

# Recycling Strategy Brief

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## End Market Analysis

### Effective demand for Recycle Materials (Aluminium Cans and PET bottles) from the Niger Delta

The change in consumer lifestyle and preferences that emphasize convenience are factors that have driven the growth of Poly-ethylene Terrephthalate (PET) packaging in the Nigerian beverage industry. The annual output of PET bottles in Nigeria is estimated at 15,000 to 20,000 tonnes<sup>1</sup>. An estimated volume of 5,600 tonnes i.e. about 280 million PET bottles were recycled in 2011 which was more than 20% increase of the volume recycled in the previous year<sup>2</sup>. PET bottles can be converted into multiple forms such as clothing, beddings, furniture, insulations, roofing sheets, hair attachments, shoes, bags and so on. In Nigeria, PET bottles are recycled into polyester staple fibres.

Global polyester staple fiber (PSF) production is estimated to touch 17.9 million tonnes by 2018, as compared to 14.6 million tonnes in 2012<sup>3</sup>. This is because synthetic fibres are not subject to weather events, pestilence or poor crop yields that restrict availability and impact costs unlike natural fibres such as cotton, etc<sup>4</sup>. Although the market is growing globally, there was a decrease in the volume of PSF exported in 2012 valued at \$14,643,000 (642,694 tonnes) as against \$28,909,000 (1,300,397 tonnes) in 2011. Observations made by the World Trade Organization (WTO) provided reasons for a decline in export revenue in 2012. The body said that issues relating to non-tariff measures (NTM) such as certification requirements, export inspection and obtaining export licenses/permits are factors that can impair a firm's ability to effectively and efficiently explore international markets<sup>5</sup>.

The global aluminum demand is around 37 million tonnes currently and has been forecasted to soar to nearly 70 million tonnes by 2020<sup>6</sup>. As a result, the recycling industry is an efficient source of raw material. Aluminium cans/straps could be converted into different alloys for multiple applications in construction, automotive industry, etc. Nigeria is ranked 41<sup>st</sup> amongst countries that produce aluminum products with an annual output of 13,000 tonnes<sup>7</sup>.

An estimate of about 164 tonnes of waste, parings and scraps of aluminium were exported from Nigeria valued at \$1,114,000 in 2012 as against 1 tonne valued at \$447,000 in 2011<sup>8</sup>. Also, unwrought aluminium alloy ingots exported from Nigeria in 2012 was 38,308 tonnes valued at \$101,087,000 as against 20,026 tonnes with a value of \$67, 465,000 that was exported in 2011. Rough statistics at hand show that the volume of aluminium alloys from Nigeria to China from January to August 2013 was about 4, 273 tonnes<sup>9</sup>. This could be attributed to the excellent recyclability of aluminium, together with its high scrap value and low energy needs during recycling make aluminium highly desirable.

Recycling PET bottles and aluminium cans save 40% and 95% of the energy required during their primary processing<sup>10</sup>. Aside from saving energy costs, there would be reduction in the impact on the environment for the demand for raw materials from mines or petroleum as recycling of 1 kg of aluminums saves up to 6kg of bauxite,

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<sup>1</sup> Post-consumer PET bottle recycling project in Nigeria

<sup>2</sup> PET Recycling Q&A-Coke MD-final[1]

<sup>3</sup> <http://www.yarnsandfibers.com/textile-pricewatch/polyester-staple-fibre-psf-price-trends-reports.html#>

<sup>4</sup> <http://www.foodbev.com/news/polyester-fibre-now-commands-almost-50-o#.UqquRvvsmp4>

<sup>5</sup> <http://businessdayonline.com/2013/12/emerging-trends-in-nigerias-non-oil-exports/>

<sup>6</sup> <http://www.ecomena.org/tag/aluminium-can-recycling/>

<sup>7</sup> <http://www.whichcountry.co/which-country-produces-the-most-aluminium/>

<sup>8</sup> [http://www.trademap.org/countrymap/Product\\_SelCountry\\_TS.aspx](http://www.trademap.org/countrymap/Product_SelCountry_TS.aspx)

<sup>9</sup> [http://www.metal.com/newscontent/53209\\_china-aluminum-imports-and-exports-data-august-2013](http://www.metal.com/newscontent/53209_china-aluminum-imports-and-exports-data-august-2013)

<sup>10</sup> Environment Protection Agency - Recycling: Cost analysis and Energy balance

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4kg of chemical products and 14kWh of electricity<sup>11</sup>. In 2003, about 16.4 million tonnes of bauxite were conserved globally as a result of aluminium recycling in Europe alone<sup>12</sup>.

Currently, countries in Europe and Asia such as Malaysia, India, Japan, China, Germany and United Kingdom remain the main markets for Nigeria's polyester staple fibers and aluminium scraps/alloy ingots<sup>13</sup> as Nigeria contributes to the growing demand for raw materials used for production.

### **Formal markets**

The formal markets for recycled PET and aluminium are primarily the global export market, where they are integrated into the global raw material markets. The export markets are majorly in Europe and Asia as raw materials for metal fabrications, automobiles, etc.

The price of aluminium alloy is about \$1,750 - \$1,900/tonne at the export market<sup>14</sup>. Some of the clients that buy aluminium ingots from Nigeria include Reukema Biocq Mannechijn, Holland, Metal Deals India, Guy Dauphin Environnement (GDE), France, Nord Schrott International GMBH, Germany<sup>15</sup>, Toyota, Mercedes, Nissan, Roll Royce, Sun Beam (ancillary of Hero Honda, India), Honda and BMW<sup>16</sup>. Polyester strap fibres are majorly exported to Germany and United Kingdom.

### **Processors and Exporters**

The export of polyester staple fibres (i.e. product obtained from recycling PET bottles) is being handled majorly by Alkem Nigeria Limited with an export value of \$10,463,187.96 to Germany and United Kingdom in 2011 and \$8,434,252.98 to South Africa in 2010, while that of aluminium ingots is being handled by companies such as Metal Recycling Industries, Maths Metals Recycling, Vicas Metals, Dofic Metals, Newstar International Limited, Sun and Sand Industries, etc. Newstar International Limited presently exports about 50 - 70 containers of Ingots valued at about \$4,720,655.20 to their clientele spread across the globe<sup>12</sup> while Sun and Sand Industries exported aluminium alloys valued at \$76,052,820.63 to Japan and United Arab Emirates in 2011 as against \$58,437,234.00 in 2010<sup>17</sup>.

### **Informal Markets**

The informal market for aluminum in Nigeria is about 5-10% of the market share<sup>10</sup>. In this market, aluminium scraps are melted and poured into earthen moulds to make local pots, spoons, etc. by local artisans. These local pots, spoons etc are used mainly for cooking on for events like weddings, birthdays, etc.

There is also a market for whole PET and glass bottles, which focuses mainly on reuse. The bottles are washed and sold to traders for use in packaging and selling palm oil, liquid soap, groundnut oil, groundnut, etc. in the markets.

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<sup>11</sup> <http://www.kianjoo.com.my/index.php?id=82>

<sup>12</sup> Aluminium Recycling: The Road to High Quality Products by Organisation of European Aluminium Refiners and Remelters

<sup>13</sup> Based on Field interviews

<sup>14</sup> <http://www.lme.com/en-gb/metals/reports/averages/>

<sup>15</sup> <http://www.nsmnigeria.com/nsmclients.html>

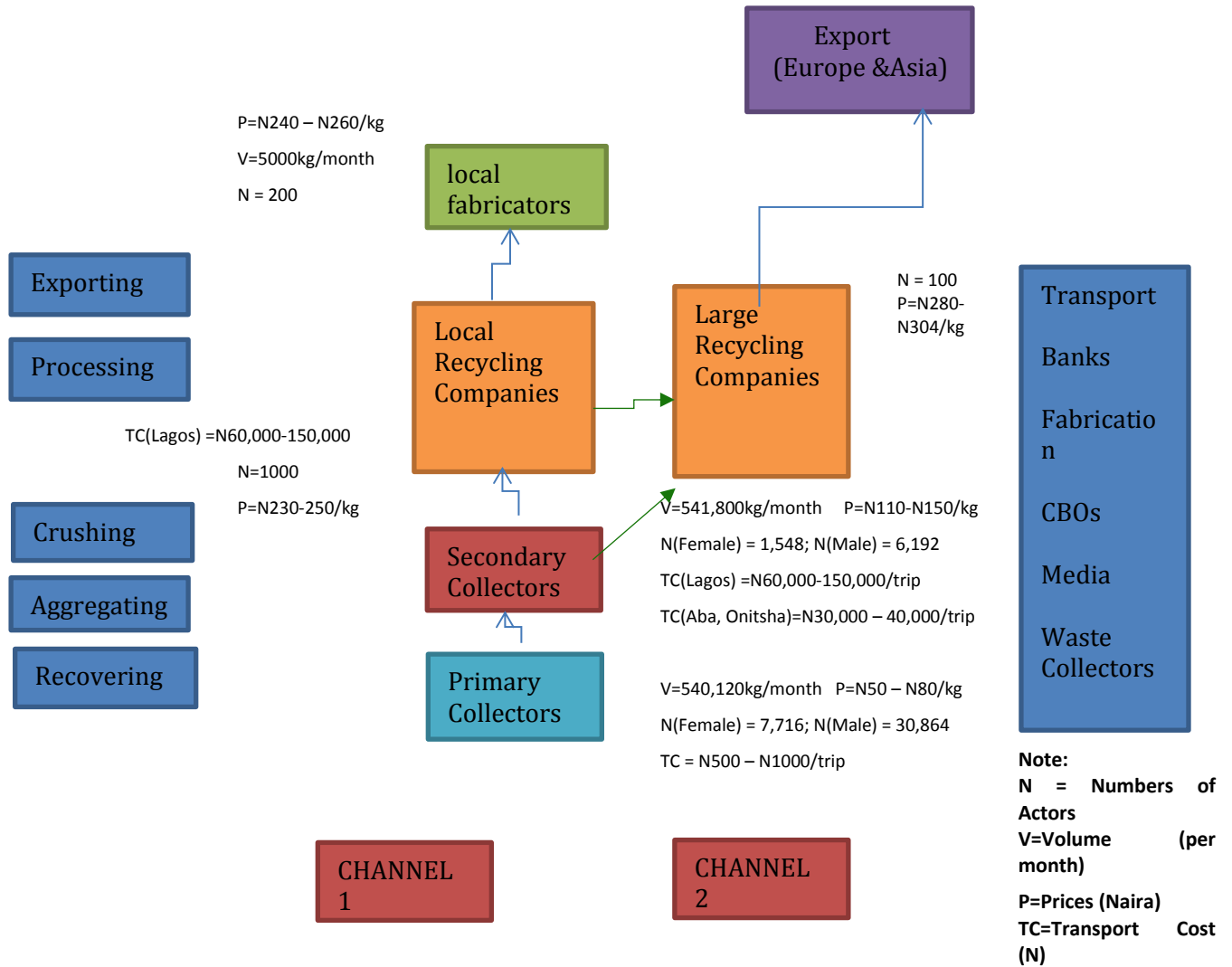
<sup>16</sup> [http://sunandsandindustries.com/distinguished\\_customers.html](http://sunandsandindustries.com/distinguished_customers.html)

<sup>17</sup> Central Bank of Nigeria: Annual Reports 2010 & 2011

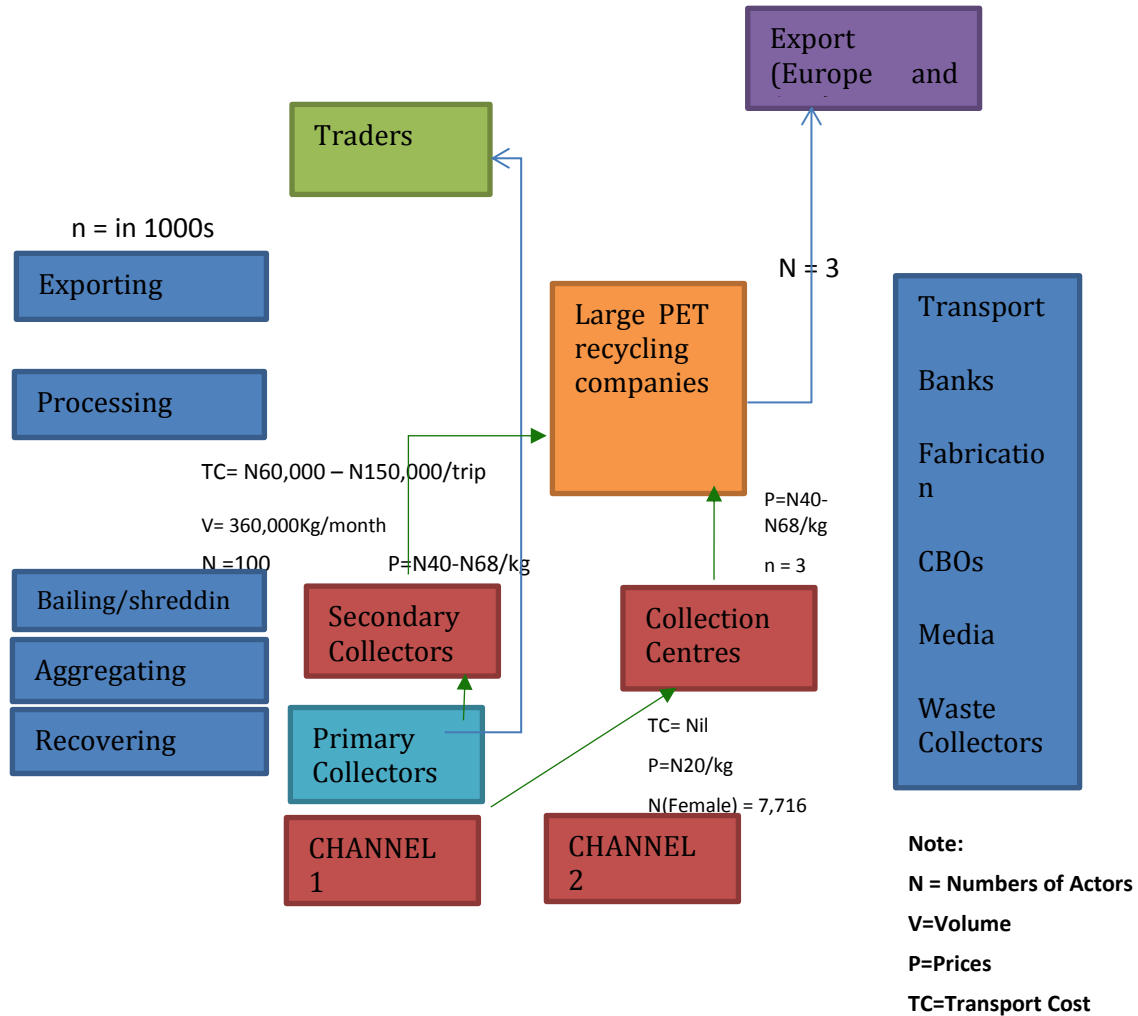
## Structure of the Value Chain in the Niger Delta

### The value chain map

#### A. Value Chain Map for Aluminium cans



**B. Value Chain Map for PET bottles**



**The Main Functions and Actors**

**Functions**

The various functions in the two value chains are similar to a large extent. The difference is that aluminum cans are crushed while PET bottles are either compressed and baled or shredded. These functions are:

1. **Recovering:** This is the process of sourcing for PET bottles and Aluminium cans. These materials are mainly sourced for from refuse at dump sites, garbage bins, events, etc. There are two types of cans or bottles and they are pre-consumer and post consumer. Post-consumer materials are those bottles that have been used and discarded and they are mostly recovered from the dump sites or bins. Pre-consumer materials are cans/bottles that became defective during blowing the pre-forms or packaging the product. They are usually sourced for from beverage and bottle water companies.
2. **Aggregating:** This involves gathering the recovered materials at a particular location until their quantity is large enough to transport. They are usually put in bulk collection bags popularly called jumbo bags/sacks.
3. **Crushing:** This process is related only to Aluminium cans and it is mostly done by the secondary collectors (point of aggregation) and few primary collectors. This helps the collectors to reduce the spaces the cans

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would occupy when being transported so that more cans could be transported. Crushing is usually done with hammers. This process is usually time consuming and requires brute force to crush the cans.

4. **Shredding/baling:** Unlike the Aluminium cans that could be crushed easily, PET bottles do not break or squash easily and this serves as its greatest disadvantage in terms of recycling, as it makes it bulky to transport. In view of these features, PET bottles are either shredded to PET flakes or baled to ease transportation. Post-consumer bottles are baled using a hydraulic scrap press which costs about 2 – 3.5 Million Naira. The machine compresses the bottles and while they are still been compressed; twines/strips are used to bind the bottles together. The machine could bale about 50-60kg at a time and about 100 tonnes of bottles/month. Pre-consumer bottles are shredded using a shredder which costs about N500,000. The bottles (without caps) are fed into the machine with double blades which shred the bottles into flakes, with a capacity of about 1 tonne of bottles/day. Post-consumer bottles are baled because they have to be washed and clean before being processed and only advanced/big recycling companies have the machines to wash the bottles. It was noted that same colours of bottles are baled or shredded together.
5. **Processing:** This is the process of converting aluminium cans into ingots and PET bottles into polyester staple fibers.
  - a. For aluminium cans, a locally fabricated furnace or an automated industrial furnace is used to process them. The only issue is that the locally recycled ingots need to be further recycled as the quality and purity are not up to international standards. The advantage is that more aluminium ingots are transported which translates to more money. The advanced/big recycling companies process either the locally refined ingots or aluminium cans/scraps to a higher degree of quality and purity using SPECTROMAX F version Analytical Instrument, NITON XLT 792 KMY Hand Held Analyzer, etc.
  - b. For PET bottles, the baled bottles are washed and treated before they are shredded or converted into polyester staple fiber.
6. **Exporting:** This is the final function in the value chain. Since about 90-95% of the processed materials are exported to the international market in Europe and Asia, the big recycling companies perform this function. They export high grade polyester staple fibers and aluminium ingots to these markets.

## Actors

The identified players/actors and functions in the value chains are

1. **Collectors:** These actors are classified into Primary Collectors (PCs) and Secondary Collectors (SCs).
    - a. PCs are mostly youths, men and women and sometimes children. Primary Collectors (PCs) recover aluminium scraps, used/damaged beverage cans, PET and glass bottles from dumpsite, garbage cans/waste bins, parties, beverage companies, etc in jumbo bags. For Aluminium cans and scraps, PCs could either crush the cans or sell them uncrushed but they mostly recover and sell them uncrushed. In the case of PET bottles, they sell PET bottles to secondary collectors or traders in the market for reuse purposes i.e. bottles used to sell engine oil, palm oil, groundnut oil, etc.
    - b. SCs purchase the recovered materials from PCs and they could directly recover cans. This is mostly necessitated by either the inability to pay cash for the purchase of cans or meet up with the quantity demanded from the PCs.

For Aluminium cans and scraps, the SCs mostly buy uncrushed cans from PCs. They either crush the cans themselves or employ the services of people to crush the cans and sell them to recycling companies in Lagos, Onitsha or Aba.

In the case of PET bottles, SCs go to the PCs usually at dump sites, water bottling companies, etc. to purchase these bottles. The SCs either shreds or bales before selling they are sold to advanced/big recycling companies in Lagos.
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The primary function of the SCs is to aggregate the materials and process them (i.e. crushing, shredding or baling) so that more recyclable materials are transported to local and advanced/big recycling companies.

- c. Collection Centers (CCs): This is an initiative from Alkem Nigeria Limited (ANL), a major PET recycling company in Lagos. The role of the CCs is similar to that of SCs and they are set up as a depot for aggregating recovered materials and processing them to enable more PET bottles to be transported. There are 21 CCs in 9 states across Nigeria including 3 states in the Niger Delta (i.e. Edo, Delta and Imo) and these centers are equipped with weighing scales, hydraulic presses, etc. CCs are set up based on agents consistently in getting adequate supply. Under the “Alkem” model, if a CC exhibits the potentials to deliver a reasonable quantity of PET bottles, ANL would give the center a truck that can move about 5 tonnes of baled PET on loan. The cost of the vehicle would be remitted monthly and the CC owns the vehicle after the loan is repaid but for the press, the agreement is that all bottles from the CC would be supplied to ANL. The machine remains the property of Alkem Nigeria Limited.
2. Recyclers: They are classified into two: Local aluminium recyclers and advanced recyclers/big recycling companies (PET and aluminium). This classification is based on their technologies, volumes and markets.
  - a. The local aluminium recyclers use local technology such as local furnaces, etc, to process the aluminium cans into ingots. This enables them to earn more and transport larger volumes but the ingots’ quality and purity are not up to international standards. They could sell to local fabricators but majority of the ingots are sold to advanced recyclers in Lagos.
  - b. Aluminium advanced recyclers either buy aluminium cans/scraps from SCs or ingots from local aluminium recyclers from Aba and Onitsha. They re-melt and further purify the alloys to meet international standards (i.e. purity and quality). These purified ingots are transported to these companies by the local aluminium recyclers. These companies export them to Europe and Asia.
  - c. PET advanced recyclers buys baled PET bottles and PET flakes from SCs and CCs. These companies export them to Europe and Asia. Currently, there is no known local technology to process PET bottles/flakes into PET pellets, etc.
3. Local fabricators: They purchase aluminium scraps from SCs and possibly ingots from local aluminum recyclers. These are melted and pour into their moulds to make local aluminium pots, buckets, cooking spoons, etc.

## Channels

As identified in the VC maps, there are two channels (i.e. Channels 1 and 2). Channel 1 is usually labour intensive and focuses mainly on reuse while channel 2 is capital intensive as it requires machines to process the recovered materials. Although both channels are growing, channel 2 is growing faster and actors in channel 2 make more money than those in channel 1. This is because of the volumes traded and the market they are being sold. Though business in both channels could be commenced with little or no investment, channel 2 provides an avenue for quick money as cans/PET bottles could be exchanged for cash instantly as against channel 1 where the lesser volumes are sold and at a lower frequency.

**Market Size** In determining the size of the market, data were generated based on the information obtained from the field. These information include:

1. An average primary collector gathers about 10kg of cans/day and 60kg of PET bottles/week
  2. An average of 6 tonnes of PET bottles/month from a dump site
  3. An average of 3 dump sites in Warri
  4. An average secondary collector crushes about 50kg of cans/day.
  5. An average secondary collector shreds about 10tonnes of PET tonnes/month
  6. There are about 20 major cities in the Niger Delta<sup>4</sup>.
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7. There are 3 main scrap yards in Warri.
8. An average of 45 tonnes of cans is transported to recyclers from a scrap yard/week in Warri, Delta State.

Table 2 shows the estimated volumes of can/scraps and PET bottles and the number of PCs and SCs engaged in the market. The estimated number of primary collectors in Warri, Delta State is approximately 1,929 and they gather about 19,290kg of cans/day. There are about 38,580 people in the nine Niger Delta states that recover about 10,802 tonnes of aluminium cans/month for recycling<sup>18</sup>. The secondary collectors and collection centers are estimated to have about 7,740 people handling about 10,836 tonnes/month and about 1,000 recyclers are estimated to handle about 10,836 tonnes/month. There are about 30,864 male and 7,716 female primary collectors, 6,192 male and 1,548 female secondary collectors<sup>19</sup>. The estimated volume of PET bottles recovered per month is about 360 tonnes<sup>20</sup>.

Table 2: Average number of players and volumes

	PC	SC
<b>Volume of cans/day/individual (Kg)</b>	10	50
<b>Volume of cans/day/individual (Kg)</b>	10	500
<b>Number of individuals/day</b>	642.9	128.6
<b>Number of volume per day (Kg)</b>	6428.6	6428.6
<b>Number of parks in Warri</b>	3	3
<b>Total of people in Warri</b>	1929.0	387.0
<b>Volume of cans/day in Warri (kg)</b>	19290.0	19350
<b>Volume of cans/month in Niger Delta (Kg)</b>	540,120.0	541,800.0
<b>Volume of cans/month in Niger Delta (Tonnes)</b>	540.1	541.8
<b>Volume of PET bottles (Tonnes)</b>	360	360
<b>Number of Players</b>	<b>Male</b>	<b>Female</b>
PCs	30,864	7,716
SCs	6,192	1,548
<b>Total</b>	<b>37,056</b>	<b>9,264</b>

## Supporting Services and Interconnected Industries

The various supporting services that support this system include:

1. Transport system: The importance of transportation to this market cannot be overemphasized as all the materials are transported to recycling companies outside the Niger Delta. Besides the fact that the cans and

<sup>18</sup> Based on calculation: Multiplication of Volume/day(19,290kg), 7 days to make a week, 4 weeks to make a month and 20 major cities in the Niger Delta.

<sup>19</sup> Based on calculation:

a. Total number of PCs and SCs – Multiplication of estimated number of people in Warri (1,929) and 20 major cities in the Niger Delta

b. Total number of males and females – Based on interviews and observations; an estimated ratio of 1 female to 5 males was adopted.

<sup>20</sup> Based on calculation:

a. Multiplication of the average of recovered PET bottles/month, 20 major cities and 3 dump sites.

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bottles have to be moved from the point of recovery to where it would either be crushed or sold to a secondary collector, the SCs have to transport them to RCs and RCs need to transport them to the export. The collectors hire the services of cart pushers or trucks to move them. Cart pushers are paid about N500 - N1000/trip; but before the ban of commercial motorcycles “Okadas”, the recovered items could be delivered for about N200 using “Okadas” (See table 3).

Table 3: Transport costs

	Before Ban	Volume (kg)	After Ban	Volume (kg)	Resultant effects
Transport Cost (PCs – SCs)	N200	10	N500 - N1000	10	Extra N300 - N800 incurred to do business
Transport Cost (SCs – RCs) - Others	N30,000 – N40,000	8,000 – 20,000	N30,000 – N40,000	8,000 – 20,000	Not Applicable
Transport Cost (SCs – RCs) - Lagos	N60,000 – N150,000	8,000 – 30,000	N60,000 – N150,000	8,000 – 30,000	Not Applicable

2. Banks: Apart from cash transactions between the PCs and SCs and sometimes between local recyclers and SCs, other transactions involving SCs and advanced recyclers or local recyclers and advanced recyclers involve the services of banks for payment for services. The collection process is cash intensive as the product is bulked up, so working capital is a constraint for secondary collectors.
3. Fabricators: The tools used to crush the cans vary from small hammers to large ones as well as the carts used to transport recovered materials are locally fabricated. However, new technologies, such as small mechanical can crushers (common in many countries) can be made by fabricators.
4. Community Based Organisations (CBOs): Some CBOs currently provide capacity building and functional training skills to some of the actors in the VC, mostly the primary and secondary collectors to enable them improve linkages and networking so as to increase learning, information dissemination, consensus building and advocacy skills with which to influence policy makers.
5. Waste Collectors: In urban areas have waste management boards that regularly collect refuse from various household and dispose them at the dump sites as recyclable materials are mostly still regarded as waste. They bring the materials to the central location where PCs and some SCs can recover them.
6. Associations/Unions: They serve as local regulatory bodies that govern the operations and coordination of PCs, SCs and local RCs. They determine who picks what at some dump sites, and provide supports such as first aid, etc. especially for PCs and SCs.



## Business Model at Enterprise Level

Primary Collectors (PCs) recover UBCs, aluminium scraps, metal scraps, bottles (plastics and bottles, etc from dump sites, parties, companies, homes etc. They either crush or sell the cans uncrushed. They sell to Secondary Collectors (SCs) or collection centers. PCs could also sell PET bottles directly to traders as traders use them to sell palm oil, engine oil, kerosene, etc. SCs could also source for additional cans on their own. Table 4 shows a summary of various costs within the business model while table 5 and 6 show abridged income statements for the PCs and SC; a more detailed income statement is in the appendices section.

It is believed that the primary collectors come to deposit the cans at an agreed location which could either be owned or leased monthly by the SCs. Cost incurred by PCs include union/association fee (N1,500), environmental fee (N1,000), transportation cost per delivery to designated points (N500 – N1000). Many of the female SCs employ the services of children which they pay about N500 to crush the cans. The older women sell to SCs that have the labour to crush their cans. The male SCs either crush themselves or hire labour.

The SCs (Aluminium) either sells to other SCs/traders to quick cash (liquidity) or to avoid the stress involved in the business especially for the older women. Some stock up to 3 – 8 tonnes and sell to advanced/big recycling companies in Lagos or to any of the about 1000 local recycling companies in Onitsha, Anambra state and Aba, Abia State. The quantity of the consignment determines where SCs sell their wares because of the cost of transportation.

On the other hand, SCs (PET) buys N20/kg from PCs at dumpsites etc. SCs have to sort the PET bottles based on colour, remove their labels and corks before baling and wash before shredding to flakes before selling to recycling companies after shredding or baling them. About 2 - 9 women are hired to sort, remove labels and wash the bottles.

The cost of transportation to Onitsha or Aba is about N30,000 – N40,000 while to Lagos is about N60,000 – N150,000 per trip depending on where the trailer was hired. Trailers hired from haulage garages are usually more expensive than those that are not in the parks. This is because those that are not in the haulage garages came from Lagos to deliver goods and would be going back empty so it is extra money for them.

Asides cans, aluminium roofing sheet scraps are also bought from PCs but it can only be gotten when houses are being roofed, scraps from aluminium companies, aluminium waste from buildings being either destroyed or renovated.

The local aluminium recycling companies buy from SCs/traders and sell to advanced recyclers. They can process a minimum of 8 – 10 tonnes and maximum of about 15 – 20 tonnes/month. An average advanced aluminium recycler which is in Lagos could do about 100-500tonnes/day. Alkeem Nigeria Limited, the major recycling company for PET bottles process about 400tonnes/month<sup>21</sup>. It takes these advanced/big recycling companies about two weeks to confirm each consignment before the collectors are paid through the bank.

The SCs and RCs are in constant communication on prevalent prices in the market, availability of supply for their demand, etc. Although sorting, washing and the removal of labels and corks are mostly done by women, there are fewer women who are either PCs or SCs.

After further processing of the materials to international standard, the advanced companies would then sell them at the global export market, where they are integrated into the global raw material markets.

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<sup>21</sup> Post-consumer PET bottle recycling project in Nigeria

*Table 4: Summary of the various costs in the business model*

Summary of Costs in the Business Model	
Items	Cost (N)
Cost of uncrushed cans/kg from PCs	50
Cost of crushed cans/kg from PCs	80
Cost of PET bottle/kg	20
Cost of 12 PET Bottles sold for reuse	100
Cost of 1 glass bottle	10
Rent for SCs	1000
Cost of crushing of cans/kg	15
Cost of crushed cans (SC - SC)	100
Sales price of crushed cans (SC - RC) (Lagos)	130 - 150
Sales price of crushed cans (SC - RC) (Onitsha/Aba)	110 - 120
Cost of sorting and removing labels from PET bottles/jumbo bag	150
Cost of transportation - Lagos	65,000 - 150,000
Cost of transportation - Onitsha/Aba	30,000 - 35,000
Price of PET (baled/shredded)/kg to RC	N40-N68
Price of aluminium scraps/kg to SC	120
Price of aluminium scraps/kg to RC	200
Price of aluminium ingot/kg to Advanced RC	220 - 250

*Note: A jumbo bag is equivalent to about 20kg of PET bottles.*

Based on the summary of cost in the sector's business model, the income statements of PCs and SCCs are as shown in Figures 5 and 6.

**Table 5: Income Statement for Primary Can Collector**

Income Statement for Aluminium	Primary Can Collector		Secondary Can Collector	
	Monthly (N)	Annually (N)	Monthly (N)	Annually (N)
INCOME				
<b>Total Income</b>	<b>60,000</b>	<b>720,000</b>	<b>200,000</b>	<b>2,400,000</b>
EXPENSES				
<b>Total Expenses</b>	<b>3,500</b>	<b>42,000</b>	<b>131,500</b>	<b>1,578,000</b>
Net Income	<b>56,500</b>	678,000	<b>56,500</b>	678,000
Net Income from Cans alone	<b>14,125</b>	<b>169,500</b>	<b>68,500</b>	<b>822,000</b>

**Table 6: Income Statement for Primary PET Collector**

Income Statement for PET bottles	Primary PET Collector	
	Monthly (N)	Annually (N)
INCOME		
<b>Total Income</b>	<b>16,800</b>	<b>201,600</b>
EXPENSES		
<b>Total Expenses</b>	<b>2,500</b>	<b>30,000</b>
<b>Net Income</b>	<b>14,300</b>	<b>171,600</b>

### Gender dynamics and the role of women in the value chain

Based on interviews and visits to dump sites, it was observed that women make up about 20% of the population working in this sector. It was also observed that the number of participants especially women decreases as one ascends the value chain because women work mostly either as collectors (i.e. recovering of aluminium cans and PET bottles) or sorters (sort based on colours and remove labels and caps) of PET bottles before bailing or shredding them. The female collectors also recover PET and glass bottles while their male counterparts recover mostly heavy metals (iron, steel, etc.). A collector gathers about 60kg of PET bottles/week for recycling purposes and about 60 PET bottles/day and 5 glass bottles/day for reuse purposes.

Women are generally allowed to recover whatever they can recover except in places like Asaba where women are restricted to the recovery of PET bottles by their association; this could be attributed to the cultural norm. Furthermore, females in Owerri, Imo state were said not to engage in the business. This could be because of their cultural norm.

The choice of the items recovered is more related to the ability to handle (recover, carry, transport, etc) the materials than restrictions by association, union, etc. Except in rare cases like in a dump site in Asaba where women are restricted to recovering PET bottles and plastic bags, the income differences between men and women involved within the value chain are mainly determined by the quantity and types of the recyclable materials that are recovered. Men recover aluminium cans and heavier metals while women recover aluminium cans and PET bottles.

Based on observations on the field, women have little or no representation in the leadership structure of these unions and association. This could possibly be accredited to the cultural norm of these areas. At a dump site in Asaba, women are charged the same fee with the men but they are restricted to the items recovered while in Yenegoa, women are said not to be charged by the association and they enjoyed some benefits such as first aid from the association. This is because men as breadwinners are expected to give women money and not the other way round. Women do not pay fees but they enjoy benefits from the association such as access to first aid, etc and they are not restricted to the materials recovered.

### Pro-Poor Implications

The PCs are primarily poor, because this business could be commenced with little or no investment. It is also a source of quick money as cans/PET bottles could be exchanged for cash instantly. The more cans/bottles (PET and glass) recovered the more money earned and the more value is added (i.e. crushing, etc.), the more money

earned. Aside from rent and transportation, there is little required to recover recyclable materials. Collectors at some dump sites incur expenses such as levies like as union/association fee (N1,500), environmental fee (N1,000), etc. There are also rules that govern the operations of PCs around the dump sites such as no criminal activities, fighting etc. The exposure to hazardous smoke and stench from the dump sites puts the collectors in great risks of respiratory and skin diseases as many of the collectors are not properly kitted for the task. Many of the collectors work under the sun throughout the day and they complain of body aches and sore backs. Some of the other health problems include typhoid fever, diarrhea, cholera, hepatitis, hook worm infestation, skin diseases.

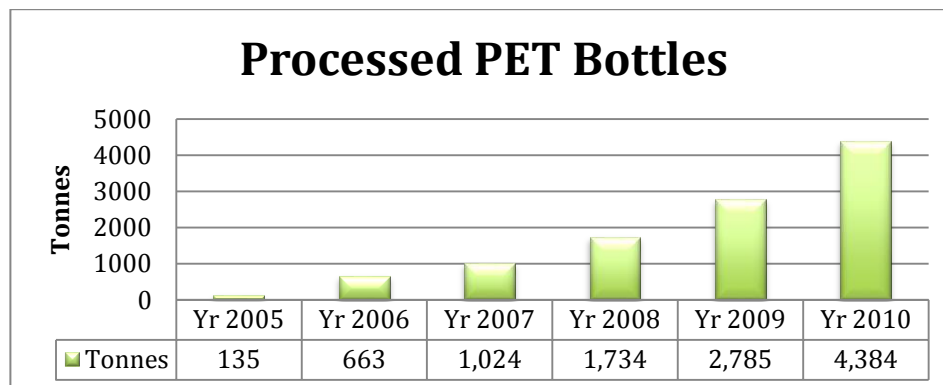
## Sectoral Dynamics and Driving Forces

### Sectoral Dynamics

The markets for both PET and aluminum are growing.

- An estimate of about 164 tonnes of waste, parings and scraps of aluminium were exported from Nigeria in 2012 as against 1 tonne in 2011<sup>22</sup>. Also, unwrought aluminium alloy ingots exported from Nigeria in 2012 was 38,308 tonnes as against 20,026 tonnes with a value of exported in 2011. This data shows that the market for aluminium is growing.
- For PET bottles, Alkem Nigeria Limited (ANL) commenced operations with the processing of about 135 tonnes of PET bottles in 2005. From 2006 – 2010, the company processed 663 tonnes, 1,024 tonnes, 1,734 tonnes, 2,785 tonnes and 4,384 tonnes. Figure 1 shows the growth trends of the volume of recycling PET bottles by ANL.

Figure 1: Recycled PET bottles growth trend<sup>23</sup>



### Driving force

The growth in the volume of recycling of PET bottles and aluminium could be attributed to the following:

#### World consumption/demand:

The global consumption of PSF Global polyester staple fiber (PSF) production is estimated to touch 17.9 million tonnes by 2018, as compared to 14.6 million tonnes in 2012<sup>24</sup>. This is because synthetic fibres are not subject to weather events, pestilence or poor crop yields that restrict availability and impact costs unlike natural fibres

<sup>22</sup> [http://www.trademap.org/countrymap/Product\\_SelCountry\\_TS.aspx](http://www.trademap.org/countrymap/Product_SelCountry_TS.aspx)

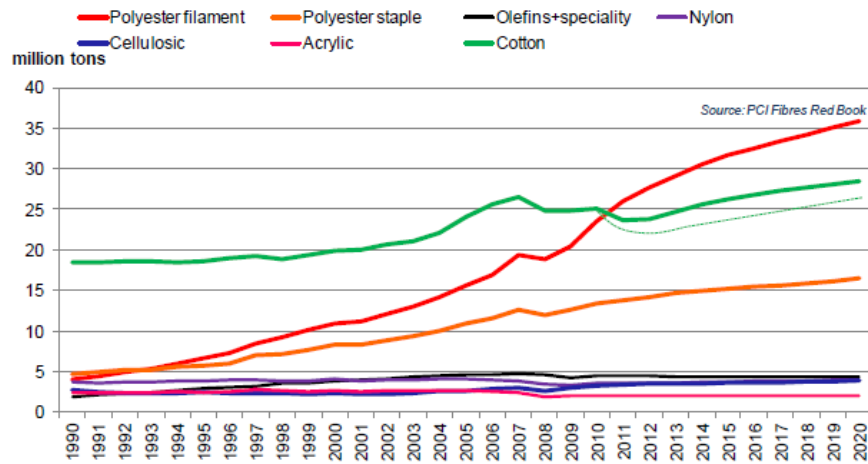
<sup>23</sup> Post-consumer PET bottle Recycling Project in Nigeria - Growth in recycling volume

<sup>24</sup> <http://www.yarnsandfibers.com/textile-pricewatch/polyester-staple-fibre-psf-price-trends-reports.html#>

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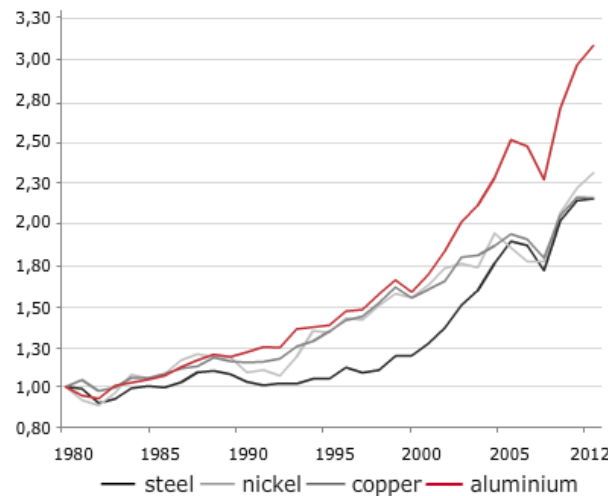
such as cotton, etc<sup>25</sup>. Figure 2 shows that consumption of PSF has grown from about 5 millions tonnes in 1990 to about 15 million tonnes in 2013 and has been projected to continue to grow.

Figure 2: World consumption of fibres from 1990 - 2020<sup>26</sup>



The global aluminum demand is around 37 million tonnes currently and has been forecasted to soar to nearly 70 million tonnes by 2020<sup>27</sup>. As a result, the recycling industry is an efficient source of raw material as recycled aluminium volumes rose significantly from 13.7 million tonnes in 2003 to 19.4 million tonnes in 2009, representing an increase of 42 percent, compared to a 28 percent increase in primary production<sup>28</sup>.

Figure 3: Global metals consumption per capita index



<sup>25</sup> <http://www.foodbev.com/news/polyester-fibre-now-commands-almost-50-o#.UqqRvvsmp4>

<sup>26</sup> Bruna Angel, PCI Fibres, November 2012 Cotton and manmade fibres: competition and complementarity pricing and sustainability

<sup>27</sup> <http://www.ecomena.org/tag/aluminium-can-recycling/>

<sup>28</sup> <http://www.hydro.com/en/Press-room/News/Archive/2010/Strong-growth-expected-in-global-aluminium-recycling/>

### **Technology:**

The existence of the technology to compress and process the recovered materials has contributed to its growth. For PET bottles, the availability of the hydraulic presses to crush and other machines to process (i.e. wash, grind and convert) them to polyester staple fibers has positively influenced its growth. On the other hand, the existence of machines (e.g. SPECTROMAX F version Analytical Instrument, NITON XLT 792 KMY Hand Held Analyzer, etc.) to produce aluminium with high level of purity from recovered materials has contributed to its growth.

### **Social responsibility:**

For PET bottles, the buyback model, an organized channel with Alkem Nigeria Limited, for locally used PET bottles which was initiated by Coca-Cola and Nigeria Bottling Company. This was necessitated by the move for these companies to be socially responsible by reducing the environmental impact of their products and that of their competitors. The buyback model has also encouraged many people to venture into the business as it provides an avenue for quick money as cans/PET bottles could be exchanged for cash instantly.

### **Change of perception:**

Although the attitude and perception of people on recycling is yet to be very evident, there is a gradual change in the perception of people. This changed perception is being driven by environmental aspects and the need to save energy<sup>29</sup> as the processes of recycling PET bottles and aluminium cans/straps save 40% and 95% of the energy required for primary productions.

## **Growth Opportunities and Constraints**

The growth opportunities in this sector include:

### **Increasing the percentage of recaptured/recycled materials:**

With Nigeria's annual output of PET bottles at about 15,000 to 20,000 tonnes and an estimated volume of 5,600 tonnes (28%) i.e. about 280 million PET bottles recycled in 2011, there is still a huge gap in the quantity of PET bottles yet to be recovered. This could be achieved through an improved coordination of all actors to increase in profit through reduction of cost.

### **Increasing the value of the recycled materials:**

Currently, PET bottles are converted to polyester staple fibres and cans to purer ingots mainly for export. The opportunity exists for companies to convert the aluminium ingots to sheets which could be used by companies such as GZI Industries Limited as raw material for the production of beverage cans rather than import at a higher cost. Recovered PET bottles could also be pelletised and produced to preforms locally which could be sold at a cheaper rate to beverage companies and the excess could be exported.

### **Employment of more poor people in the value chain:**

With the existence of value adding companies in the sector, there would be more demand for the poor to function in various activities from recovery to sorting, packaging, etc.

### **Constraints**

Some of the bottlenecks to achieving growth in this sector include:

1. Availability of transportation: The ban/restriction of the movement of commercial motorcycles (Okadas) on certain roads in most cities across the Niger Delta now constitutes a constraint for PCCs or SCCs to source for and transport/convey more cans.

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<sup>29</sup> <http://www.hydro.com/en/Press-room/News/Archive/2010/Strong-growth-expected-in-global-aluminium-recycling/>

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2. Major costs associated with transport of a bulky but low value material especially for the PET bottles.
3. PET bottles cannot be squashed easily and they take up a lot of space when transporting them.
4. There are no existing groups/associations/unions for female SCs.
5. There is still a limited public awareness on recycling, the benefits of waste sorting and the values of the materials considered as waste.
6. Access to moveable hydraulic presses.

## **Opportunities**

The poor could be positioned to benefit more with the following:

1. The provision and access to simple fabricated machines that could crush cans. This would enable the PCs to earn more i.e. N10 - N30/kg, reduce the stress and time taken to crush the cans by the SCs and SCs and PCs could recover more cans as the time spent to crush is drastically reduced.
2. The provision and access to simple mobile hydraulic press that could compress and bale PET bottles would enable SCs to transport more PET bottles to where they would be shredded to further make them handier to transport. This would reduce the cost of transporting the bottles.
3. The availability of the machine for crushing cans could enable the crushers to charge N10/kg as there is opportunity for more cans to be crushed with less stress. This would translate to the increase in the volume of cans crushed by day, thereby increasing his income.
4. Provision of VC finance from advanced recycling companies for SCs. The idea is to peg the prices being dictated by the export market at a particular price so that the excess or windfall could be converted to fund the VC finance scheme for the SCs and local RCs. This could enable the SCs/local RCs purchase materials while the company is processing the payment for the last consignment delivered by the SCs/local RCs. This increases the supply of recyclable materials to the recyclers.
5. The proper segregation of wastes by consumers of the product would enable collectors recover more cans/bottles faster and possibly before the cans/bottles get to the dump sites. This could also help the sanitation agencies to carry more decomposable materials to the dump sites as the cans and bottles that could consume space would have been separated. This could be achieved through orientation of the public on proper sorting of waste.
6. Provision of protective kits for those that work at the dump sites.
7. Provision of handpicking tools so that the collectors do not bend for long scouting for bottles and cans.
8. Possible awareness of the public through the media and enforcement of sanitary laws could possibly contribute to the ease of doing this business.
9. The possible reduction in the payment time that collectors that sell to advanced/big recycling companies get pay as it currently takes about two weeks before they are paid. This would enable them buy more from the collectors.

## ***Constraints to Accessing End Market Opportunities***

The products sold at the end markets are of high standard and quality. The cost and capital required to set up a business at this level restrains a lot of people from getting involved in the market.

## **Illustrative Interventions**

### ***Potential Lead Firms for Interventions***

Currently, the host communities of the major oil companies in the Niger Delta are structured under a GMoU process. The Regional Development Councils (RDCs) could be engaged to organize their women and youths so as to sensitise them on the recycling business. They could then engage companies around their area in sorting their aluminium and PET bottle wastes.

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## Annex 1: Business Model of the Sector

Primary Collectors (PCs) recover UBCs, aluminium scraps, metal scraps, bottles (plastics and bottles, etc from dump sites, parties, companies, homes etc. They either crush or sell the cans uncrushed. They sell uncrushed cans @ N50/kg and crushed cans @ N80/kg to Secondary Collectors (SCs) or collection centers. PET bottles are sold @ N100/dozen and glass bottle is sold for N10/bottle to traders to sell palm oil, engine oil, kerosene, etc. but PET bottles are sold @ N20/kg to SCs. However, in Asaba, PCs hire the caterpillar that works in the dump site to crush their cans @ N3000 and PET bottles to Ecoplastics, a company that compresses and bales @ N600 per jumbo bag irrespective of its weight. SCs could also source for additional cans on their own. In Yenegoa, 12 PET bottles are sold @ N50 to traders and 4 glass bottles @ N50 and they are sold for N100 by traders in the market. Table 4 shows a summary of various costs within the business model.

It is believed that the primary collectors come to deposit the cans at an agreed location which could either be owned or leased for about N1,000/month by the SCs. Cost incurred by PCs include union/association fee (N1,500), environmental fee (N1,000), transportation cost per delivery to designated points (N500 – N1000).

Many of the female SCs employ the services of children which they pay about N500 to crush the cans. The older women sell to SCs that have the labour to crush their cans. The male SCs either crush themselves or hire labour @ N15/kg.

The SCs (Aluminium) either sells to other SCs/traders @ N100/kg either to quick cash (liquidity) or to avoid the stress involved in the business especially for the older women. Some stock up to 3 – 8 tonnes and sell to advanced/big recycling companies @ N130 – N150/kg in Ikorodu, Lagos or to any of the about 1000 local recycling companies in Onitsha, Anambra state and Aba, Abia State @ N110 – N120/kg. The quantity of the consignment determines where to sell their wares because of the cost of transportation. For PET Bottles, SCs (PET) buys N20/kg from PCs at dumpsites etc. and sell to recycling companies @ N40 – N60/kg after shredding or baling them. SCs have to sort the PET bottles based on colour, remove their labels and corks before baling them. The PET bottles have to be washed before they are shredded to flakes. About 2 - 9 women are hired to sort, remove labels and wash the bottles @ N150/Jumbo bag which is about 20kg.

The cost of transportation to Onitsha or Aba is about N30,000 – N40,000 while to Lagos is about N60,000 – N150,000 per trip depending on where the trailer was hired. Trailers hired from haulage garages are usually more expensive than those that are not in the parks. This is because those that are not in the haulage garages came from Lagos to deliver goods and would be going back empty so it is extra money for them.

Other expenses incurred by SCs asides rent for space to stack cans/PET Bottles include N10,000 as levy when travelling to Lagos.

Asides cans, aluminium roofing sheet scraps are bought @ N120/kg and sold @ N200/kg but it can only be gotten when houses are being roofed, scraps from aluminium companies, aluminium waste from buildings being either destroyed or renovated.

The local aluminium recycling companies buy from SCs/traders to recycle @ N110 – N150/kg and sell @ N220 – N250/kg to advanced recyclers. They can process a minimum of 8 – 10 tonnes and maximum of about 15 – 20 tonnes/month. An average advanced aluminium recycler which is in Lagos could do about 100-500tonnes/day. Alkeem Nigeria Limited, the major recycling company for PET bottles process about 400tonnes/month<sup>30</sup>. It takes these advanced/big recycling companies about two weeks to confirm each consignment before the collectors are paid through the bank.

The SCs and RCs are in constant communication on prevalent prices in the market, availability of supply for their demand, etc. Although sorting, washing and the removal of labels and corks are mostly done by women, there are fewer women who are either PCs or SCs. In one of the dump sites in Asaba, there were about 3 female PCs

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<sup>30</sup> Post-consumer PET bottle recycling project in Nigeria

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to about 15 male PCs and all the women but one were restricted to recovering only PET bottles. This is because she had been working at the dump site for over 20 years.

After further processing of the materials to international standard, the advanced companies would then sell them at the global export market, where they are integrated into the global raw material markets.



## Annex 2: Income Statement for Primary Can Collector

### Income Statement for Aluminium

	Primary Can Collector		Secondary Can Collector	
	Monthly (N)	Annually (N)	Monthly (N)	Annually (N)
<b>INCOME</b>				
<b>Revenue</b>				
<b>Goods and services - Metal scraps</b>	48,000	576,000		
<b>Goods and services - Aluminium cans</b>	12,000	144,000	200,000	2,400,000
<b>Total Revenue</b>	<b>60,000</b>	<b>720,000</b>	<b>200,000</b>	<b>2,400,000</b>
<b>Total Income</b>	<b>60,000</b>	<b>720,000</b>	<b>200,000</b>	<b>2,400,000</b>
<b>EXPENSES</b>				
<b>Crushing</b>			500	6000
<b>Suppliers</b>			92,500	1,110,000
<b>Intra City Transport</b>	1,000	12,000	-	-
<b>Inter City Transport</b>	-	-	32,500	390,000
<b>Rent</b>	-	-	1,000	12,000
<b>Other expenses (levy, etc)</b>	2,500	30,000	5,000	60,000
<b>Total Expenses</b>	<b>3,500</b>	<b>42,000</b>	<b>131,500</b>	<b>1,578,000</b>
<b>Net Income</b>	<b>56,500</b>	<b>678,000</b>	<b>56,500</b>	<b>678,000</b>
<b>Net Income from Cans alone</b>	<b>14,125</b>	<b>169,500</b>	<b>68,500</b>	<b>822,000</b>
<b>Data for PCC</b>				
Price of metal scraps	<b>48,000</b>			
Volume of cans/month (kg)	<b>240</b>			
Cost of uncrushed can/kg (N)	<b>50</b>			
<b>Data for SCC</b>				
Volume of cans/month (bags)	<b>500</b>			
Cost of uncrushed can/kg	<b>50</b>			
Cost of crushed can/kg	<b>80</b>			

Note: These figures are based on data from the field. The following assumptions include:

1. The recovery of cans to metal scraps is ratio 1:4.
2. The quantity of cans and metals recovered are constant throughout the year.
3. The quantity of cans purchased is an average of 500kg Since the SCC sells 700kg of cans bi-monthly and about 3000kg every other month.

**Annex 3: Income Statement for Primary PET Collector**

Income Statement for PET	Primary PET Collector	
	Monthly (N)	Annually (N)
<b>INCOME</b>		
<b>Revenue</b>		
<b>Goods and services</b>	16,800	201,600
Total Revenue	<b>16,800</b>	<b>201,600</b>
<b>Total Income</b>	16,800	201,600
<b>EXPENSES</b>		
<b>InterCity Transport</b>	-	-
<b>Environment Fee</b>	1,000	12,000
<b>Association Fee</b>	1,500	18,000
<b>Total Expenses</b>	<b>2,500</b>	<b>30,000</b>
Net Income	<b>14,300</b>	<b>171,600</b>
<b>Data</b>		
Number of PET bottles/month (bags)	<b>12</b>	
Volume of Plastic bags/month (Kg)	<b>240</b>	
Cost of 1 bag of PET (N)	<b>600</b>	
Cost of Plastic bag/kg (N)	<b>40</b>	

*Note: These figures are based on data from the field. The following assumptions include:*

- 1. The quantity of plastic bags and PET bottles recovered are constant throughout the year.*

**Annex 4: Contact List per State**

<b>NAME</b>	<b>ORGANIZATION</b>	<b>CONTACT</b>
<b>Mr. Joseph Jibueze</b>	Plastics Recycle Enterprise	Plt C/4, Industrial Layout, Owerri Onitsha Road, Owerri, Imo State. 08034051050
<b>Mr. Dike</b>	Constant Waters	MCC – Urata Road, Owerri, Imo State
<b>Mr. Tony</b>	Aqua Aqud Waters	Urata Road, Owerri, Imo State
<b>Mr. Azine</b>		Aba-Owerri Expressway. 08033553009
<b>Mr. Kabiru</b>		East-West Road, Ahoda, Rivers State
<b>Mr. Yahaya</b>		Amassoma Road, Yenegoa, Bayelsa 08037376754
<b>Mr. Kenneth</b>		Amassoma Road, Yenegoa, Bayelsa
<b>Mr. Gerald Okoye</b>	Ecoplastics	Behind Dump site, Asaba-Benin Expressway, Asaba. 0803694010
<b>Mr. Abuchi</b>	Scrape Brothers	Dump site, Asaba-Benin Expressway, Asaba. 07032891856
<b>Mrs Rose</b>		Dump site, Asaba-Benin Expressway, Asaba.
<b>Aunty Stella</b>		Dump site, Asaba-Benin Expressway, Asaba.
<b>Chuks</b>		Iyara, 08035798464
<b>Mr Sadiq</b>		Naval Scrapyard, NPA Expressway, 08037266335
<b>Mrs Kamen</b>		Naval Scrapyard, NPA Expressway, 08026581804
<b>Mr. Tobenna</b>		Ochanja Market, Onitsha, 08038926587
<b>Mrs. Rhoda Onomakpome</b>		NPA Expressway, 08164006265
<b>Mama Lolo</b>		NPA Expressway, 08094540868
<b>Abu</b>		Naval Scrapyard, NPA Expressway, 08026581804
<b>Mrs. Agu</b>	Metec West Africa Limited	08070890874
<b>Mr. Charles Azubuike</b>	Asaba Aluminium Co. Ltd	KM 11, Asaba-Benin Expressway, Asaba, 08030919006; 08092296296