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Research Article

Performance Assessment of Solid Waste Management following Private Partnership Operations in Lagos State, Nigeria

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The strategy of delivering modern, high quality public services and promoting competition in the waste management sector leads to formation of private sector participation (PSP) to handle solid waste management in Lagos State. The findings depict that quality of service among the PSP operators recorded high success in the high income areas than those of the low and medium income areas. On the average, industry productivity was 6.63 tonnes per day per vehicle. 18 out of 30 companies in the study area were above this average and in meeting increased productivity, year of experience in operations, number of trips made, number of times trucks were serviced, and adhering to regulatory agency requirement were among the factors influencing company's productivity in the state. The study, therefore, recommends that regulatory agency should be more aggressive in playing its statutory roles of managing the PSP operators.

1. Introduction

Municipal solid waste management constitutes one of the most crucial health and environmental problems facing governments of African cities. This is because even though these cities are using 20–50 percent of their budget in solid waste management, only 20–80 percent of the waste is collected. The uncollected or illegally dumped wastes constitute a disaster for human health and the environmental degradation [1]. More so population growth, high urbanization, industrialization, economic growth rates resulting in a huge increase in the volume of wastes generated daily in the countries with ineffectual and underfunded governments, and poverty prevent efficient management of wastes [2–4]. Another problem is that developing countries' cities are characterized by unplanned, haphazardly constructed, sprawling slums with narrow roads that are inaccessible to collection vehicles [5, 6]. More so, there has been often a much smaller stock of environmental and social capital in developing countries.

Urban solid waste management in Nigeria is constitutionally the responsibility of the third tiers of government, that is, the local government (Federal Republic of Nigeria, 1999). Financial, material, and human resources that have been committed to waste management by this tier of government have not matched this responsibility. However, this has led to lack of effective waste management systems in urban areas of the country. As a result, most urban households resort to the haphazard dumping, burning or burying of solid waste. The common arrangement in the few urban communities where a system is in place is for waste management authorities to collect refuse from households and public containers on a regular basis using a collection truck. Unfortunately, operations managed by the waste management authorities have mostly been inefficient and ineffective as evidenced by the mounds of decomposing refuse that have become a regular sight in many urban areas. This is evident by the reasons indicated earlier, the poor management of many landfill sites and soil and groundwater pollution due to often mixing of household, industrial, and toxic waste [7]. In view of the environmental situation described above in many urban areas, many Nigerian cities have been described as dirty, unsanitary, and aesthetically displeasing in the world [8].

Waste generation nationally is alarming, on the increase with an estimated annual rate of about 0.5–0.7% and current

figures ranging from 0.4 to 0.8 Ton per capita per annum. Complexity in waste is also increasing with biodegradable waste currently accounting for over 50% [9]. This amounts to an annual average approximately 50 million tons per annum of waste burden on the nation with less than 10% waste management capacity [10]. Management has emerged as one of the greatest challenges facing state and local government environmental protection agencies in Nigeria as the volume of solid waste generated increases at a faster rate than the ability of the agencies to improve on the financial and technical resources needed to parallel this growth. It was also found that waste disposal habit of the people, corruption, work attitude, and inadequate plants and equipment among others are militating against effective waste management in Nigeria.

As a result of the failures recorded by local governments in solid waste management, many state governments have put in place bodies that are regional in outlook (i.e., covering more than one local government). For instance, Lagos State established the Lagos State Waste Disposal Board [11], which is now transformed to Lagos State Waste Management Agency (LAWMA). The agency is faced with the task of effectively managing the waste of about 18 million residents of the state and delivering a clean environment through transportation, management of waste disposal sites, and, much recently, recycling. LAWMA, therefore, went into public—private partnership initiative to run the scheme. It is public in the sense that LAWMA serves as the regulators to both resident and the private partners. While the PSP carries out the services delivery, the LAWMA fixes the prices for residents and establishments. Charges for waste collection are based on direct charges to household and other establishments. The amount to be paid for waste collection is not based on the volume of the waste generated rather on the location and type of households/establishments. The services have been made to be patronized by all Lagos residents under the state law as a pathway to keep the state clean. This situation has also been compounded by the reluctance of some resident households to pay for waste disposal services for reasons of poverty and not willing to pay. One of the reasons of not willing to pay in the country and most especially in Lagos State lies on the fact that the Waste Management Board was established as a nonprofit oriented sector and their services as being a public good that attract little or no charges.

Based on the above challenges and the fact that Lagos is a mega city (highly industrialized) with a population estimate of about 9,113,505 (2006 Population Census Commission), growing at the rate of 6–8% annually, and generating about 9000 metric tons of waste daily at 0.5 kg per capita per day which is quite a great quantity, it is a huge burden to the state. More so it was found that waste management which entails disposal is a labour and capital intensive function often consuming 20–50% of the municipal operational budget [12]. In light of this, the state government has contracted the solid waste collection and disposal to the private sector operators with the hope that a clean Lagos can be sustained at no extra cost implication to the government. The issue here is how sustainable the project is in the state ensuring that all the waste generated by residents and establishments are collected without dumps on the streets of Lagos State and also a cleaner Lagos State for a long time. More so, conservation interventions can only be successful in the long term if their aims and activities are accepted by local people [13]. On the other hand, a key determinant of acceptability is the perceived fairness of the distribution of the costs and benefits of the intervention [13]. Arising from the foregoing, the study intendsto analyze the performance of the private sector participation in domestic solid waste management operations in Lagos State. Specifically, it evaluates the general characteristics of private sector participation contractors in domestic solid waste management and the users in Lagos State. Also attempts to evaluate the extent to which the objective of service is met in practice-effectiveness (quality of service rendered) evaluate the efficiency in production of the PSP operators in waste management of the selected areas, examine the factors influencing the production efficiency of the PSP operators, and highlight constraints associated with effective operations of the PSP operators in the state.

2. Theoretical and Conceptual Framework

Sustainable development refers to a mode of human development in which resource use aims to meet human needs while ensuring the sustainability of natural systems and the environment, so that these needs can be met not only in the present, but also in generations to come [14]. It ties together concern for the carrying capacity of natural systems with the social challenges faced by humanity. The concept of sustainable development has in the past most often been broken out into three constituent parts: environmental sustainability, economic sustainability, and sociopolitical sustainability. The idea of sustainability has its roots in systems theory. Systems are sets of interacting and adaptive structures and processes which together produce functional outputs and outcomes. They are characterized by their capacity to maintain their functional outputs and outcomes within desirable parameters while adjusting and adapting to variations in inputs. Feedback mechanisms adjust system processes and structures in response to input variation to maintain outputs and outcomes. Change is an inherent feature of systems. While systems are able to adapt to change in inputs, they remain relatively sustainable. When they cannot adjust, discontinuity occurs until a new equilibrium is reached or disintegration occurs [15].

Systems theory has been widely applied to the understanding of social organizations [16]. For human service organizations, programs are organized sets of inputs (people, facilities, and equipment) which carry out strategies (processes) designed to achieve specific outputs and outcomes. The three key attributes of sustainability are the benefits that are produced over time for individuals and populations, the contingencies which cause the benefits, and the costs of the program resources that are required to achieve them. Programs can be judged as unsustainable because (1) sufficient benefit is not produced, (2) the contingencies which cause outcomes cannot be produced or maintained, and (3) the cost of the program resources required to achieve the benefits is

too high [15]. This sustainable development ideas need to be well integrated into solid waste management and other environmental intervention programmes.

Solid waste management (SWM) is an important environmental health service and is an integral part of basic urban services. Research on urban SWM in developing countries has been developed from two main concerns: public sector reform (including privatization issues) and sustainable development in the urban context [17]. The former is closely connected to the neoliberal doctrine proclaiming a resurgence of the market and a reduction of state control. The latter focuses on private sector involvement in service provision; it raises issues of public interest and acceptability [17]. These ideas give rise to the demand for an effective management system. An effective waste management system is a veritable way to ensuring economic development. In Nigeria, one state that has really championed the course of environmental sanitation through effective waste management is Lagos State. Against the backdrop of being regarded as one of the dirtiest states by the world press after the celebration of FESTAC '77, this betterment was achieved through public-private partnership of LAWMA and PSP operators. LAWMA engages, coordinates, and evaluates the activities of the private sector participant (PSP) in the municipal solid waste collection. It is of importance to examine the opportunities and challenges posed by benefit distribution of environmental service delivery with regard to PSP operations in Lagos State. Interventions can only be successful in the long term if their aims and activities are achieved. The state private sector operation waste management project needs to be evaluated of the quality of service provided to its consumers and challenges facing its sustenance.

A number of earlier studies on solid waste have been carried out in Ghana. There were studies focused on private sector involvement in solid waste management and result pointed that house-to-house service proved to be more effective and appreciated by most residents [18–20]. In Nigeria, studies were centered on characteristics of solid waste and composition [21, 22], disposal, and management [1, 23–26] perception on payment for solid waste collection [27, 28]. In most cases, the economic tools used were percentages, severity index, chi-square, and ordinary least square models. There have been rarely a few or no studies on the performance assessment of the private sector participation operation of Lagos State. The present study is intended to fill this gap. The result generated from this study will also be necessary for policy intervention in Lagos State and the country at large.

3. Methodology

The study area is Lagos State. The state is made up of 20 local government areas. It has a land size of 999.6 km^2 and a population of about 9,113,505 (2006 Population Census Commission). Lagos State has a total of 337 domestic private sector participations in solid waste management, serving all residential areas in the state. The private sector participation operators are well distributed in the local government areas (LGA(s)) and the number of operators in an area varies based on the population and the need of the area. Primary data were sought for, through the use of structured questionnaire and interview to ascertain the authenticity of the responses. Data were collected from domestic waste management operators and users of the services provided by the operators.

Stratified sampling technique was employed to explore the heterogeneous population of the study area. The state was stratified based on the socioeconomic group (high, medium, and low income economic groups). One local government area was randomly selected from each stratum. The last stage involved a random selection of households/residents and PSP operators in a ratio proportional to the size of the operators in the local government areas selected. With regard to socioeconomic group, Eti-Osa local government area (LGA), Ikeja LGA, and Alimosho LGA were selected from high, medium, and low income groups, respectively, in the state. Among the groups, 4 PSP operators were randomly selected from the total of 10 operators in Eti-Osa LGA, 6 out of 18 were randomly selected from Ikeja LGA, and 20 out of 56 were randomly selected from Alimosho LGA in the state. Users were randomly selected proportionate to size based on the number of PSP operators in the areas. All 30 PSP operators and 262 users were sampled in the study.

3.1. Economic Tools Used for the Study. The economic tools employed in this study include the following. Descriptive statistics such as percentages were used to evaluate the general characteristics of the private participation contractors and residents. The performance of the service providers were assessed using productivity analysis and quality of service assessment (score card). Productivity analysis was carried out using productivity analysis ratio and industry average productivity ratio was used as the base of comparison. Quality of services was assessed using severity index. Productivity was based on the last 24 months production.

The severity index (SI) was calculated based on the following equation. This measure is also applied following the pattern of Al-Hammad and Assaf [29]. Consider

$$\mathrm{SSI} = \frac{\sum_{i=1}^{5} a_i x_i}{5 \sum_{i=1}^{5} x_i} \times 100\%, \tag{1}$$

where a_i is the index of a class, constant expressing the weight given to the class; x_i is the frequency of response; $i = 1, 2, 3, 4, 5$ and described as below; x_1, x_2, x_3, x_4, x_5 are the frequencies of response corresponding to $a_1 = 1$, $a_2 = 2$, $a_3 = 3$, $a_4 = 4$, and $a_5 = 5$, respectively.

The rating classification was analysed following the classification pattern of Majid and McCaffer, [30] which is read as

(i) $a_1 a_1 a_1$ low or extreme ineffective $0.00 \leq \mathrm{SI} < 12.5$,

(ii) a_2 low or ineffective $12.5 \leq \mathrm{SI} < 37.5$,

(iii) a_3 moderate or effective $37.5 \leq \mathrm{SI} < 62.5$,

(iv) a_4 high or very effective $62.5 \leq \mathrm{SI} < 87.5$,

(v) a_5 very high or extreme effective $87.5 \leq \mathrm{SI} \leq 100$.

3.2. Productivity Analysis. The model adopted for the study follows from Sampson Oduro-Kwarteng [19] pattern. The productivity of an individual vehicle v is defined as the average quantity of waste output q for a period t as follows:

$$P_v^t = \frac{\sum_{q=1}^{Q} W_q^t}{\sum_{t=1}^{T} t}, \tag{2}$$

where P_v^t = productivity of vehicle v during the period t, $t = 1, \ldots, T$; W_q^t = actual quantity of output q for vehicle v during the period t, $t = 1, \ldots, T$ and $q = 1, \ldots, Q$; t = the working time in days for vehicle v during the period t, $t = 1, \ldots, T$.

The productivity of a company c is defined as the weighted average of individual vehicles v for a period t. It is expressed as follows:

$$P_c^t = \frac{\sum_{v=1}^{V} P_v^t e_v^t}{\sum_{t=1}^{T} t}, \tag{3}$$

where P_c^t = productivity of company c during the period t, $t = 1, \ldots, T$; $v = 1, \ldots, V$; e_v^t = maximum output capacity for vehicle v during the period t, $t = 1, \ldots, T$; $v = 1, \ldots, V$. Productivity ratio (PR) is the sum of the productive capacity of a company over a period of time divided by the number of productive inputs. Consider

$$\mathrm{PR}_c^t = \frac{P_c^t}{\sum X_i}, \tag{4}$$

where X_i = productive inputs used for production by operator i.

Therefore, the industry average productivity ratio = $\sum_{n=1}^{N} P_c^t / \sum_{n=1}^{N} x^t$, where P_c^t = productivity of company at the particular period t, X^t = productive inputs used by operators in the sample at the particular period t, and N = number of operators in the sample, where $n = 1, \ldots, 30$.

3.3. Econometric Model. Probit model was used to analyse the relationship between productivity and factors influencing it among the private sector partnerships in domestic solid waste management in the state. Probit regression, also called a probit model, is used to model dichotomous or binary outcome variables. In the probit model, the inverse standard normal distribution of the probability is modelled as a linear combination of the predictors:

$$\begin{gathered} p = \mathrm{pr}\left[y = 1 \mid x\right] = F\left(X'\beta\right) \\ \text{that is the probability that } y = 1, \\ p = \mathrm{pr}\left[y = 0 \mid x\right] = I - F\left(X'\beta\right) \\ \text{that is the probability that } y = 0, \end{gathered} \tag{5}$$

where Y the dependent variable is a binary response. It takes only two values, 0 and 1:

$$Y = \begin{cases} 0 & \text{if no} \\ 1 & \text{if yes} \end{cases} \tag{6}$$

and X is the explanatory variables likely to influence y.

Hence, Y = productivity of company belonging to category j (1 is for above average productivity per day; 0, otherwise).

X = explanatory variables include (years of operation, education of service manager, number of daily trips of company, number of vehicles used for operations, number of households covered, and daily operating cost.)

In probit model, $F(x'\beta)$ is the conditional distribution function of the standard normal distribution which is the functional form of probit model:

$$F\left(x'\beta\right) = \phi\left(x'\beta\right) = \int_{-\infty}^{X'\beta} \phi(z)\, dz, \tag{7}$$

where $\phi(z)$ is the normal density function,

$$\phi(z) = \frac{\exp\left(-\left(x^2/2\right)\right)}{\sqrt{2\pi}}. \tag{8}$$

The predicted probabilities are limited between 0 and 1.

The marginal effects of the function are generated. Marginal effect is the result of a unit change in the explanatory variable on the probability given that all other explanatory variables are constant. It is the net effect holding the other variable at its means. Hence, marginal effects are partial derivatives of the probabilities with respect to the explanatory variables evaluated at their sample means. Consider

$$\frac{\delta p}{\delta x_i} = F'\left(x'\beta\right)\beta_i. \tag{9}$$

The index i is the ith observation of the independent variable. The marginal effects depend on x (typically the means). The coefficients and marginal effects have the same signs because $F'(X'\beta) > 0$.

Therefore, the marginal effect for the probit model is

$$\frac{\delta p}{\delta x_i} = \phi'\left(x'\beta\right)\beta_i. \tag{10}$$

4. Results and Discussions

4.1. Providers. The privatization of solid waste collection has given rise to the spring up of quite large number of operators in the state. Among the contractors interviewed, 67% were from the low income area in Alimosho LGA, 20% from the medium income area in Ikeja LGA, and 13% from the high income area in Eti-Osa LGA. All are operating in different size or capacity in terms of manpower and available equipment. The strength and quality of staff with available facilities are often an indication of firm's waste collection capacity. All the firms have offices in their locations; hence it becomes easier for their customers and monitoring agencies to locate them in case of difficulties in service provisions.

All the service providers use compaction trucks of about five tonnes of capacity made available by the Lagos State government. The firms either own the trucks or in a few cases take on lease. About 57% of the firms operate with two compact closed trucks, 26% of the firms operate with three

trucks, 13% of the firms operate with four trucks, and only 3% make use of five trucks in the various areas surveyed in the state. The average age of their trucks ranges from 3 years to 7 years. Firms' staff strength ranges from 7 to 19. Other facilities owned and provided by firms for efficient service delivery include vehicles for logistics, shovels, and protective gears such as gloves, boots, and pullovers to shield the crew from injuries and direct contact with pathogenic organisms.

The system of waste collection is mainly door-to-door collection. In low income area and part of medium income area, when the collection truck arrives on the streets to be served, it alerts the households by horning. In the high income areas, waste is collected by the crews from the waste bin kept in front of the house.

Waste collection frequency varies from one area to another. Around 73% of interviewed contractors reported that collection is done once per week in a particular area. However, they admitted that most of the collection frequency depends on the mechanical condition of collection trucks and on the agreement between the contractors and the residents of the area. It is observed that most collection trucks purchased from LAWMA are new except few fairly used ones. Most contractors' collection crews are casual labourers with little or no education and they are lowly paid, with a salary between seven thousand to twenty thousand naira (naira is represented as ₦) (i.e., from ₦ 7,000 to ₦ 20,000) depending on the area. The low income area waste collection crew earns between ₦ 7,000 and ₦ 14,000. The medium income area labourers earn between ₦ 10,000 and ₦ 18,000 while the waste collection crew in the high income area earns between ₦ 10,000 and ₦ 20,000. The number of crews varies between 3 and 4 per truck in all the areas in the state. While the drivers earn higher amount of pay from ₦ 20,000 to ₦ 30,000, the supervisors or managers who are mostly educated earn between ₦ 18,000 to ₦ 40,000. Other benefits that accrue to workers may include daily food, stipends, free accommodation, and holidays in low income area. In middle income area, contractors offer benefits such as allowances, opportunity for loan, and holidays while the high income area contractors offer benefits such as allowance, daily food, stipends, loans, and free accommodation. All domestic solid waste collection is done between 8 am and 6 pm from Monday to Saturday.

The monthly operating cost of the PSP operators varies from ₦ 500,000 to ₦ 900,000 in low income area, from ₦ 600,000 to ₦ 800,000 in middle income area, and from ₦ 640,000 to ₦ 1,000,000 in higher income area. The operating cost covers the cost of fueling trucks, other vehicles, cost of maintenance and repairs of trucks, vehicles, and generators, cost of renting other inputs in some cases like trucks, and expenditure made on paying salaries and wages to workers or staff members.

Each contractor caters for varying number of houses in coverage areas of wards. In the low income area, contractors are in charge of houses between 180 and 231; in medium income area, it is between 192 and 230 houses; and in high income area, it is between 125 and 240 houses. Payment for service rendered in all the areas is done mainly through issuance of bills and paying through banks. Around 60% of the contractors claimed payment through this means and 40% cash. Contractors faces the challenges of delayed or refusal of payment. Only few operators recover more than 50% of their user fees. The user fee depends on property value and area in the state. User charges range from ₦ 1000 to ₦ 1500 per month per house in low income area, from ₦ 1500 to ₦ 1800 per month in medium income area, and from ₦ 1500 to ₦ 2000 in high income area.

Wastes collected are disposed at the dump site. No technology for waste minimization is employed; rakes and shovels are used to clean up waste at the point of collection.

4.2. Residents. Among the residents/users sampled, 47% were male and 53% were female with an average age of 40 years. 78% of the respondents were married, having an average family size of 5 members. About 45% of them were educated up beyond secondary school education while about 30% were secondary school certificate holders. The educated ones earn an income between ₦ 20,000 and ₦ 1,000,000 and above depending on the area.

All users sampled prefer and accept the door-to-door waste collection system. Around 79% of the users were satisfied with the current level of cleanliness brought about through the effort of their own PSP operator in the area (78% in low income area, 77% in medium income area, and 81% in high income area). This is attributed to the reasons that they have witnessed waste overflow off bins or containers, foul smell, and littered premises as a result of low collection frequency or delayed waste collection in the areas earlier.

The most practiced allotted frequency of waste collection in designated areas from users experience was once per week (88% in low income, 65% in middle income area, and 40% in high income area) followed by twice per week frequency (12% in low income area, 45% in medium income area, and 60% in high income area). However, 44% of users in low income area, 55% in medium income area, and 18% in high income area were not satisfied with low frequency of waste collection. On this basis, it is obvious that the residents would appreciate the allotted frequency of waste collection services in the area to be increased. Around 10% of users in low income area are willing to pay for higher user charges but in the medium and high income areas, residents do not accept to pay higher user charges. Only 48% of the users expect the fees to be determined by PSP operators and the public. On the part of the regulatory agency/LAWMA, their monitoring and evaluation of the whole exercise have been poor as around 78% of consumers hardly find their presence in the areas.

4.3. Quality of Service. The quality of waste collection service was assessed in two ways. First, by rating companies (on a five-point scale from very poor to very good) for service quality attributes (reliability of collection, waste overflow, and sanitary conditions at bin/container locations and response to customer complaints and crew attitude at waste collection). Second, the residents were asked to indicate service satisfaction by responding as satisfied or not satisfied to the quality of service provided in the study area. In a customer satisfaction survey, service satisfaction is the customers' perceptions

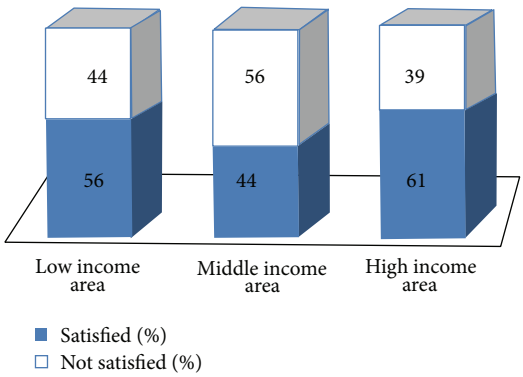

Figure 1: Satisfaction with quality of service.

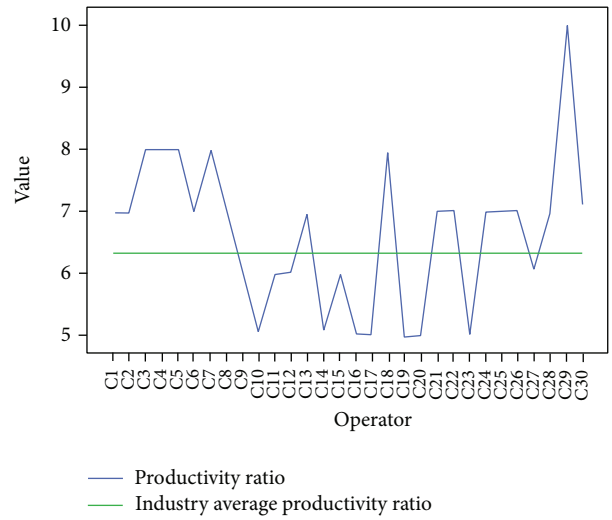

Figure 2: A graph showing the productivity ratio of operators.

of service received (perceived quality) compared to their expectations of the desired service quality.

Table 1 shows the results of the quality of service across the cities. Residents across the income areas perceived some level of quality of service provided by PSP operators in the areas. Result depicts that higher income area (Eti-Osa LGA) had the highest quality of service (74%), followed by medium income area (Ikeja LGA) with 62% and the low income area (Alimosho LGA) with 61%. Chi-square analysis shows that there was a significant difference (Chi-square value = 28.097; $df = 6$; $P < 0.01$) in quality of service across the income areas of the state.

Furthermore, the result from severity index used to analyze the quality of service in the various areas depicts that, in the low income area, the sanitary condition of house-to-house solid waste collection is moderate (SI = 59%), while in the medium and high income areas were rated as high (SI = 60%) and very effective (SI = 75%), respectively. The later areas have a moderate-to-high clean environment with less spillovers of wastes. The reason for a high rate of sanitary condition in the high income areas might be attributed to a high rate of quick responses of service providers to customers' complaint (71%), high rate of reliability in terms of waste collection frequency (76%), and high rate of positive attitude of the waste collectors' crew to services.

4.4. Service Satisfaction. As shown in Figure 1, around 56% of users in the low income areas and around 61% of users in high income area appear to be satisfied with the current quality of service provided by the domestic solid waste contractors.

4.5. Productivity. Productivity is an efficiency measure of the performance of operators. The productivity of each operator was computed using the sum total of the weighted average individual vehicle waste collected. The productivity ratio is estimated using the ratio of total output of waste collected by each operator in tonnes to operating inputs used (vehicles).

Table 2 shows the performance distribution of all 30 companies surveyed in the various income areas based on the average industry performance. The industry average productivity was 6.63 tonnes per day per vehicle and 18 out of 30 companies had values above this average. In low income areas, companies C9, C10, C11, C12, C14, C15, C16, C17, C19, C20, and C23 performed below average, while C5, C6, C7, C8, C13, C18, C21, C22, and C24 performed above average. In medium income areas, C27 is below average and C25, C26, C28, C29, and C30 performed above average while companies C1, C2, C3, and C4 performed above average in high income areas. This implies that companies with vehicle productivity above average had a higher average daily quantity of waste collected than those companies with productivity below average. Figure 2 shows each company's productivity capacity in the survey period.

4.6. Econometric Results. In the study area, the relationship between productivity performance of the service provider companies and their influencing factors (derived from the framework of Wilson et al. [31]) is examined using the probit regression model (see Table 3). The result showed that years of service operation, number of trips per day, number of time vehicle/truck serviced per month, and adherence to regulatory arrangement are significant factors influencing the productivity performance of the PSP domestic solid waste contractors. The result further depicts that a one year increase in the years of service provision will bring about 15% increase in productivity of the service provider's company. One more time of servicing operators truck per month will necessitate 77% increase in productivity of providers. An additional frequency of monitoring service providers on controlling quality of service, accessing their roles and obligations in partnership, will bring about 55% increase in productivity and an additional increase in the frequency of solid waste collection (number of trips per day) will boost company's productivity by 34%.

4.7. Constraint. The common constraints facing the PSP solid waste contractors include customer challenges in the low income area (75%), medium income area (21%), and high income area (3%). Such challenges include debts and delayed

Table 1: Results of severity index on service quality scores by consumers across the income areas/LGA.

Income areas	Sample size (N)	Reliability at collection (%)	Sanitary condition at bins (%)	Quick response to customers complaints (%)	Crew attitude (%)	Overall quality of service (%)
Low	176	50	59	53	57	55
Middle	54	65	66	58	61	62
High	32	76	75	71	75	74

Source: Field Survey, 2013.

Table 2: Distribution of operators by their performance based on industry average productivity ratio.

		Performance	
Income group	Sample size	Below average	Above average
Low	20	11	9
Middle	6	1	5
High	4	0	4

Source: Field Survey, 2013.

Table 3: Probit result on influence of productivity performance of service provider companies.

Explanatory variables	Estimates
Years of operation	0.496^{*} (0.2975) 0.1531^{+}
Number of vehicles used	0.5656 (0.6737) 0.1740^{+}
Number of houses covered	−0.0116 (0.0145) − 0.0036^{+}
Adherence to regulatory arrangement	3.1568^{**} (1.3583) 0.5470^{+}
Average number of times truck is serviced per month	2.4100^{**} (1.0571) 0.7692^{+}
Number of daily trips	1.1001^{*} (0.6300) 0.3390^{+}
Proportion of user fee recovered	1.4410 (2.9540) 0.4434^{+}
Operation cost of operator	−1.7271 (2.5769) 0.7140^{+}

Source: Field Survey Result generated from Stata, 2013.
Log likelihood = -9.3185^{***}; chi-square = 21.74^{***}; pseudo R^2 = 0.5385; number of observations = 30; figures in parenthesis are standard errors of the coefficient.
$^{+}$Marginal effect coefficient.
The $***$indicates that variable is significant at 1%.
The $**$indicates that variable is significant at 5%.
The $*$indicates that variable is significant at 10%.

payments of user fees. Poorly managed dump site constitutes a greater challenge at rainy season as it results in incurring more cost on repairs and services of collection trucks. Other constraints include poor policy implementation and infrequent monitoring of quality of service provision of contractors in the various areas.

5. Conclusion

In this study, the performance of the private sector companies was analyzed in terms of quality of services provided and a company's productivity. Constraints associated with companies' performance were also examined. The responses from residents/users on quality of service on PSP operations can be said to be highly effective in the state. While the quality of service is rated highest/highly effective in high income area, it is moderate in medium and low income areas, signifying that there is a difference in quality of service across the incomes groups in the state.

Difference in productive performance was explored by analyzing two groups of companies: those below and above average performance using a criterion of industry average. Result depicts that 18 out of 30 companies had values above average productivity value of 6.63 tonnes per day per vehicle. While most companies in the medium and high income areas performed above average, most companies in low income areas performed below average. The factors which explain the difference in productivity by the individual companies included the years of experience in operation, the number of trips made per day, number of time vehicle serviced per month, and adherence to regulatory arrangement. Hence effective performance can be constrained by shortage of funds by operators, poorly managed dump site at rainy season, and poor service monitoring and policy implementation. To enhance effective productivity, it is recommended that all PSP operators should strictly adhere to the regulatory arrangement and policies governing the operations, ensuring frequent waste collection and increasing the number of daily trips. It is paramount that stiffer and healthy competition among the PSP operators is encouraged by LAWMA for the programme to be sustainable. Also, there should be public forum where PSP service providers meet regularly to find ways of overcoming challenges facing the business in their areas of operation. Above all, government should make and implement favorable policies targeted to sustainability of the intervention. LAWMA as a body should take full responsibility in adequately maintaining dump sites and seek means of promoting PSP operations into waste minimization and recycling technology for better use of waste.

Conflict of Interests

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

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