

## DU Social Good Project – Africa Recycling Feasibility

### **Business Concept:**

*The focus of this paper is on replicating a successful Bottle-to-Bottle recycling plant that currently exists in South Africa. We believe the best solution is to build the same plant in a central location in East Africa (i.e. Kenya) to serve as a regional solution to the processing of plastics collected across multiple East African countries including those collected in Uganda. We have become aware that the current pain point is NOT lack of collection, but more the actual process of recycling and buyer market for either plastic flake or fiber. In addition, the demand for bottle-to-bottle recycling is strong and is projected to increase as opposed to the market for other uses of recycled plastic. The global recycle market for the plastic bottle industry is poised to grow by USD 3.10 billion during 2020-2024, progressing at a CAGR of about 7% during the forecast period (Business Wire, 2020).*

Plastic waste in Africa is a problem that is not being sufficiently addressed by bottling companies and governments leading to increased landfills and unsanitary conditions. We will examine the feasibility of a new venture modeled on an existing initiative by a collaboration between Coca-Cola and the South African government. In 2015, Africa's first bottle-to-bottle PET recycling plant was opened in Wadeville, Johannesburg, South Africa. The operation is largely driven by PETCO, a company created to represent the joint effort to self-regulate post-consumer polyethylene terephthalate (PET) recycling. South Africa recycled nearly two-thirds of its plastic waste in 2018 and is the only African nation with a successful recycling model. We believe the PETCO model, with an East-African regional focus, could solve the plastic waste problem plaguing countries along the east coast. The recycling plant we are proposing could be located in Kenya or Rwanda which are both poised for new business investments.

### **The Problem:**

Africa in general does not have adequate waste management facilities. Waste is disposed of in dumps or open uncontrolled landfills that are not contained, and the waste is openly distributed into the environment. Wealthy countries have adequate waste disposal infrastructure and even though most plastic waste is not recycled it is contained from leakage into the environment. In Africa 80-90% of plastic waste is inadequately disposed of and at risk of causing environmental damage (Ritchie, 2018).

Plastic is difficult to recycle and comes in several thousand different chemical variations. All collected plastics must be sorted by the type of chemical composition and then most can be recycled but the lack

of infrastructure and logistical requirements in Africa prevents it. The costs associated with recycling plastics such as hauling, sorting, cleaning, and breakdown into flakes known as fiber is costly. All plastic recycling requires equipment that has high electrical energy cost/needs and requires adequate/reliable power sources (Guardian, 2019).

Recycled plastics (rPET) tend to follow two different supply chain paths. The fiber path includes processed plastic flakes which are shipped off of the continent to India, China and Malaysia and then used to create polyester used in clothing, linens and other fabric-type products. The bottle-to-bottle path can be a self-contained in-country option where plastic flake can be processed further and then used to create new bottles for bottling companies.

The only sub-Saharan country that has a recycling plant is South Africa and it is capable of producing recycled plastic flake for export AND for further processing into new bottles. South Africa has the capacity to collect and process large amounts of plastic due to the size of its population and cities. Countries like Rwanda, Uganda, Nairobi and Kenya would have to band together to collect enough plastic to process in a large plant. So, a regional model with a coalition of countries working together is the vision that will solve the expensive and inefficient pain points of the current plastic recycling supply chain.

### **The Market - Supply & Demand:**

The global plastic recycling market is valued at \$41.73 billion in 2018. Demand is forecasted to grow at a 6.6% compounded annual growth rate (CAGR) with respect to revenue and 8.8% increase to volume until 2027. With increasing environmental awareness by developing countries and growing environmental concerns worldwide the plastic recycling market is expected to have steady growth. The Asia-Pacific has the largest market with respect to volume of plastic produced and plastic waste. Europe is expected to be the leader in technological advances and recycling in the coming years. Increasing demand from the packaging industry and clothing industry specifically denim products along with improved plastic recycling technology has driven market growth. There are thousands of recycling companies worldwide from regional start-ups to global companies with the following being the largest contributors; KW Plastics, Kuusakoski Oy, Envision Plastics, and Plasgran, Ltd. (GlobeNewswire, 2020).

In 2020 the world is projected to produce 73.4 million metric tons of PET. This number is increasing and expected to continue increasing with the low costs of vPET production. The price of creating plastic “from scratch” or “virgin plastic” (vPET) is directly related to the price of oil. In 2019 the price of virgin plastic became cheaper to buy than recycled plastics (Plastic Expert, 2020). Of PET production approximately 30% is used to make bottles. This makes the global projected market for bottle to bottle recycling approximately 22 million metrics tons of new material this year without factoring in recycling waste. (Statista, 2016).

Data is available for 33 of the 54 African countries, estimates are made using the GDP of the country for plastic consumption. From 1990-2017 Africa imported approximately 172 million metric tons of plastics. With added components of imported products an estimated 230 million metric tons of plastic were added during the same time. Plastic production in eight African countries added 15 million metric tons from 2009-2015 (Transparency, 2020). Using the assumptions that PET bottles are approximately 30% of the above numbers and 40% waste during the recycling process would provide an estimated 1.85 million metric tons per year.

With the COVID outbreak and resulting economic impacts across the world, along with the lower cost of oil, has decreased the demand for plastic fiber. The supply chain between Africa and India, China, or Malaysia has come to a standstill, however, the bottle-to-bottle recycling demand remains constant and is projected to increase over time. An in-country recycling plant that can handle both types of plastic recycling (fiber and bottle-to-bottle) would eliminate enough costly inefficiencies related to transportation and shipping that a strong return on investment could be realized. The supply of plastics that need to be collected and recycled is plentiful and as the market demand for bottles and fiber shifts around, this plant could adjust operations accordingly. Most notably, this new plant brings a circular value chain to a region lacking self-sustainable opportunities.

#### **Financial Feasibility & Required Investment:**

Financial support will require a public and private partnership in order to be successful in development, implementation, and operation of a recycling plant. The land would need to be donated or subsidized by the local government. There is some optimism that the governments of some countries will support this project as it brings jobs, environmental stewardship, and opportunities for support services to be built around the location of the plant for the workforce to access.

The build out of the plant is projected to be \$20million USD. This is based on prior PET plant buildouts in South Africa and Mexico. Funding for the new plant development will come from a combination of private and public partnerships and is projected to take two years to complete. Once completed the B2B plant will require a minimum 20,000 tons of white or blue plastic every year. The global PET consumption by end users is 23.5 million tons however it is estimated that Rwanda, for example, has less than 10,000 tons of recycle plastic available. This requires the plant to service multiple countries to be successful which brings additional complexity to the operations. The countries that would need to participate to meet the required scale are Rwanda, Uganda, Kenya, Northern Tanzania and Nairobi. Scale is critical for success and justification of the initial upfront expense.

The multi country partnership will succeed in production of an estimated revenue for plastic recycling of \$26 million dollars annually. The proforma Income Statement projects a 16% net profit with a successful operation. This project would bring the full recycling lifecycle into the region and is a critical part of long-term success. The financials are sustainable however the political risk and need for collaboration between countries will require a concerted effort in order to succeed.

| Income Statement          |            |              | Notes                       |
|---------------------------|------------|--------------|-----------------------------|
| Revenue                   | 26,000,000 |              | 20,000 tons yearly @ .65/lb |
| COGS                      | 20,800,000 |              | 80%                         |
| Gross Profit              |            | \$ 5,200,000 |                             |
| SG&A                      | 1,040,000  |              | 20%                         |
| Net Profit                |            | \$ 4,160,000 |                             |
| Net Profit % Direct Sales |            |              | 16%                         |

**Competition:**

Using a Porter's 5 Forces analysis (see Appendix A), we have determined that the competition for a new recycling plant in east Africa can be described as follows:

1. Competitive Rivalry – Low: Bottle-to-Bottle recycling in Africa currently exists solely in South Africa. There are other countries with successful operations including a successful 10-year operation in Mexico.
2. Supplier Power – Low: Collection of plastics takes on a variety of forms from the local resident on foot to the network of mobile collection vehicles used by the Chinese. Currently, there is a surplus of plastics sitting inside collection centers with nowhere to go.

3. Buyer Power – High: The market for recycled plastic includes demand for both plastic fiber flakes used to make polyester and other fabrics, and more beverage bottles. Due to COVID, the demand for polyester has decreased significantly, however the demand for more beverage bottles remains constant.
4. Threat of Substitution – Medium: Currently, making bottles from virgin plastic which is made largely from low-price crude oil is cheaper than using recycled plastics.
5. Threat of New Entry – Low: Infrastructure challenges in East Africa are significant enough that there are few trying to open up industrial plants. Once it happens, the barriers to entry will be smaller for others.

### **Cultural, Political and Economic Factors:**

Using Ian Bremmer's guiding questions to frame the discussion about cultural, political and economic factors will help assess the factors that will affect the success of a new recycling plant. We recommend using this a guide in analyzing and determining which country/location shows the most promise. A sample of this analysis completed for Rwanda is included in Appendix E.

1. How strong are the government and rule of law?
  - a. Politics -
  - b. Economy –
2. How much social tension exists?
3. How stable are the country's geopolitical alliances?

### **Strengths, Weaknesses, Opportunities & Threats (SWOT):**

The plastic problem in Africa is significant and threatens social well-being and the environment. However, this also presents an opportunity to enable a circular economy that starts to break Africa's dependence on imported goods and services. We recommend completing a SWOT analysis for those countries most attracted to this endeavor. Appendix B is an example of a SWOT analysis completed for Rwanda.

Another significant opportunity of creating a bottle-to-bottle recycling plant and collection network is the circular economy it creates and supports (Appendix C). Recycled PET (rPET) sells for 20-30% over virgin PET. As consumers buy product in PET containers, they provide money to the bottler, who buys rPET from the recycling plant. The recycling plant buys raw materials from the collection networks and

the networks pay the consumer for the raw material. While profit margins will be taken from each transaction, the cost of good is passed through and cycles through the local economy. This impact is quantifiable and is open to funding from NGO, World Bank and FDI.

**Decision Matrix:**

Primary research will be used to generate more data to complete the decision matrix and offer a final recommendation as to the feasibility of proposed initiative. The decision matrix will use the existing South African PETCO bottle-to-bottle recycling plant and collection network as a baseline. This operation is successful and can be evaluated with accuracy. Using this information, we will compare two possible areas for implementation; Cape Town, South Africa and Kigali, Rwanda. An expanded matrix could be developed for multiple countries under consideration. The factors used to evaluate the potential of each investment opportunity are outlined in this document and include: Market Opportunity; Partner Network, Political and Economic Risks; Feasibility of the Financial model and access to Property, Plant and Equipment; strength and reach of existing competition including fiber recycling; the Collection network capacity and readiness; and ability of the locations to support logistic needs. The following table will be used to calculate the comparisons.

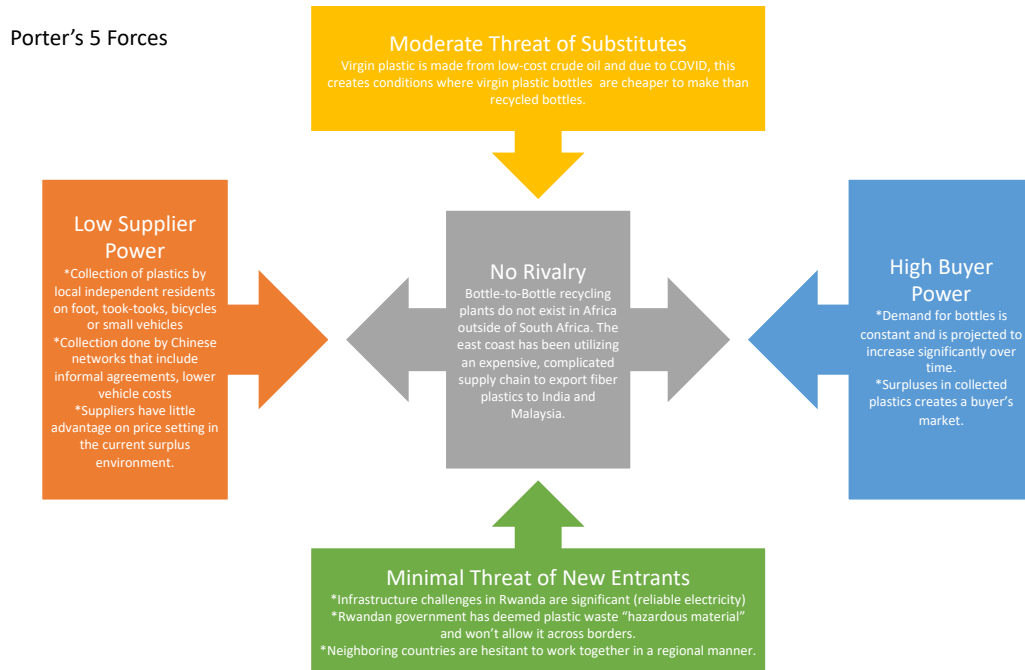
| Bottle to Bottle Recycling Criteria | Options   |           |               |       |        |       |
|-------------------------------------|-----------|-----------|---------------|-------|--------|-------|
|                                     | PetCo     |           | Cape Town, SA |       | Rwanda |       |
|                                     | Weight    | Score     | Weight        | Score | Weight | Score |
| Market Opportunity                  |           |           |               |       |        |       |
| Partner Support                     |           |           |               |       |        |       |
| Political Risks                     |           |           |               |       |        |       |
| Economic Risks                      |           |           |               |       |        |       |
| Financial Feasibility               |           |           |               |       |        |       |
| Property Plant Equip. Feasibility   |           |           |               |       |        |       |
| Competition                         |           |           |               |       |        |       |
| Collection                          |           |           |               |       |        |       |
| Logistics                           |           |           |               |       |        |       |
| <b>Total</b>                        |           |           |               |       |        |       |
|                                     | Excellent | Very Good | Good          | Fair  | Poor   | NA    |
| <b>Weighting</b>                    | 1         | 2         | 3             | 4     | 5      | 0     |

**Primary Research Needed:**

1. Current Operational Conditions – South Africa’s recycling plant is located in Johannesburg and we are already connected with a Coca-Cola representative who is responsible for sustainability in the east and south-African countries. His name is David Drew, and he can connect us to others that have the following information:

- Cost Analysis
  - Financial Sustainability
  - Operational Functionality
  - Product Opportunities
2. Requirements for Sustainability – The PETCO partnership in South Africa includes raw material producers, converters, brand owners, retailer, consumer and recyclers. Our Coca-Cola contact will help us meet other partners in these areas so we can better understand the following:
- Goals
  - Funding Requirements
  - Management /Oversight Requirements
3. Market Entry Requirements – While in country, we will meet with government officials, utility experts, and assess political interest in a regional recycling coalition with local political officials.
- Government Rules, Regulations
  - Infrastructure Needs Assessment
  - Regional Coalition Partners

## Appendix A – Porter's Five Forces





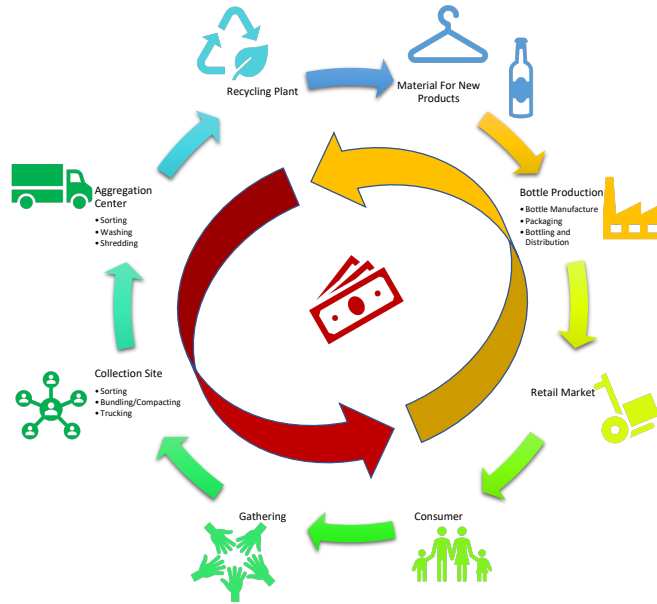
**Appendix B – SWOT Analysis**

SWOT Analysis

| Strengths   | Weaknesses  |
|---|---|
| <ul style="list-style-type: none"> <li>• Fastest growing economy in Africa – 8.6% GDP in 2018</li> <li>• Favorable monetary policy – 954.22 Franc: US Dollar</li> <li>• Ranked 38<sup>th</sup> for ease of business</li> <li>• Level 1 security risk</li> <li>• South Africa as model/partner</li> <li>• Bottle-to-Bottle demand to reach 10x today's production in 10 years</li> </ul>   | <ul style="list-style-type: none"> <li>• High cost and unreliability of energy</li> <li>• Lack of skilled workforce</li> <li>• Trade deficit is 7.8%</li> <li>• 83.3% of country debt is external</li> <li>• Low domestic savings</li> <li>• Lack of FDI due to risk factors</li> <li>• Cost of necessary equipment and transportation</li> <li>• Growth in public sector far outweighs private sector</li> </ul> |
| Opportunities   | Threats   |
| <ul style="list-style-type: none"> <li>• Small industrial sector</li> <li>• Small private sector attractive to start-ups</li> <li>• Job creation and skilled worker training and development supported by gov't, public and private sectors</li> <li>• S&amp;P rating: B+ and Moody: B2</li> <li>• Missing a circular recycling value chain</li> <li>• Regional collaboration creates political, economic and social stability</li> </ul> | <ul style="list-style-type: none"> <li>• Border conflict – Uganda, DRC, etc.</li> <li>• Environmental disaster – Mt. Nyiragongo volcano is active and threatens land and water supply</li> <li>• COVID lock-downs</li> <li>• Chinese networks</li> <li>• Boundary fees set by governments</li> <li>• Border militia activity</li> <li>• Plastic bans</li> </ul>   |

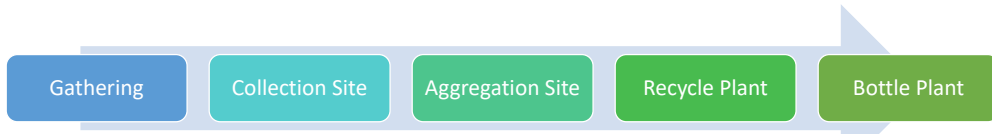
### Appendix C – Circular Economy

Bottle Product Lifecycle  
& Circular Economy



## Appendix D – Value Chain Analysis

Value Chain  
 Analysis



|                         | Gathering   | Collection Site  | Aggregation Site   | Recycle Plant  | Bottle Plant   |
|-------------------------|---|--|--|--|--|
| <b>Who?</b>             | Individuals   | Small group of employees on dedicated facility footprint.  | Large group of employees at a dedicated facility (buildings & land).   | Established corporation, international subsidiary or collation.  | Established corporation or international subsidiary.   |
| <b>Location?</b>        | Remote areas, small villages and communities that may not be road served. | Larger but still rural villages and towns that are served by road and vehicles but not Hwy.                    | Regional cities or capitals. Has good Hwy access and is a transportation hub.                                  | Capital or industrial city with reliable power supply and labor force. Access to all transportation modes.             | Capital or industrial city with reliable power supply and labor force. Access to all transportation modes.             |
| <b>How Moved?</b>       | By foot, in bags<br>By tri-cycle bike<br>Last mile transport              | By hand from gatherer to storage. Sorted and stored by hand. Moved to Aggregation Site by truck.               | By mechanical and by hand. Use of forklifts and other heavy equipment and Large trucks.                        | By forklifts and other heavy equipment or automated factory chain.   | By forklifts and other heavy equipment or automated factory chain.   |
| <b>Financial Terms?</b> | Payment on delivery from Collection Site.                                 | Payment on pickup by aggregator truck made to business.  | Payment is 30 days from delivery to recycle plant. Cashflow management required.                               | Payment is 30-90 days from delivery to bottle plant.   | Payment is 30-90 days from delivery bottler.   |
| <b>Storage?</b>         | Limited by location and collection device (bag).                          | Small to medium lot size and storage requirements based on frequency of pickup vehicle.                        | Large storage required for additional sorting and demand fluctuations. Based on Plant needs.                   | Storage facility required to supply plant for operational period with variability both raw material and finished good. | Storage facility required to supply plant for operational period with variability both raw material and finished good. |
| <b>Value Provided?</b>  | Gathers raw materials and transports last mile to collection site.        | Collects raw materials and sorts them. Compacts them for better transport. Pays Gatherers. Multiple employees. | Additional raw materials sorting and processing. Increases efficiency of shipments and lowers transport costs. | Consistent supply of raw materials in an efficient package at negotiated process for stability.                        | Offers long term stable demand for raw materials. Create job demand and growth.  |
| <b>Value Received?</b>  | Gets paid immediately and increases ability to buy food, clothing, goods  | Gets paid premium for collecting, sorting and bundling. Has dedicated relationship with buyer(s).              | Has established relationship with plant and long-term contracts with consistent pricing.                       | Has agreements in place for long term contracts at stable pricing.   | Receives quality and consistent recycled raw materials at stable price. Generates good will and received govt support. |

## Appendix E – Cultural, Political, Economic Forces in Rwanda

1. How strong are the government and rule of law?
  - a. Politics - Rwanda's government appears to be stable and managed by the rule of law with several effective initiatives to keep corruption in check. This is mainly due to the leadership of President Kagame and the plans put in place that have allowed Rwanda to grow economically. The next election would be the biggest concern politically that any business would need to consider. Rwanda has low corruption levels relative to most other African countries although not rated on the corruption index hosted by transparency.org, the efforts to recover from the genocide are well-known publicly.
  - b. Economy – In 2018, the country outperformed projections and expanded GDP by 8.6 percent to \$9.51 billion, the highest growth rate in Africa. Rwanda is very much considered an emerging economy and while inflation is low, the country must deal with very high external debt.
2. How much social tension exists?
  - a. Although the genocide in Rwanda took place 25 years ago, there are still residual social impacts today. In fact, the recent arrest of Felicien Kabuga in France has reopened some of the old wounds of the past and Rwandans are both relived and grateful for the contributions of multiple countries in the arrest (BBC, 2020).
  - b. Poverty declined from 59 to 39% between 2001 and 2014 but was almost stagnant between 2014 and 2017. The official inequality measure, the GINI index, declined from 0.52 in 2006 to 0.43 in 2017.
  - c. Corruption is low in Rwanda and Transparency International rates the country 51<sup>st</sup> out of 183 countries measured.
3. How stable are the country's geopolitical alliances?
  - a. Rwanda has had to build strong relationships with neighboring countries due to its land-locked location. Access to international trade is limited and there are infrastructure issues outside of its control.
  - b. Rwanda has grown exports of Coffee, Tea and Tin internationally and provides agricultural products to its immediate neighbors in exchange for energy imports.
  - c. Rwanda has neighbors that have political risks themselves and are open to stability issues and each country blames the other for backing rebels in their respective countries. Recently, Rwanda closed its border with Uganda citing construction projects however underlying reasons related to rebel activity are well known.

## Resources

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