Empirical Investigation of Formal and Informal Sectors in Waste Recycling of the Municipal Waste Management System of Developing Countries:

The Case Study of Lagos State

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Abstract

Municipalities in metropolitan cities of developing countries often find it difficult to cope with the onerous task of providing waste services to their citizens due to financial constraints and poor infrastructure. In most of these cities, waste collection services are grossly inadequate as less than half the population is served with regular and efficient waste services. However, the shortcomings of the formal waste management system are compensated by the activities of the informal sector engaged in waste collection and make significant contributions to the MWMS through material recovery and waste recycling. In view of this, the study focuses on the roles of the formal and informal sector in municipal waste management with regards to their impacts on the recycling rate of Lagos State. In this study, we measured and compared the recycling rates between the formal and informal sectors to determine their impacts on the recycling rates of Lagos State. The study relies on primary field data, site visits and observations backed by secondary sources to investigate the range of informal sector activities in comparison to the formal sector. The findings indicate that, while

both sub-sectors play significant roles in the MWMS, the informal recycling activities contribute more to the recycling rate of Lagos state than the formal sector.

Keywords: Formal and informal sectors, Recycling rate, Waste management, Public health and environment

1. Introduction

Municipalities in metropolitan cities of developing countries often find it difficult to cope with the onerous tasks of providing municipal waste services to their citizens due to financial constraints and poor infrastructure (World Bank, 2006). They are often overwhelmed by the growing volume of the municipal waste stream due to population explosions, income growth, and lack of waste treatment technology and above all, lack of political will (Medina, 2000). In most of these cities, waste collection services provided by municipalities are grossly inadequate as less than half of the population is served with regular and efficient waste collection services (World Bank 2006, UN-Habitat, 2006). This has elicited the clamour for private sector participation in municipal waste management (World Bank 2006, Kwanteng 2011). However, in spite of the formal sector intervention in MWMS, there still remains a problem of inadequate waste collection, illegal dumping and other structural inadequacies. These shortcomings are compensated by the activities of waste pickers or scavengers in the informal sector who also intervene in MWMS and make their contribution through waste collection, material recovery and recycling of waste materials (Wilson, Chessma and Clinns 2007).

1.1 Overview of the Municipal Solid Waste Management System in Lagos State

In the 1970s, Lagos state was tagged the dirtiest city in the world because every nook and cranny of the state was some sort of dumpsite due to improper and illegal waste dumping which made the city vulnerable to environmental pollution and public health hazard (Adebibu and Okekunle, 1989). Successive governments in the state had since taken steps to address the problems by adopting planning strategies and setting machinery in motion aimed at tackling the improper waste disposal. These efforts culminated in the establishment of various institutions to address the problems. As outlined in Table 2, beginning in 1977, the Lagos State Refuse Disposal Board (LSRDB) was established under the supervision of the ministry of Works and Transport to take charge of waste management disposal in the state. This was followed by the establishment of the Lagos State Waste Disposal Board (LSWDB) in 1979 under the same ministry which oversaw waste management in the State up till the 1990s.

The year 1991 saw the creation of Lagos State Waste Management Authority (LAWMA) under the supervision of the environment and physical planning ministry which marked a change of baton from the Work and Transport ministry to the environment and physical planning ministry (Opeyemi, 2012, LAWMA 2013). In 1994, there came the introduction of private sector partnership (PSP) operations in municipal waste management state-wide while LAWMA was left with the handling of industrial waste from 1999 up to present. Private

sector participation in the Lagos State MSWM evolved over time leading to full participation in waste management today (see photo 1). This underscores the importance of waste management as a driver of sustainable development and economic growth aside from its traditional functions of waste removal and disposal (Contreau, 2006). Encouraged by the involvement of the private sector in the municipal waste management of Lagos State, LAWMA set an ambitious goal of annual projected recycling rate it hopes to achieve every year beginning from 2012, its recycling target rate for 2016 would be 38% of its annual waste generation.
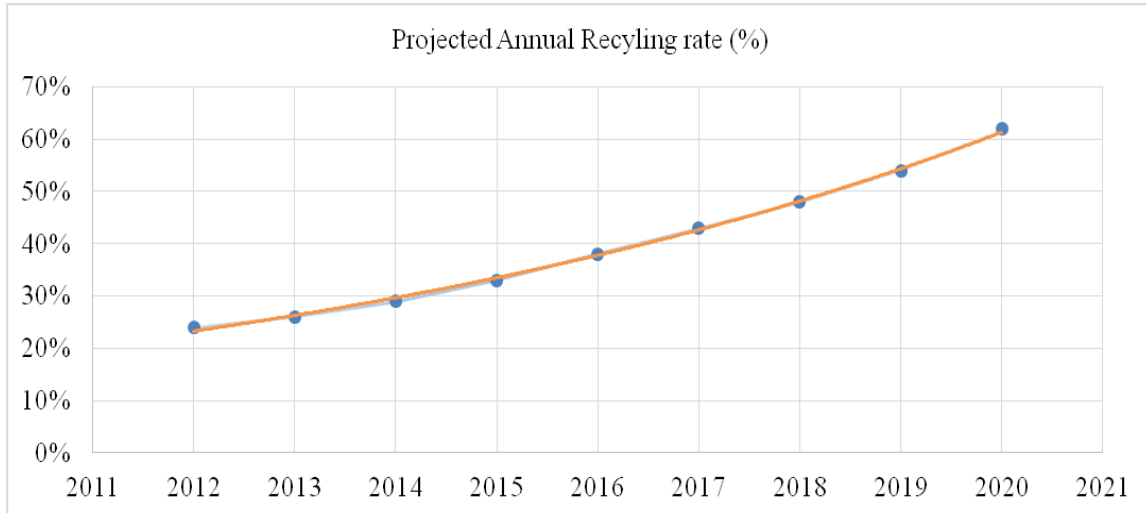
In Lagos State there is no official recognition of the informal sector in waste management, but there exits tens of thousands of cart pushers and scavengers on the streets and landfills of Lagos State collecting and recycling waste materials which constitute a viable component of the MWM in Lagos State (see photo 2). The goal of the Lagos State MWMS to achieve a 60% recycling rate by 2020 according to figure 1, would be a mirage without a strident waste management system that recognize, supports and incorporate the informal sector in its fold.

Table 1. Timeline of Municipal Waste Management Evolution in Lagos State

Years	Name of Institutions	Supervising Authority
1977 -	Lagos State Refuse Disposal Board (LSRDB)	Ministry of work and Transport
1980 -	Lagos State Waste Disposal board (LSWDB)	Ministry of work and Transport
1991 -	Lagos State Waste Management Authority (LAWMA)	Ministry of Environment and Physical Planning (MEPP)
1994 -	Local Government Councils and LAWMA	Local Government and MEPP
1997-	LAWMA and PSP pilot scheme in Somolu & kosofe local government areas	Ministry of Environment and Physical Planning (MEPP)
1998 -	Private Sector Participation (PSP) in domestic waste management statewide	Ministry of Environment and Physical Planning (MEPP)
1999	Private Sector Participation (PSP) in waste management	All Local Government/ Ministry of Environment and Office of the Deputy Governor
2004-present	Mega PSP involvements in waste management	Ministry of Environment and Office of the Deputy Governor

Source: Institutional Changes in the Lagos State MSWM (Opayemi 2012)

Figure 1. Annual projected Recycling Rate by Lagos state

Source: LAWMA published Data, (2013)

Photo 1 PSP Waste trucks in partnership with LAWMA Photo 2 scavenger at Olushosun landfill

Source: LAWMA Published Data (2013)   Source: LAWMA Published Data, (2013)

2. Previous Research

The Municipal Solid Waste Management System (MSWM) is a global phenomenon which has become increasingly complex due to rapid population explosion, income growth, urbanization and effects of industrialization (Aluko 2010, Moren, 2011). Thus, waste has been variously defined as useless, unwanted, unused or discarded materials of no value to its producer (World Bank, 2006). Waste was also viewed as any material having no direct value to the producer that needs to be disposed of but could be of value to others (Terry, 2011, Moven, 2011 and Xioanly 2011). The World Bank (2012) stressed that the overall goal of the

municipal waste management system is to collect, treat and dispose of solid waste in an environmentally and socially satisfactory manner using the most economic means available. However, the traditional method of municipal waste management which totally relies on low-cost waste service removal for cities has been significantly altered. This has assumed a new dimension of much complex tasks including source minimization and resource recovery due to population growth, exploding urbanization and rapid industrialization (Enwisile, 1998). The United States Environment Agency (EPA, 2011) described the Integrated Municipal Solid Waste Management (IMSWM) as a hierarchy of functions consisting of source reduction and source separation; collection and transportation; transfer and treatment; recycling and composting; material and energy recovery; and landfilling and disposal all aimed at maximizing material and energy recovering and conserving resources every step of the way.

With respect to waste recycling, Zimring (2005) described waste recycling as a process by waste materials can be changed or converted into new products or secondary raw material for manufacturing. This is to prevent waste of potentially useful material, reduce consumption of fresh raw materials, reduce energy usage and reduce environmental pollution (air, water and soil) by reducing the need for conventional waste disposal and lowering greenhouse gas emissions. The World Bank (2012) argue that, waste recycling allows for production and consumption of products with reduced depletion of natural resources and energy with the potential reduction of negative impact on the environmental system. Also the USEPA (2011) stipulates that, waste recycling is a series of activities including collection of used, reused or unused waste, sorting and processing of the recyclable materials into secondary raw materials and remanufacturing the recycled raw material into new products.

With regards to the formal sector, The World Bank (2012), described formal sector as a partnership of stakeholders in the municipal solid waste management system due to its strategic role in cost-effectiveness of service provision, standard of disposal, support infrastructure and management information; inflow of investment and a formal sector role in waste reduction. According to Contreau (1994), privatization of waste management is a reduction of government activity in waste service delivery, this happens when government divested its waste enterprises to unregulated ownership or through commercialization of government agencies into autonomous and financially accountable enterprises. Kwanteng (2011), postulates that the formal sector participation in waste management is a response to a deficiency in the system, therefore private sector involvement in MSW is due to market and government failures in service delivery.

On the other hand, the informal sector plays a crucial role in the MWMS through waste services provided by waste pickers in all aspect of MSW via collection and disposal of waste and especially, in the recycling segment of waste management (Ahmed and Alli, 2004). Olughenga (2006) observed that the informal waste management sector permeates all segments of the MSW via collection, transportation, recovery, recycling and merchandising of both recovered and recycled materials with a high network of operations and distributions both within and outside the country. The informal sector is populated by individuals, family members or micro or small enterprises comprising 10-20 people with low capital investments

and is characterized by small-scale, labor-intensive, highly unregulated and low-paid individuals (Wilson, Whitman and Torun, 2001). According to ILO (2010), the informal waste workers comprise of individuals, small or micro-enterprises that intervene in waste management without being registered or regulated and without being charged formally with the responsibility of providing waste management services and are not officially recognized or acknowledged. The Un-Habitat (2010) estimates that in the developing countries, 15-20% of the waste generated is managed by the informal sector, thereby providing financial and environmental benefits to the society Wilson (2006), listed four main categories of informal sector. These include the following:

1.) *Itinerant Waste Buyers:* they include waste collectors who go from door to door to buy and collect sorted recyclable materials from household and sell to recycling junk shops.   This group operates with small capital and own some forms of transportation such as bicycle, tricycle and pushcarts.
2.) *Street Waste Picking*: they specialize in picking recyclable waste materials from the street or trash bins before collection.
3.) *Dumpsite Waste Scavengers:* these are waste pickers or scavengers who sort through waste mix at the dumpsite looking for recyclable or reusable materials and they mostly live in shanty towns close to the dumpsite.
4.) *Municipal Waste Collection Crew*: they specialize in salvaging reusable and recyclable waste materials from the waste transportation truck before dumping at disposal site.

According to Simpson and Gupt (2010), the economic activities of the informal sector in MSW can be divided into two sub-sectors: the informal service sector and the informal valorisation sector. The informal service sector consists of individuals and microenterprises that engage in waste services provision such as waste removal, transport, street sweeping, drainage and litter removal; while the informal valorization sector undertakes an extractive resource function such as identifying and removing valuable materials from the waste stream (Simpson and Gupt, 2010).

3. Methodology Framework

The methodology framework relies on primary field data making use of survey questionnaires, site visits, discussions and observations. The sampling size comprised of waste scavenger participants in the informal sector and PSP operators in the formal sector of the Lagos state MWMS. With respect to informal sector, 100 scavengers were randomly selected from two landfill sites of Olushosun, and Solous dumpsites in Lagos State. The one hundred respondents were randomly selected across the two landfills to build a plausible representative sample of the scavenger population in Lagos State because the exact size of scavengers is unknown and they could be easily tracked in those locations. With formal sector, 50 participants were randomly drawn from the PSP. These were legally registered private waste enterprises which operate in partnership with waste management municipal Authority in Lagos State. Some of the selected companies have their offices located close to the landfills, while others are located in other areas of the state; so getting to some of these

offices was made easier.

3.1 Survey Instrument

Survey questionnaires were designed to obtain information on the recycling activities of scavengers at the landfills as well as the recycling activities of the formal sector operators. The elements of the questionnaire include the demographics, size of family members involved in waste picking, quantities of items recycled, the sorts of waste materials being sorted for recycling; the recycling rate and how much of waste is being recycled per month among others. A small group of students from Lagos State University were engaged and trained to administer the questionnaires. This involved daily visits and observations of scavengers' activities at the two landfill sites which were preceded with discussions and interviews with scavenger representatives and officials at the sites, in order to build trust and develop familiarity. The data collected was processed using IBM SPSS version 22 and descriptive statistics was adopted as the main analytical tool.

4. Data Analysis and Results

4.1 Study Objectives

1. The main objectives of the study are: (1) To document key activities of the formal and the informal sectors in the Lagos State MSWM and (2) To measure differences in recycling rates of formal and informal sectors in relation to the recycling rates of Lagos State MSWM.

Table 2. Age Distributions of Respondents

	Frequency	Percent
Age		
18-19	7	7.0
20-24	11	11.0
25-29	9	9.0
30-34	27	27.0
35-39	22	22.0
40-44	13	13.0
45-49	8	8.0
50 and above	3	3.0
Total	100	100

Source: Field survey, 2015

The above table indicates that the age group of the highest participation rate of informal sector ranged from 30-34, which is 27% of respondents while the lowest age group (3% of the total sampled) ranged from 50 and above.

Table 3. Educational Background of Scavengers

Education Background	Frequency	Percent
Never Attended School	13	13.0
Completed Primary School	31	31.0
Completed Secondary School	48	48.0
College/University	8	8.0
Total	100	100

Source: Field survey, 2015.

The result suggests that 48% of scavengers have completed secondary school (High school diploma) while only 8% have completed college education which is the lowest participating level of education of total sampled. This indicates that people with higher education level have the lowest participation rate in scavenging.

Table 5. Cross Tabulation of Items scavengers mostly found against the quantities (size) of items by weight they recycle per month

	Quantity of items recycled per month						
Items mostly Found	1-20 Tons	21-40 Tons	41-60 Tons	61-80 Tones	81-100	above 100	Percent
Used Electronics	4	1	0	0	0	0	5.0
Can	5	1	2	1	0	0	9.0
Toys	1	2	1	0	1	1	6.0
Plastics	7	6	4	3	1	0	21.0
Bottle	6	5	1	1	2	0	15.0
Scrap Metal	5	6	4	3	3	1	22.0
Car Batteries	1	3	3	1	0	0	8.0
Computer Scrap	4	2	2	1	1	1	11.0
Others	1	1	1	0	0	0	3.0
Total	34	27	18	10	8	3	100

The above table reflects the mostly sought and found items recycled by scavengers at the landfills in Lagos State. Scrap metal appears to be mostly found item, followed by plastics and bottles. Twenty-two percent of scavengers mostly found and recycled scrap metals by weight in different quantities on a daily basis while only 3% mostly look for and find other types of recyclable items. Other mostly found items include plastics and bottles; 21% of scavengers mostly found and recycle plastics while 15% look for and mostly found and

recycle bottles.

Table 6. Categories of formal sector waste management

	Frequency Percent
Waste Collection and Disposal	21 42.0
Waste Recycling	27 54.0
Transfer Services	2 4.0
Total	50 100

Source: Field survey 2015

Table 6 shows the categories of the formal sector waste management. As the table indicates, 42% of the formal sector are involved in waste collection and disposal services, 54% account for waste recycling services while only 4% are engaged in waste transfer services. Hence, the waste recycling service is the largest activity in the formal sector. However, it is noteworthy that during our observation, some of those who categorized themselves as waste recyclers are also actively involved in waste collection and disposal services.

Table 7. Distribution of the recycling rate by the formal sector (in tonnage) per month

	Frequency	Percent
0-10 Tones	10 20.0	
11-20 Tones	18 36.0	
21-30 Tones	17 34.0	
More 31 Tones	5 10.0	
Total	50 100	

Source: Field Survey 2015

Table 7 indicates that a majority of the formal sector, (36% of respondents) recycle between 11-20 tons of waste materials per month, and only 10% recycle above 31 tons of waste materials on a monthly basis. But they still depend on scavengers for the supply of their

recyclable materials.

Table 8. The monthly recycling target rate by the formal sector

	Frequency	Percent
0-50%	8	16.0
51-100%	42	84.0
Total	50	100
Total	50	100

Table 8 presents the range of the recycling target rate by the formal sector based on the waste items in which they are specialized. This table shows that 84% of the formal sector has a recycling target rate of between 50-100% of their products while 16% would target to recycle up to 50% per month. This outcome may also depend on the supply flow of recyclable materials from scavengers because the data reveals that 64% of the formal sector buys their recyclable materials from scavengers. The data also shows that 84% of the formal sector recognizes scavengers as the major suppliers of secondary raw materials to their recycling companies and 86% of the formal sector recognizes that their recycling output will increase when more scavengers are in business.

Based on the above data analysis, the study developed the following hypothesis to measure each sector contribution to the Lagos State recycling rate: the informal sector does not contribute more to the recycling rate of Lagos State than the formal sector.

5. Results

Table 9. T-Test Research Result for the group statistics to the recycling rate of Lagos State

	Group	N	Mean	Std. Deviation	Std. Error Mean
Q_Contribution	Informal	100	7262.9800	1625.55925	162.55592
Diff	Formal	50	6303.7200	693.81460	98.12020

Table 10. Independent sample test

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Equal	30.959	0	3.99	148	0	959.26	240.4343	484.1323	1434.39

variances assumed							
Equal variances not assumed	5.052	145.31	0	959.26	189.8737	583.9891	1334.53

Table 8 shows the result of the independent Samples test for the group statistics of the informal and formal sectors' contributions to the recycling rate of Lagos State. In order to test the statistical differences of the two groups in table 7, a t-test was required. According to Babbie, (2004), a t-test is the statistical significance of the difference between the means of two groups. Thus the result shows that, the mean score for the informal sector recycling is 7262.9800 while the mean score for the formal sector is 6303.7200, therefore the mean score of the informal sector is greater than the mean score of the formal sector. This indicates that *there is more contribution by the informal sector to the recycling rate of Lagos State than the contribution by the formal sector.* Based on the analysis in table 9, the implications of the contribution differentials between the informal and the formal sectors in the MWMS of Lagos State is that, both are statistically significant at $(0.000 > 0.005)$ to the recycling rate of Lagos State; but there is more contribution to the recycling rate of Lagos State by the informal sector than that of the formal sector, due to the statistical differentials of the mean scores between the two group.

6. Conclusion and Recommendations

This study focused on the recycling activities of the major stakeholders in the Lagos State waste management. The intent was to determine their impacts on the recycling rate and their contributions to the value chains of the Lagos State municipal waste management system.

The findings show that both formal and informal sectors have played significant roles in the recycling activities of Lagos State waste management, but that the informal sector has played a more significant role in waste recycling than the formal sector. Hence there is need to fuse together the activities of the formal and informal sectors as a strategic and viable partnership in order to promote a sustainable waste management system for Lagos State and other developing countries. Based on the above, it is therefore recommended that the institutional structure of the municipal waste management system in Lagos State should be strengthened to accommodate and recognize the informal sector as a viable component of the MSWM. This will lessen high cost of enforcement and mitigate social problems associated with extreme poverty. The present arrangement of partial privatization in a joint partnership between the government and the private sector that leaves out the informal sector in the scheme of things and prohibit their activities is structurally deficient and unrealistic.

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