL	**23.56**		**30.26**		**13.64**		**23.03**		**20.06**		**49.12**		**159.67**	

The majority of the scavengers have been in the profession for between 5- 10 years (36%) and 1-5 years (33%). These are actually the professional scavengers, who have taken the profession as a career. Those that have been in the business for less than one year are usually students, scavengers dependants and some artisans who just see it as a means to an end. The average income of the professional scavengers indicates that 17% generate ₦50,000 and above, while 80% generate income of between ₦10,000 – ₦50,000 in a month. The analysis shows that about 86% of the scavengers generate more than ₦20,000 in a month. This is above the national minimum wage for the federal, state and most employees working in the formal sectors (NSIWC 1993). It indicates that it is a lucrative business, keeps people self-employed as well as keeps the environment clean.

Daily scavenging practices

The scavengers obtain waste by scrambling indiscriminately once a waste truck arrives the dumpsite. At Osubi Slaughter, Ewhere I and II dumpsites, the scavengers have formed a quasi group where only "registered member" are given first priority. Outsiders can only come in after the registered members have had their pick. The registered members also pay a little amount to the "site engineers" who oversees the daily maintenance of the dump and is the "eye" of the dumpsite owner. The scavengers comb through mixtures of waste dumps and collect items they consider valuable enough for their merchandise. At times scavengers also purchase the reusable or recyclable waste materials from residents at negotiated paltry sums of money.

The mobile scavengers store their wares in a locally fabricated cart and move from one site to the other while resident scavengers store their wares within the dumpsite area where they are resident. The metal cart is manually pushed by the scavenger from street to street visiting dumps and collecting valuable materials desired. The final destination of the scavenger terminates at the scrap market where the merchandise is segregated, weighed using the salter scale and sold to the junk merchant. The resident scavengers on the other hand "warehouse" recovered items and wait for buyers to come. Most items are scavenged based on customers request. There is no form of sorting or treatment before the wastes are disposed to the dumpsites. The wastes exist in mixtures of garbage, combustible and non-combustible waste, biodegradable and non-biodegradable waste, etc. Sorting is carried out by the scavengers in a very crude manner without the use of personal protective equipment (PPE). Due to their ignorance of the safety hazards associated with this occupation, scavengers are exposed to sharp objects leading to cuts, which lead to loss of blood and infection; encounter with dangerous animals such as scorpions, reptiles, rats, mosquito, cockroaches and flies. They are also faced with air pollution in form of objectionable odor, obnoxious gas inhalation from decomposing materials, eyesores, radiation from sun, fatigue, and risk of infectious diseases like cholera,

Table 5. Monthly average received and recovered waste in the investigated dumpsites

S/N	Location	Daily received waste (tonnes)	Monthly received waste (tonnes)	Recovered wastes (tonnes)	Recovered wastes (%)
1	Niger Cat	30	900	23.56	2.62
2	Don Parker	35	1050	30.26	2.88
3	Osubi Slaughter	20	600	13.64	2.27
4	Osubi Road	32.5	975	23.03	2.36
5	Ewhere I	12.5	375	20.06	5.35
6	Ewhere II	45	1350	49.12	3.64
	Total	175	5250	159.67	3.19

malaria, typhoid fever and dysentery.

The weight and percentage composition of recovered wastes are summarised in Table 4. The most scavenged wastes are scrap metals, tins, cans, glass bottles, polyethylene products, plastics bottles, aluminum, ceramics, paper, wood, textiles, batteries, computer accessories and foams. The most scavenged waste material by weight is scrap metals (29.1%) followed by tins and cans (12.2%), polythene products (8.0%), glass bottles (7.1%) and plastic bottles (4.1%). Highest recovered wastes were from Ewhere II, followed by Don Parker and Niger Cat dumpsites. This is similar to the work of Bichi and Amatobi (2013), Sridhar and Hammed. (2014) and Mshelia (2015) carried out in Kano and Mubi metropolis of Nigeria

The average dumped wastes for each of the dumpsites and amounts of recovered wastes is presented in Table 5. Daily waste dumped varies from 12.5tonnes/day (Ewhere I) to 45tonnes/day (Ewhere II). Dumped wastes were not dependent on the size of the dumpsites but rather on access to dumpsites, truck operators, and the dumpsite owners/managers. Total recovered wastes varied from 13.64tonnes/month (Osubi Slaughter) to 49.12tonnes/month (Ewhere II), indicating 2.27-5.35% recovered wastes from the six locations as shown in Table 5.

Conclusion

Material scavenging is a form of resource recovery, reuse and recycle. Though it is informal in nature, it has given rise to employment generation, income to the practitioners and is environmentally friendly. It revealed that both illiterates and educated citizens are involved in this profession. It reduces the volume of waste municipal authorities have to grapple with, and if well managed may form the cornerstone to the solution of waste management in Nigeria if effectively integrated.

Recommendation

The following are recommended in other to enhance the activities waste scavengers in resource recovery:

- Put policies and laws in place by the respective tiers of government to encourage scavenging.
- Laws to encourage waste segregation at source
- Support the industry in terms of loans with low-interest rate.
- Mobilise the scavengers to form formal cooperative societies.
- Safety awareness and health education should be provided for the scavengers to protect them against associated hazards at their place of work.
- Provision of safety gears to scavengers at a subsidized rate to make the collection, sorting and handling easier.
- The scavengers should be formally recruited by the government to carry out the segregation of solid waste at source as this will reduce the amount of waste that needs to be collected for disposal.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this manuscript**.**

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