

BUILDING A CIRCULAR ECONOMY IN EAST AFRICA: PLASTIC BOTTLE RECYCLING IN UGANDA

*Prepared for the Global Livingston Institute as part of
the degree requirements for a Master of Public Policy
from the Batten School at the University of Virginia*



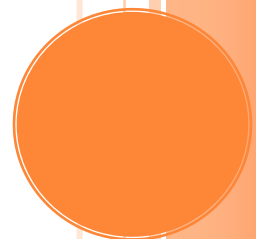
FRANK BATTEN SCHOOL
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DISCLAIMER

The author conducted this study as part of the program of professional education at the Frank Batten School of Leadership and Public Policy, University of Virginia. This paper is submitted in partial fulfillment of the course requirements for the Master of Public Policy degree. The judgments and conclusions are solely those of the author, and are not necessarily endorsed by the Batten School, by the University of Virginia, or by any other agency.

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GLOSSARY AND ACRONYMS

Carbonated Soft Drinks (CSD): A sectorized product of the beverage industry that usually contains some sort of artificial sweetener and flavoring. These beverages are typically sold in PET bottles designed for one-time usage in either a single serving or multiple serving bottle.

Circular Economy: An economic model for a product or sector that minimizes the addition of new materials and maximizes the reclamation of existing resources within that product's lifecycle. In the context of this report, a circular economic model would minimize the addition of new, virgin PET and maximize the usage of recycled PET when creating additional plastic bottles

Kampala Capital City Authority (KCCA): Legal entity established in 2011 by the national government of Uganda which is responsible for the administration and operations of the city of Kampala. It is responsible for the collection and management of municipal solid waste for the capital.

Municipal Solid Waste (MSW): Consists of all common, every day solid trash that we produce. Some of the items that commonly make up MSW include packaging, newspapers, furniture, cardboard boxes, bottles, cans, and all general trash. PET bottles are included within MSW.

Metric Ton or Tonne: Unit of measurement equivalent to 1,000 kilograms.

Polyethylene Terephthalate (PET): This is primary plastic used to create plastic bottles that are for water or carbonated soft drinks. This is also the primary plastic collected by GLI's site in Uganda.

rPET: Abbreviation of Recycled Polyethylene Terephthalate. The goal of this report is to increase the rate at which rPET is utilized within new plastic bottles.

vPET: Abbreviation of Virgin Polyethylene Terephthalate. This plastic is newly created from raw input materials that are not post-consumer plastic and is created from a chemical process that transforms crude oil into the plastic. This report hopes to minimize the creation of new vPET.

EXECUTIVE SUMMARY

Industry in Uganda consumes up to 600 metric tons of plastic waste a day and only about 6% of that waste is collected (Planet Buyback, 2021). Much of that plastic, more specifically Polyethylene Terephthalate (PET) which is the plastic used for plastic bottles, is not properly processed to be recycled nor is there a sufficient buyer market for recycled PET (rPET). The price differential between virgin PET (vPET) and rPET makes it very difficult to create a viable market for rPET and reclaimed PET generally as producers opt to continue to create new virgin PET. Newly created PET is created through a chemical process and its price point is heavily tied to the price of crude oil. As big-name brands continue to produce more vPET, more and more plastic ends up within the natural environment leading to public health and environmental concerns.

This report was prepared for a group named the Global Livingston Institute, which was founded in 2009. The institute, also referred to as GLI, is an economic development NGO that operates in Uganda. GLI currently operates a PET buyback center in Kabale, Uganda which is about 250 miles southwest from the capital city of Kampala.

This report is focused on developing a circular economic model for the PET market in Uganda. A circular economic model aims to minimize the introduction of new raw materials and to maximize the reclamation and re-usage of already existing resource inputs. The report also aims to ensure that market is built to be **resilient**, **sustainable**, and **regional**. After introducing and providing detailed insights on the problem and the consequences of uncollected PET, this APP will discuss potential solution areas and offer up 4 alternatives which will be measured against 4 criteria. The 4 alternatives are as follows:

1. *Continue status quo expansion of buyback centers across Uganda:* This alternative aims to expand upon the already existing model utilized by GLI through the continued establishment of plastic buyback centers in underserved communities throughout Uganda. These buyback centers provide opportunities for waste pickers to offload plastic from the environment back into the value chain, income opportunities for the community, as well as higher supply for recyclers.
2. *Advocate for a cap and trade regulatory scheme within the East African Community:* This alternative would aim to develop a market for vPET allowances for producers. Cap and trade regulatory frameworks leverage competitive market forces to encourage innovation towards more sustainable

plastic policies amongst brands. This framework would encompass the entirety of the economic block called the East African Community.

3. *Coordinate investment for an East African bottle to bottle plant:* This alternative aims to develop the infrastructure necessary to process post-consumer plastic bottles and prepare that rPET for reincorporation into new PET bottles. East Africa does not currently exhibit the infrastructure for this capability yet – however there is a plant in South Africa that has significantly boosted their own recycling rates for PET.
4. *Advocate for stricter extended producer responsibility (EPR) within Uganda:* This policy alternative, similarly to alternative 2, advocates for greater government regulation in the production of new vPET. It would advocate for the government of Uganda to introduce a “bottle bill” regulatory system that would largely operate like a tax on producers who continued to produce vPET products.

These alternatives will be objectively evaluated with 4 distinct criteria. The most important criteria for GLI are Effectiveness and Resiliency. The 4 criteria which these alternatives will be measured with are below:

1. Cost for GLI and its partner organizations
2. Effectiveness
3. Ease of Implementation
4. Resiliency

After analysis and estimation of all 4 alternatives against all 4 criteria, I recommend that GLI pursue Alternative 3 which is to coordinate investment for an East African bottle to bottle plant largely modeled after a plant which is successfully transforming the PET recycling sector in South Africa. It scores a the highest amongst all four alternatives within criteria 2, effectiveness, and criteria 4, resiliency. In terms of effectiveness, it is expected that this alternative could boost raw recycling of PET by as much as 10,000 tonnes at the start and up to 50,000 tonnes in the near future. This alternative also scores very high within the resiliency criteria as it provides the policy alternative that is most insulated from outside market forces or sways in the global market policies on plastics trade. GLI's role in implementing this policy alternative would largely be through the creation of a forum of stakeholders and to really sell East Africa as the next preferred location for investment in a plant modeled after PETCO South Africa. GLI occupies an excellent opportunity as a liaison between informal waste pickers, brand owners, and the recycling industry as a whole. This alternative is expected to jumpstart

investment into a regional plant which will accelerate PET recycling within the region and hopefully elevate East Africa as a global leader in recycling.

INTRODUCTION

The self-described mission of the Global Livingston Institute is to “educate students & community leaders on innovative approaches to international development and empower awareness, collaboration, conversations and personal growth.” GLI strives towards these goals through a mantra of “listen, think, act,” (GLI: “About,” 2020). In 2018, GLI opened a recycling buyback center in Kabale, Uganda with the express purpose of generating economic activity and providing jobs while also collecting, bailing, and sorting through a valuable plastic that would otherwise be wasted in a landfill or cause harm within the environment. Uganda is located in East Africa and can be seen highlighted in Figure 1 (Alvaro1984 18, 2009). The Ugandan environment is full of vast beauty as the nation ranks amongst the top 10 most biodiverse nations on the globe. More than half of all of Africa’s native birds and 13 different primate species call Uganda their home (Start Them Young, 2019).



Figure 1. Map of Uganda

Based upon World Bank data and projections, the population of Uganda will double from 46 million to over 100 million people by 2060 (*The Demographic Boom*, 2021). This population increase also has brought a growing middle class and higher levels of general consumption. Large booms in population also come with greater strain on waste management systems but also the opportunity to formalize more sustainable waste management and recycling practices.

The recycling buyback center in Kabale sustains itself by selling its plastic stock pile to another aggregation facility in the capital city of Kampala. The Kampala site, Plastics Recycling Incorporated (PRI), recently experienced a disruption in

their standard policy of selling that plastic abroad. China's enactment of the 2018 National Sword policy heavily disrupted the global recycling value chain, including in Uganda, by barring the importation of many plastics. Uganda and East Africa more broadly have the chance to adopt a circular economy for the value chain of PET. A circular economy would look like an economic cycle that minimizes the addition of new raw materials and maximizes reclamation of post-consumer material for future reuse. **The goal of this report is to suggest an effective policy alternative that builds a resilient and regional market for recycled PET in the East African region.**

PROBLEM STATEMENT

Industry in Uganda consumes up to 600 metric tons of plastic waste a day and only about 6% of that waste is collected (Planet Buyback, 2021). Much of that plastic, more specifically Polyethylene Terephthalate (PET) which is the plastic used for plastic bottles which are used for water bottles or carbonated soft drinks



Figure 2. GLI's Plastic Buyback Center

(CSD), is not properly processed to be recycled nor is there a sufficient buyer market for recycled PET (rPET). It is cheaper to create and consume new virgin PET (vPET) than to recycle and reuse already existing PET within Uganda and East Africa broadly.

The Global Livingston Institute (GLI) currently operates a PET and High-Density Polyethylene

(HDPE) plastic buyback center in Kabale, a small town about 250 miles south west of the nation's capital. The recycling center, shown in Figure 2, collects post-consumer plastic bottles in exchange for Ugandan Shillings and also is entirely run by locals living in Kabale.

BACKGROUND

Uganda currently registers one of the highest global population growth rates, clocking in at 3.3 percent population growth per year. Much of that growth is concentrated within cities as Uganda currently experiences an urbanization rate, or the average rate of change of the urban population, of about 5.7 percent. Much of that urbanization is tied to higher standards of living and consumption. Between the years of 1993 and 2013, Uganda cut the proportion of their population living under the international extreme poverty line from 68.1 percent to 34.6 percent (Oates et al., 2019). While many Ugandans still live in poverty, these rates of urbanization bring with them higher rates of consumption and therefore waste. By 2025, projections predict that Uganda will generate up to 6,300 tonnes of municipal solid waste per day (MSW) which presents a challenge to a central government that doesn't currently have a national plan for MSW gathering (Oates et al., 2019). The population of Kampala is estimated at about 1.65 million – meaning by 2025 the city will produce up to 3.8 kilograms of MSW per person per day. This would place Kampala's average production of waste higher than the average for the US (US EPA, 2017).

In 2011, the Kampala Capital City Authority (KCCA) was formed as a centralized body appointed directly by the national executive to govern the city (Ngwomoya, 2018). One of their recent responsibilities include orchestrating the take up and collection of MSW. However, as described by a representative of KCCA during a panel discussion, MSW collection is a “battle” in Kampala. Kampala currently generates up to 2,000 tonnes of waste a day and the KCCA is only able to collect about 1,300 tonnes daily (*GLI Virtual Panel*, 2020). A sizable portion, an estimated 12%, of that waste is plastic which can be recycled and reused (Oates et al., 2019).

Many developing nations on the African continent rely upon the informal waste picking and collecting sector (Andrianisa et al., 2016). These waste pickers are generally young people who are unemployed, have low levels of education, and are looking for any form of income to sustain themselves (Auler et al., 2014). They currently play an invaluable critical role within the recycling efforts of PET and other plastics. It is estimated that there are about 15 to 20 million informal waste collectors globally (Oates et al., 2019). Their role is collecting, usually by hand, recyclable plastic after it has already been consumed and dumped. They then transport this plastic either by bicycle or on foot to a collection site such as the one run by GLI, in exchange for payment (Gall et al., 2020). Collection sites, such as the one in Kabale, exist all throughout the country, however they remain relatively sparse. Once packaged and sorted at a collection site by a small group of full time employees the plastic is sent to aggregation sites and recycling plants, such as Plastic Recycling Industries (PRI), which is responsible for recycling about 18% of

all plastic waste generated in the capital city (Oates et al., 2019). After preparation of the raw material inputs of rPET the plastic can then be turned back into bottles and is ready for future use.

At the moment, Uganda and the vast majority of the world operate within a linear economic model for PET. A linear model is one where the PET is produced, consumed and then discarded. The end of life period of the product results in lost value to the economy and society (Azoulay et al., 2019). The current value chain does not include large scale reclamation or reuse of PET. Brands, such as Coca-Cola, PepsiCo, and Unilever, create the bottle. It is then purchased by a person, consumed, and then disposed of either “properly” where it makes its way to a landfill or “improperly” where it is littered. The largest and only official dump site in Kampala is the Kiteezi landfill, where a lot of this plastic ends up (*GLI Virtual Panel*, 2020). If the plastic doesn’t end up in Kiteezi, it ends up in an illegal and unofficial dump site or within the natural environment.

While the consumption chain operates in a mostly linear fashion, efforts at establishing circularity in the PET market exist within Uganda. The linear cycle can be summarized as first the initial creation of a bottle, then the consumption of that bottle, and then that bottle is either thrown out to be landfilled or makes its way to the natural environment. Figure 3 represents an ideal circular economic lifecycle of a PET bottle.

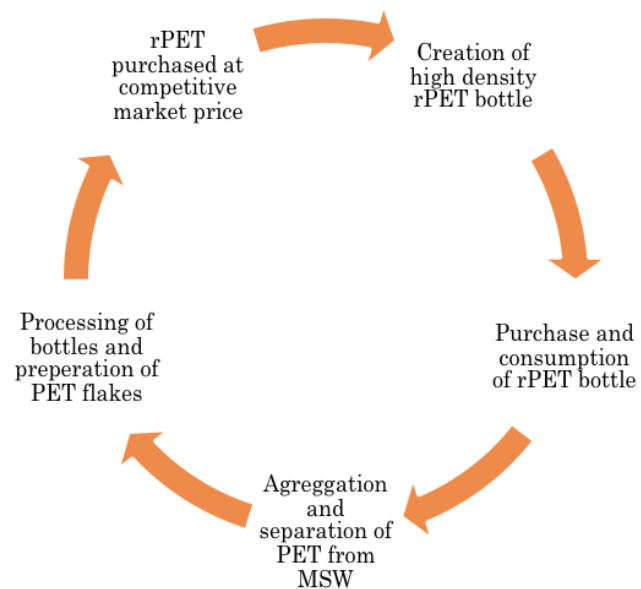


Figure 3. Circular Economic Model of PET

East Africa as a region has slowly been growing its capacity to collect, sort, and prepare plastic for recycling. However, like a large portion of the globe, it heavily relied upon exporting most of that plastic to South

East Asia and China over the past decade. In 2016, China purchased about 2/3rds of the global plastic market. On January 1st, 2018 China enacted its National Sword policy, which effectively placed an embargo on all plastic imports and completely disrupted the global recycling value chain (Crawford & Warren, 2020). After intense

fluctuations in imports for other South East Asian countries, other importing countries soon followed in China's footsteps, meaning Uganda now must look domestically or regionally for the demand of plastics. As of September 2020, GLIs collection site remained over capacity with about 1,200 tonnes of plastic and few buyers (Daniel Rubin, personal communication, September 21, 2020). PRI is also looking for other buyers of their plastic products. While this did place an initial shock to the system it provides a window of opportunity for a fully domestic or regional East African circular processing of PET. At the moment there is no supply-side obstacle, rather it remains a greater challenge to find buyers for rPET and other recycled plastics.

On top of the Chinese demand shock, the market for rPET faces another challenge. The closest and most obvious substitute for producers, vPET, remains a cheaper option than rPET. The price differential is largely due to the comparatively low price of crude oil, which is the main commodity behind the price of vPET, as well as the relatively unstable and informal value chain of rPET that currently exists (Davies et al., 2020). This is a large obstacle to creating a sustainable and stable circular economy. However, trends are currently moving in the right direction. As consumers demand more responsible behaviors from brands, producers, and companies that are responsible for a large portion of global pollution and greenhouse gas production, the demand for sustainable business practices rises. Uganda is no exception to this trend. Some countries are also now experimenting and discussing the possibility of enacting extra taxes or fines for producing vPET over rPET – effectively raising the market price of vPET for producers and allowing rPET to be a more viable competing material (Tudball, 2020). Enacting policy change to make rPET a more competitive alternative is at the heart of this APP. As rPET becomes a more desirable input for producers, the recycling value chain should become more formalized, efficient, and drive demand for higher levels of recycling.

PROBLEM CONSEQUENCES

Continued creation of PET bottles in a linear model leads to a variety of social problems and costs that are borne outside of the producers and consumers alone. There are very few known social benefits of these plastics in the environment while the costs are growing clearer as they continue to spread. Some of the costs to society from the presence of general plastic in the environment are discussed below. The consequences of plastic within the environment are wide ranging (Oa & Oa, 2019). They involve public health risks, environmental degradation, flooding, and increased microplastic consumption by wildlife, just to name a few.

Harm to natural beauty

A large portion of the plastic bottles are used once and then discarded either in landfills or end up in the natural environment. The largest landfill outside of the capital Kampala, the Kiteezi landfill, is filled with large amounts of PET plastic which contributes to groundwater pollution. GLI operates a retreat on Lake Bunyonyi in South West Uganda, which is a site praised for its natural beauty. The recent Marvel film, *Black Panther*, used spots of the lake to film as a location within the fictional African kingdom of Wakanda (Daniel Rubin, personal communication, September 21, 2020). However, this lake is slowly becoming inundated with growing levels of plastic pollution including PET bottles. Not only does this plastic detract from the natural beauty of the Ugandan environment, which is a large draw of the tourist industry in Uganda, it also severely hampers natural ecosystem cycles and harms public health. Uganda ranks amongst the top ten biodiverse countries in the world, which only heightens the consequences to the natural environment to continue plastic pollution (*Start Them Young*, 2019).

Blocked drainage systems

There are two main concerns for Ugandan society that arise from blocked drainage systems due to plastic waste. The first is that improperly disposed of plastic bags used at many general retailers, commonly known as kaveera in Uganda, can act as both repositories for rain water as well as block drainage ditches and systems. PET bottles can also fill these drainage repositories. Standing water is the preferred location for many pests and bugs to reproduce, including mosquitoes. Mosquitoes pose a particularly worrisome health risk for Uganda, which is currently holds the 3rd highest global burden of Malaria cases worldwide (*Uganda | Severe Malaria Observatory*, n.d.). Transmission peaks in the country during their rainy seasons, which occur twice a year in March to May and September to November (Yeka et al., 2012).

Increased levels of flooding due to blocked drains and canals is the second concern for Uganda stemming from the improper disposal of plastic waste. Flooding is most noticeable in the areas surrounding the capital city of Kampala. The Kampala City Capital Authority (KCCA), which was formed in 2011, has been charged with the upkeep and creation of the drainage channels to divert floods (Ngwomoya, 2018). The canals are regularly filled with plastic waste which exacerbates flooding during the rainy season. These floods cause damage to homes, businesses, and halts economic activity.

Consumption of plastics by fish and wildlife

Many of the plastics that are not disposed of properly make their way into the natural environments and water ways. When this plastic makes its way into these environments, it can pose very real and tangible risks to the health and safety of the ecosystem (Beaumont et al., 2019). Many fish, birds, livestock, and other animals consume plastic waste mistaking it for food. This can result in either the death of these fish or animals, or the later consumption of these animals by unsuspecting people that do not realize the animals are poisoned with dangerous chemicals due to the plastic consumption (Khan et al., 2018).

This is also a particularly large concern for Uganda – which comprises a geographic region that is heavily spotted with large lakes and interconnecting streams and rivers. Many people in Uganda rely on fishing not only for food, but for their livelihoods. Streams and rivers clogged with plastics put the industry and health of the aquatic environment in danger.

Incineration of plastic which disperses harmful toxins into the air

When single use plastics end up in landfills or other traditional trash processing facilities, it is not uncommon for them to be incinerated or burned. Many of these plastics release toxic chemicals into the atmosphere that are dangerous for human consumption, many of which are carcinogenic. Some of the toxic gases released from burning polyethylene plastics (PET), which are commonly burnt but could be recycled, include dioxins, furans, and mercury. On top of the toxic gases, burning PET releases harmful greenhouse gases, which contributes to accelerated global warming and climate change (Okwoko, 2020). This poses both risks for public health and long-term environmental longevity. It also fails to recognize that plastic is a commodity that can be utilized to a country's advantage.

POSSIBLE SOLUTION AREAS

The existing literature on the potential solutions to the problem of PET plastic pollution is burgeoning as essentially no modern society has successfully addressed this problem. It truly is a new field as society continues to recognize the costs of unaddressed plastic pollution and consumption. However, these solutions are centered around a relative general idea – that the solution to closing the loop of PET consumption in Uganda should be both resilient and regional, if not local. China's National Sword policy which closed their international borders to accepting any packaged plastic for recycling severely damaged the buyer market for the raw material inputs for rPET. Rather Uganda or East Africa regionally should explore options to develop a healthy, balanced, and stable market for rPET that does not rely heavily upon exports. Many of these options also look into solutions that

penalize the continued unnecessary production of vPET. Virgin PET prices and cost of production remain heavily tied to the price of crude oil and are currently a more economically viable option for producers. However, this is because they don't currently internalize the costs associated to society due to this continued production, which many of these solutions attempt to induce. At the heart of many of these solutions is also the hope that **industry and society alike will recognize that plastic is not trash – rather it is a commodity**. Many neighboring countries to Uganda, such as Rwanda, actually have bans on the trade of plastics because there is a disconnect regarding the value of that plastic. The CEO of the American Chemistry Council, Chris Jahn, stated during an Axios panel discussion on December 2, 2020 regarding the future of plastics recycling globally that we must reverse the notion that plastic is waste that cannot be recovered (Axios, 2020). Rather we must think of it as a commodity to be broken down and repurposed. That is at the heart of a circular economy and remains an important challenge for solving the PET crisis in East Africa.

Boost Local or Regional Demand for rPET

Reclaimed post-consumer PET is mainly transformed into two distinct forms. It can either be turned into plastic fiber, which is then used as a raw material for creating textiles products, or it can be turned into plastic flake which is then re-processed to be a new bottle (Davies et al., 2020). Recent forecasts for the international market for rPET projects 7% CAGR or Compound Annual Growth Rate, which is the compounding rate of return for an investment which can rise or fall over time, such as a volatile commodity. However, this demand was driven mostly by import growth in Southeast Asian countries who recently closed their borders to accepting international rPET. There remains a very shaky and volatile market for rPET within Uganda.

One factor which has contributed to driving demand is through a rise in the practice of Extended Producer Responsibility (EPR). EPR, which was recently been formally proposed through the Kenyan Ministry of Environment and Forestry, dictates that producers hold a responsibility to provide services and initiatives for end of life post-consumer recycling for the products they create (Macharia, 2020). EPR can manifest through a variety of policy tools. One of those tools is the practice of container requirements or bottle bills. This policy charges consumer a small fee for the purchase of plastic bottles and that fee would be recouped when delivering that bottle back to the producer. Multiple sources confirm that bottle bills of this sort have exhibited success at increasing rates of recycling (2012; Karidis, 2018). States within the US that had bottle bill programs recycled an average of 76% of their

bottles in comparison to 37% for the states that did not have such programs (Bailey, n.d.; Gilitz & Pat, 2006). However, when examining the data that indicates that bottle bill states do indeed recycle at higher rates than non-bottle bill states, it is important to avoid confusing correlation with causation. However, a study ran by the Minnesota Pollution Control Agency determined that a bottle bill scheme would increase recycling by an additional 107,000 tons of PET or by about 97,000 tonnes (Karidis, 2018). It is unclear how exactly a bottle bill scheme would translate to Uganda, but there is existing evidence to suggest that such mandatory programs are effective. There have been multiple American comparisons may prove dubious due to a more formalized Waste Management System and infrastructure. However, generally mandatory EPR schemes can ensure that producers and manufacturers of PET, which is a market dominated by Coca-Cola, PepsiCo, and Nestle, are required to engage in both financial and physical practices which would promote post-consumer recycling (*Extended Producer Responsibility - OECD*, n.d.).

Externality Policy Options

Another way to boost demand for rPET over vPET is to pass and implement some form of a Pigouvian Tax. Pigouvian Taxes are taxes designed and passed for the express purpose of negating a negative externality, which is a cost that is borne on third parties that are not members of the original transaction, and to “internalize” costs on the producer of the externality. An example of a Pigouvian tax would be the French tax on noise pollution that is produced by its most heavily trafficked airports (U.S et al., n.d.). There is a general expectation that taxes of this sort are effective and work to make the market more “efficient,” as they force producers to bare some of the burden of the cost to society that is associated with the continued production of vPET. In this particular case – the negative externality are all of the costs associated with the creation and failure to recycle vPET. The Italian government recently passed a tax of this sort which has taxed the creation of vPET at .45 euros a kilogram. While adoption was postponed due to coronavirus, the tax is set place to be adopted in 2021 (Tudball, 2020). A proposal in the state of California follows similarly to Italy’s initiative. The revenues from the California program would be used to promote the creation and processing of rPET (*California Plastics Tax Ballot Initiative on Track for 2022 Following Court Ruling*, n.d.). However, while this tax would almost certainly encourage the switch from vPET to rPET, society should be concerned with the possible regressive nature of this policy option. Poorer populations of Ugandans would be hit harder by the per unit tax, as it would take up more of their income in comparison to richer populations.

Another possible solution would be to create a regional cap-and-trade program to limit vPET. Cap-and-trade is a policy where a regional limit is set on the future production of vPET (*Cap and Trade Basics*, 2020) (*Reviving Cap-and-Trade to Reduce Corporate Garbage Production | Green Opinions | Green Blogs*, n.d.). Large producers of vPET then buy production allowances at auction and have the option to trade those allowances to one another. This would motivate companies to move towards rPET so they can either sell these allowances or refuse to purchase them in the first place. As the cap on vPET is diminished year after year, the demand for rPET would rise as vPET becomes more expensive due to a diminished supply. Schemes of this sort have been successful in the EU, California, and the Northeast US in decreasing carbon dioxide emissions. The Regional Greenhouse Gas Initiative, or RGGI, has successfully reduced carbon emissions in comparison to non-RGGI states since its inception (*Regional Greenhouse Gas Initiative (RGGI)*, 2020). The European Union Emissions Trading System has received criticism about its success due to its over allocation of carbon allowances and price volatility due to that over allocation (Abdel-Ati, 2020). When creating a cap and trade system, it's critical to ensure that administration and initial allocation of allowances is well rolled out to avoid any initial hiccups and that the cap is effective.

Boost and Formalize Collection and Early Separation

Another large challenge presented in regards to the high price of rPET and the lack of stable rPET prices is the lack of a formal value chain and process for separation. The current value chain starts with informal waste pickers, who are generally low-income youth that pick through landfill and other garbage sources for PET bottles. These bottles are then sold to plastic aggregation facilities and eventually processed to be exported or in the very rare case processed locally into consumer goods. However, the informal waste collection process is highly inefficient and unattractive (Katusiimeh et al., 2013). Formalizing the process could lead to greater efficiency in the process, driving down the price of rPET to be more competitive to vPET. Most formalizing processes in Africa are conducted by the private sector, such as through the efforts of Mr. Green Africa, Kudoti, and PETCO South Africa, a Coca-Cola initiative that has seen high levels of success of increase PET recycling in the region (*GLI Virtual Panel*, 2020).

The Ugandan government could engage in a few policy options to increase a more formalized collection process. First, education initiatives for Ugandan residents to engage in separation at home and the creation of a waste management system that can aggregate plastic from the get go would be beneficial. Japan engaged in such a policy and saw their recycling levels increase from 37% to 83% according to their

Plastics Management Institute (Oa & Oa, 2019). This data is coming straight from their publicly run plastic recycling organization. While Japan currently has much greater access to immediate MSW management infrastructure, a whole of government strategy and creating a government organization dedicated to proper plastic waste management is a possibility in Uganda's future. Education initiatives could also engage consumers to use these plastics less frequently and find other replacement products rather than single use plastics. A good first start is just getting across the point that plastic isn't waste – rather it is a commodity that can boost their economy. There is an estimated 2-3 billion dollar's worth of plastic locked up in Africa – being able to more formalize the process of collection would be helpful in ensuring the continent can soak up as much of that value as possible.

CRITERIA FOR EVALUATING POLICY ALTERNATIVES

These criteria will provide a baseline point of comparison against which all of the policy alternatives can be measured. The criteria are **immediate cost**, **effectiveness**, **ease of implementation**, and **resiliency**. They were selected and developed based upon the goals of GLI as well as practical constraints for the selected policy alternative.

Criterion 1: Immediate Cost

All of these alternatives cost money to both GLI *and* partner organizations. Creating a marketplace which places higher value on rPET than it does currently will require investment in a variety of kinds of infrastructure. However, I also want to show that many of these costs will be for initial up-front investments into projects or policies that will within the next 20 years, become profitable enterprises. All of the costs measured for this analysis are accounting for the first year. Costs will be estimated based upon previously collected data, previous research reports sponsored by GLI, and well-founded assumptions regarding the alternatives presented. The importance of this criteria is borne out of the immediate need to understand how much investment will be required to implement the policy option for GLI. As demand for rPET continues to increase, societies that already have infrastructure for collection, processing, and transporting these plastics in place will be rewarded. Costs will be calculated by USD but ranked within a high/medium/low scale based upon comparative costs for the alternatives.

Criterion 2: Effectiveness

The goal of this criterion is to measure the efficacy of the option at increasing the usage of rPET in new bottles in the region. It will measure effectiveness of increasing rates of recycling as well as the amount of plastic collected, processed, and sold to be used in a bottle-to-bottle format or as plastic flake, which will eventually be reused as a bottle or other consumer plastic. The estimates for effectiveness will be measured on how much estimated plastic recycling will be increased due to the implementation or pursuit of the policy alternative. This will be calculated using prior data for similar projects in comparable recycling environments and will be scored comparatively on a high/medium/low scale, which will be relative amongst all of the policy alternatives based upon their calculated recycling output. This scale will be determined through a baseline comparison of the raw amount of plastic recycled

Criterion 3: Ease of Implementation

Ease of implementation is a large concern for any organization and should especially come as a concern for a partner organization like GLI. GLI has no formal authority within this market as a producer or a large-scale recycler. Rather a lot of their power and leeway comes from their ability to leverage existing partnerships and bringing stakeholders together under a common goal of increased usage of rPET in the newly consumed plastic bottles. This will be measured on a relative high/medium/low scale, with an analysis of current partnerships and access to resources for implementation.

Criterion 4: Resiliency

GLI and its partner organization in Kampala, Plastic Recycling Incorporated (PRI) suddenly lost a large portion of their plastic export market when China and other southeast Asian countries engaged in policies that effectively embargoed PET from entering their borders. Prior to 2019, Uganda and many other nations relied upon Chinese purchasers of plastic flake to support demand for recycling. Much of the refining and actual usage of the rPET occurred overseas but this change in trade policy left GLI and PRI holding the bag with approximately 1,200 tons of plastic flake. This exposes how unstable the rPET supply chain remains in Uganda and many industry leaders are hopeful to create a regional system that can be more resilient and sustainable in the face of market shocks. The scale is as follows

1. Very Exposed to Global Market Forces
2. Somewhat Exposed to Global Market Forces
3. Somewhat Insulated from Global Market Forces
4. Very Insulated from Global Market Forces

POLICY ALTERNATIVES AND EVALUATION

This section will describe the four policy alternatives and then score them within each previously outlined criterion for evaluation. The four alternatives are **status quo**, **advocate for a cap and trade scheme**, **coordinate investment for a bottle to bottle plant**, and **advocate for stricter extended producer responsibility**. Alternative 1: Status quo would include the continued expansion of plastic buyback centers across Uganda, such as the one already operated by GLI in Kabale. Alternative 2: Advocate for a cap and trade scheme would entail that GLI act largely in a lobbying and advocacy role within the East African Community to create a regulatory framework that incorporates market incentives to innovate towards sustainability. Alternative 3: Coordinate investment for a bottle to bottle plant would entail that GLI create a forum for stakeholders to invest in a large scale recycling plant to serve the region. Alternative 4: Advocate for stricter extended producer responsibility regulation would also see GLI act in an advocacy role to encourage government regulation of brands that produce a large portion of this vPET. After a description of each alternative, that alternative will then be scored and evaluated against each criterion.

Alternative 1: Status Quo

GLI announced as recently as early February 2021 that, through a new partnership with Planet Buyback, they plan to open a new recycling plant in Lira, Uganda (*Projects – Planet Buyback*, n.d.). GLI is hopeful to open more collection and aggregation plants across Uganda. This status quo expansion would give more Ugandan waste pickers the opportunity to find work and contribute to the clean-up process as well as give GLI an even greater supply of plastic to offload and hopefully get turned back into rPET bottles. This process would inevitably lead to an expansion of the GLI network and bring in even more stakeholders – which is a generally good thing throughout this process as the market is largely complex and informal. This alternative largely targets increasing supply of post-consumer plastic for the recyclers within the market and region.

Criterion 1: Cost

At the moment, GLI operates their recycling buy back center in Kabale. Projections for the month of March 2021, the center incurred expenses of 6,600,000 UGX or approximately \$1,820. These expenses include transportation of the plastic, baler machines, wages, food for the workers, and security for the trip. The plant sold 10 tonnes of baled PET to PRI at the end of the month for 500,000 UGX per tonne, or approximately \$136 per tonne. This places GLI's revenues at \$1,370 (Danny Rubin, personal communication, March 11, 2021). Their losses for the month of March are

projected to be \$450. It is also important to note that unless something changes from the demand side, the profitability of the site is unlikely to change.

The plan for the new plant in Lira will be opened with a \$15,000 from Planet Buyback (*Projects – Planet Buyback*, n.d.). For continuity purposes, we are going to assume monthly costs of the Lira plant will be similar to the plant in Kabale and that PRI will offer a similar amount of money for plastic (500,000 UGX per tonne). Using the March data, we can extrapolate that the first years' cost is \$5,400. It is safe to assumed that the Lira plant will cost about the same. This classifies as a **low-cost** alternative.

Criterion 2: Effectiveness

The Kabale plant is currently collecting and selling about 10 tonnes of PET to PRI monthly, or about 120 tonnes a year. There is no reason to believe that the Lira plant could not be just as successful in supplying reclaimed plastic to PRI as the plant will look very similar to current efforts by GLI. This would supply an additional 100-140 tonnes of PET reclaimed from the environment each year (Danny Rubin, personal communication, March 11, 2021). This would total to be about 200-280 tonnes of collected PET. This is still a staggering amount of plastic and it would ensure the collection or nearly 300,000 kg of PET from landfills and the environment to be recycled each year. However, in comparison to the other alternatives available, this alternative scores a **low** within the Effectiveness criterion.

Criterion 3: Ease of Implementation

Alternative 1 scores a **high** level of ease of implementation for GLI. While continued growth of new buy back facilities in Uganda is not a guarantee, it is the current trajectory of the organization. In terms of timeliness, this alternative can be completed within a short time period as it is currently within the organization's plans. GLI also has current access to both the resources and partnerships necessary to complete this alternative as they already have established relationships with organizations in the recycling value chain in Uganda. GLI has proven capable at establishing new partnerships as well as successfully leaning into current ones. While hiring new employees, obtaining proper government approval, acquiesce land, and getting a new buy back center off of the ground isn't a guarantee – the barriers to entry are low.

Criterion 4: Resiliency

Alternative 1 scores a **2 (somewhat exposed to global market forces)** on the resiliency scale, meaning it isn't a totally regional option but it does not fully expose

Ugandan PET recycling to domination by the global market. While a totally insulated market for rPET isn't possible in a burgeoning economy like Uganda's, the option of continuing to grow the number of aggregation centers provides infrastructure that can be controlled domestically while also preparing for a possible increase in the demand of rPET as major brands are slowly but surely increasing the percentage of recycled PET in their bottles. This alternative would rely upon that increasing global demand as East Africa does not have the current available infrastructure for cradle to cradle bottle production.

Alternative 2: Coordinate and Advocate for a Regional Cap & Trade Within East Africa Community

A cap and trade system is designed to reduce the creation, consumption, and spread of products that have high levels of negative externalities. A negative externality is best understood to be a product or service where the consumers or producers do not bear the entirety of the costs, rather a third party also must pay a price (*How Cap and Trade Works*, n.d.). The creation and importation of vPET into the region carries high costs to the environment, public health, and general economy. Cap and trade works by creating a "market" for the continued usage of vPET by first setting a total cap on the production levels and allowing producers to trade vPET allowances. The cap is then gradually lowered year after year – driving up the price of vPET and artificially making recycled polyethylene terephthalate (rPET) a more competitive resource for creating plastic bottles. Ideally this system would be regional within East Africa, partnering with markets in Kenya, Rwanda, and Tanzania. The Global Livingston Institute (GLI) occupies a particularly unique position in the market for rPET in that they act as a partner organization for many different functional market movers. This partnership positions allows them to start a discourse and coordinate a task force to start developing the first regional cap and trade system aimed at reducing the creation or importation of vPET.

Criterion 1: Cost

Costs associated with this policy option would be through hiring a dedicated GLI staff member to focus on government relations. This staff member would be responsible for coordinating messaging, creating campaign materials to distribute to partner organizations and government personnel, as well as communicating with government personnel. They would also be tasked with finding new stakeholders that would be in favor of this policy in both the government and civil society that would be helpful in the effort to advocate for a bottle bill. The costs for this alternative largely fall upon the assumption that hiring a full-time staffer within

this field would cost approximately \$40,000 a year (*Uganda | 2020/21 Average Salary Survey*, n.d.).

Costs borne by the industry are unknown as a policy of this sort has never been enacted within the plastics industry. At the moment, all of the efforts towards increasing rPET usage within their bottles performed by private companies are voluntary. This policy would 100% require brands to invest more resources in recycling efforts and formally establish ways to increase the amount of recycled plastic in their bottles. Costs would nevertheless be high no matter what as companies would have to take hits to their profits in order to invest in technology, personnel, and infrastructure to remain compliant. The governments of the EAC would also be required to invest in regulatory frameworks and technology to ensure compliance is met. For this reason, it scores a **high** in the cost category.

Criterion 2: Effectiveness

As far as I'm aware, there are no cap and trade schemes developed anywhere else in the world that are focused on decreasing the amount of virgin PET in new bottles. However, there are cap and trade programs around the world which target carbon emissions such as the Regional Greenhouse Gas Initiative in North Eastern United States, a Chinese program targeting Green House Gases (GHG), and a European Union Emissions Trading System (EU ETS). Many of these programs are relatively new, however early signs, such as reduced greenhouse gas emissions, from RGGI states indicates that the program has been effective at reducing the amount of GHGs which are expelled into the atmosphere (*Regional Greenhouse Gas Initiative (RGGI)*, 2020). The effectiveness of a regional program in East Africa would depend upon the actual numerical "cap" of virgin PET that is set for the entire market, enforcement of the policy universally, and the ability of brands to successfully trade those virgin plastic allocations. The uncertainty that this alternative brings makes it difficult to allocate a value for the effectiveness of how many more bottles would be recycled due to this policy. However, other cap and trade schemes do generate market incentives to innovate and decrease carbon emissions. There is no reason to believe that a scheme of this sort wouldn't do the same in the market for plastic bottles. For this reason, it scores a **medium**.

Criterion 3: Ease of Implementation

Alternative 2 scores a **low** for ease of implementation. It would be relatively difficult to create a comprehensive and enforceable cap and trade program throughout the entire region for plastics. In terms of timeliness, the creation of a region wide cap and trade would take many years to coordinate and implement. Existing resource availability for this alternative would largely require GLI to

develop an advocacy and government relations office, which would also take some time. It would also require the development of new partnerships across the region broadly and outside of Uganda which places even higher barriers on implementation feasibility. While there is an existing intergovernmental organization called the East African Community (EAC) with a common market and free trade agreement, it would be difficult for GLI to coordinate this policy without an established relationship with the EAC (*East African Community*, 2019).

Criterion 4: Resiliency

This option scores a **3** for resiliency, meaning it is an alternative that would help transform the PET market to be somewhat insulated from global market forces. The regional approach of a cap and trade program would give the power back to the public institutions to shape the market of PET. It would force the brands that are creating PET bottles to compete and innovate amongst themselves in order to drive up the levels of rPET within the bottles.

Alternative 3: Coordinate Investment for an East African Bottle to Bottle PET Plant

GLI currently provides a PET collection site in Kampala, where they pay waste pickers per kilogram of PET collected. They then drive that PET 6 hours to a partner organization in Kabale, Plastic Recycling Incorporated (PRI), which then turns that plastic into flake to be shipped off to plants that can complete the recycling process. This only describes the first few steps in the “bottle to bottle” process, or the complete transformation of vPET to rPET. PETCO is the company name given to PET Recycling Company of South Africa. In 2018 alone, PETCO successfully recycled 98,000 metric tons of PET and created nearly 68,000 income opportunities for the region (“Who Is PETCO?,” n.d.). For comparisons sake, GLI’s plant has recycled about 75 metric tonnes since 2018 (*Recycling Center*, 2018). The South Africa plant is largely driven by industry leaders and financed by producers of PET. The PETCO model would require intensive infrastructure development and engagement with producers. The South African region also has successfully reached nearly to 65% recycling rates in 2017 which is more than 20 percentage points above of the rates of recycling in the US for PET (*Coca-Cola Fast-Tracks Collection and Recycling of PET Plastic Bottles across Africa*, n.d.). GLI’s role in this alternative would also be largely through advocacy, lobbying, and by creating a forum for stakeholders, such as government regulators, producers of PET, consumer groups, economic development organizations, and sustainability advocates.

Criterion 1: Cost

GLI's role within this alternative would largely be through advocacy, lobbying, and by starting the conversation with the PETCO enterprise about why East Africa and more specifically Kenya due to its geographic position, should be the next location of a bottle to bottle plant. Based upon the costs present in previous plants of this size and previous research sponsored by GLI, it would cost approximately \$20 million in up-front investment to create (Davies et al., 2020; *PET Industry Waste Management Plan - Shared Cost Plan*, 2018). For this reason, it will be the most expensive option and score a **high**. This cost would have to be largely paid for by governments and brands paying to be PETCO members. As we have seen in South Africa, a regional approach to ensuring a stable value chain can lead to a reinforcing and ever-growing market (*PETCO – the South African PET Recycling Company*, n.d.). The initial hurdle of the investment is tough to overcome; however, as the demand for rPET is projected to continue growth at 7-8% CAGR, the investment in a large plant would prove fruitful even within the first year of operation (ReportLinker, 2020).

Criterion 2: Effectiveness

The creation of a bottle-to-bottle recycling plant with the infrastructure necessary to process the region's PET would be highly effective at increasing rates of recycling. The plant created by PETCO in South Africa has increased rates of recycling at an impressive rate. In 2005, when the plant was relatively new in South Africa, the plant recycled 9,840 tonnes of PET. In 2018, that number had increased 10-fold as the plant recycled a staggering 98,649 tonnes of PET. The targeted number of collected and recycled plastics is 170,000 tonnes, which would boost South Africa's recycling rate to 70% of post-consumer PET bottles ("How Is PET Recycled?," n.d.). A similar plant in Nairobi, Kenya could easily service the processing and recycling of more than 50,000 tonnes of post-consumer PET in the future. This would be a **highly** effective alternative for increasing recycling.

Criterion 3: Ease of Implementation

Alternative 3 scores a **low** for ease of implementation. This project requires high levels of coordination and investment as well as government oversight and approval. It would also require a very high level of infrastructure development. GLI is in a good position within the market to leverage existing partnerships as well as advocate and coordinate for the necessary investment. East Africa broadly as a region is one that is experiencing large scale economic growth as well as an increasing middle class that will continue to grow their appetite for consumption, making it an ideal candidate for sustainable investment.

Criterion 4: Resiliency

Alternative 3 scores a 4 for resiliency, meaning it is very insulated from global markets. This would be the ideal policy alternative for this criterion as it would entirely allow Uganda and the East African community broadly to take a very large step towards creating a circular, cradle to cradle market for PET without reliance upon outside market forces. All of the necessary pieces of the supply chain would be “in house” within the region and would not require any assistance from any outside market players.

Alternative 4: Advocate for Stricter Extended Producer Responsibility (EPR) Requirements within Uganda

Another way to drive demand for rPET is through legally required Extended Producer Responsibility. EPR, which has recently been formally proposed through the Kenyan Ministry of Environment and Forestry, dictates that producers have a responsibility to provide services and initiatives for End of Life post-consumer recycling for the products they create (Macharia, 2020). EPR can come in a variety of policy tools. One of them is the practice of container requirements or bottle bills. A container requirement sets a standard that new plastics that are created by a producer must be recyclable. Bottle bills charges the consumer a small fee for the purchase of plastic bottles and that fee would be recouped by the consumer when delivering that bottle back to the producer. Generally mandatory EPR schemes can ensure that producers and manufacturers of PET, which is a market dominated by Coca-Cola, PepsiCo, and Nestle, are required to engage in both financial and physical practices which would promote post-consumer recycling. There is evidence to suggest that surface level commitments to EPR in sustainability efforts are not successful and consumers can differentiate and reward the difference between lip service and long term projects (Richards & Zen, 2016). GLI would act as an advocacy and lobbying organization to the Ugandan government in this capacity as well as leveraging their partnerships with Coca-Cola. The campaign for the EPR legislation would largely follow the Ugandan Guide on Effective Advocacy developed by Ministry of Finance, Planning, and Economic Development.

Criterion 1: Cost

The cost of an advocacy campaign for stricter EPR legislation in the form of a bottle bill would be very similar to the cost's accrued within Alternative 2, but rather than dedicate advocacy efforts across the entirety of the East African Community it would be through issue advocacy at the Ugandan state level. Costs associated with this policy option would be through hiring a dedicated GLI staff member to focus on government relations similarly as in Alternative 2. The cost of this staff member

would be a yearly salary of about \$40,000 (*Uganda | 2020/21 Average Salary Survey*, n.d.).

Cost to stakeholders, and more specifically brands producing PET bottles. The costs are largely borne by the brands and consumers as they are forced to charge higher prices or pay higher prices respectively for both producing bottles or not depositing the bottles properly by recycling. According to Mary Wells of the US Public Interest research group, brands do see a slight dip in sales once the policy is enacted, however the sales levels return to normal after about a year and follow along an expected growth pattern. We can assume that there is a 2-5% decrease in sales in Uganda and then a return to normal sales level after the bill is passed. As of 2018, the Ugandan bottle drink market was worth approximately 144 million USD in sales (Brendan, 2019). A 2% decrease would cost the market 2.88 million USD and a 5% decrease would cost the market 7.2 million USD.

Combined with internal GLI costs of about \$40,000 and the general costs to producers, which fall into the category of GLI partner organizations, of about \$2.88-\$7.2 million USD, the alternative would cost a total of \$2.92-\$7.24 million. For this reason, it scores a **medium**.

Criterion 2: Effectiveness

States within the US that had bottle bill programs recycled an average of 76% of their bottles in comparison to 37% for the states that did not have such programs (Bailey, n.d.) Another study by the Container Recycling Institute found similarly elevated rates as states within the US that currently have bottle bills on their books recycle, on average 60% of their PET bottles. States that do not have bottle bills recycle at far lower rates, recycling on average 24% of their plastic containers (Gilitz & Pat, 2006). As of 2006, the eleven US states that enacted bottle bills recycled more than twice as many beverage containers per capita than the 39 non-bottle bill states. Going off of the assumption that an EPR scheme could boost recycling rates by a conservative estimate of 10%, we could see an increase of about 21,000 tonnes of plastic collected per year. For this reason, it scores a **medium**.

Criterion 3: Ease of Implementation

Alternative 4 has a **medium** level ease of implementation score. Brands are voluntarily setting standards for increasing levels of rPET themselves and other nations have successfully implemented bottle bills. There will be some push back from industry in regards to the passage of bottle bills, but they have been successful in actually increasing the amount of recycling and greatly increase reclamation rates, which could prove to be helpful as demand for rPET increases over time.

Criterion 4: Resiliency

Alternative 4 scores a **2** on the resiliency scale, meaning that it is somewhat exposed to global market forces. This alternative receives this score because it is still exposing the regional market for PET to outside market shocks. It largely receives this score because this alternative doesn't necessarily guarantee a that there will be the creation of a regional circular value chain. Rather, the increased supply of available post-consumer plastics and higher rates of reclamation for PET would be used as possible supply for the projected global demand for PET as brands continue to work towards their internal goals set for rPET usage within their products.

OUTCOMES MATRIX

	Criterion 1: Cost for GLI and partners	Criterion 2: Effectiveness	Criterion 3: Ease of Implementation	Criterion 4: Resiliency
Alternative 1: Status Quo Expansion	Low (\$5,400)	Low (200-280 tonnes per year)	High	2 (Somewhat exposed to global market forces)
Alternative 2: Advocate for Cap and Trade within East Africa Community	High (Unknown)	Medium (Unknown)	Low	3 (Somewhat insulated from global market forces)
Alternative 3: Coordinate Investment for Bottle to Bottle Plant	High (\$20,000,000)	High (10,000 tonnes at the start, more than 50,000 tonnes per year in the near future)	Low	4 (Very insulated from global market forces)
Alternative 4: Advocate for Stricter EPR in Uganda	Medium (\$2,920,000- \$7,240,000)	Medium (21,000 tonnes per year)	Medium	2 (Somewhat exposed to global market forces)

Fields shaded green indicate the policy alternative that scores the highest within that criterion.

RECOMMENDATION

GLI's most important criteria are effectiveness and resiliency. It is very important to create a circular economic model that directly benefits the Ugandan community and East Africa. For GLI, the best policy alternative available is Alternative 3: Coordinate Investment for Bottle to Bottle Plant in East Africa, and more specifically in Kenya due to its physical geographic location within the region. This alternative does bear high costs and wouldn't be the easiest alternative to implement – however it would be by far the most effective and the most resilient option to weather future market disruptions in the PET market. This alternative secures the highest scores on both of those criteria. This policy will also be the most effective at driving demand for post-consumer plastic, which would help collection sites like the one in Kabale and the new one opening in Lira, sustain themselves with higher profits. PETCO Kenya already exists and receives membership payments to support smaller scale recycling efforts within that country. Contacting PETCO Kenya to start planning for a new industrial plant the size of PETCO South Africa would be the first step in this process. While the \$20 million USD price tag is high, the East African Community and brands will benefit from this initial investment in the future as consumers demand higher levels of rPET within their products.

IMPLEMENTATION CONCERNS:

Stakeholders Involved

The stakeholders in this alternative would be PETCO Kenya, brand name producers such as Coca-Cola, PepsiCo, and Unilever, governments in Kenya, recycling centers across the region such as GLI, and waste pickers who are members of the informal economic supply chain for PET. The current model which successfully erected and operated the bottle to bottle plant in South Africa is industry financed. Brands and producers of PET bottles voluntarily pay via a fee based upon how much plastic they create or use (*PETCO – the South African PET Recycling Company*, n.d.). That money then funds the continued operation of the plant, which is the role they would play in implementing a plant of this magnitude in East Africa. Successful implementation would require high levels of investment from brand owners as well as oversight from experienced recycling professionals within the PETCO network.

The role of the Kenyan government, or whatever government that would be willing to host a post-consumer bottle to bottle plants, would be to provide regulatory support by providing the proper clearances for building and operation. Other small

to mid-sized businesses such as Plastic Recycling Industries (PRI) would want to partner with PETCO Kenya to ensure that any obstacles along the supply chain are approached and tackled. This would largely look like an advisory position, assisting in the creation of stable value chain of moving plastic from consumer to recyclers.

It's also paramount that when this plant is created, the role of informal waste pickers is not overlooked. This could be a great opportunity to formalize the role they play in the supply chain by creating an administrative record of waste pickers and offering higher levels of support to them as members of the supply chain and take their perspectives into consideration. Formalized employment for waste pickers offers the chance to better integrate these workers with higher pay and employee benefits offered through the new recycling plant.

PETCO already has many informal and formal relationships with various stakeholders which they could leverage to coordinate this investment. Figure 4 provided by PETCO below illustrates their experience with various stakeholders along the recycling value chain (*PET Industry Waste Management Plan - Shared Cost Plan*, 2018). This figure does an excellent job describing all of the key stakeholders along the way that GLI should hope to reach when coordinating the necessary investment and opinions for a bottle to bottle plant in East Africa.



Figure 4. Selection of PETCO's PET Plan Interventions

Perspectives of brand stakeholders

Brand producers such as Coca-Cola, PepsiCo, and Unilever have all made promises to increase the percentage of recycled materials within all of their packaging. Coca-

Cola aims to have 25% of all packaging materials be recycled by 2025. PepsiCo is also targeting 25% along with Unilever. Nestle is even more aggressive with a target of 30% by 2025 (Staub, 2020). Despite these aggressive targets, Coca-Cola is the closest to reaching their 2025 target with about 10% of their packaging made of recycled plastics. All of these industry promises largely drives the 8% CAGR projected demand growth for rPET globally (*Recycled PET Demand Projected to Surge*, 2020). Given these stated goals and the expectations from consumers of more environmentally conscious businesses, these brands should look for opportunities to invest in infrastructure that will improve the formality of post-consumer PET supply chain. Areas of resistance would most likely come up when organizing the original investment - \$20 million is a lot of money but many of these brands are multi-billion-dollar entities. Investment in this infrastructure is in their best interest as consumers become more concerned with corporate social responsibility (Corkery, n.d.; Sustainability Is a Value That's Changing Consumer and Retailer Behavior, n.d.). However, GLI prides itself on creating new bold and creative programs and initiatives and the pursuit of an East African Bottle to Bottle plant would be a daring but fitting prescription.

A regional bottle-to-bottle plant would also fuel demand for more bottle reclamation sites like the one run by GLI. As the plant requires more post-consumer plastics, more entrepreneurs will be willing to open up recycling sites.

Steps to move the recommendation forward

The first step in this process would be to reach out to PETCO Kenya and see what their goals are for the region at the moment. How do they see the environment evolving? GLI should attempt to become a member of PETCO Kenya as a civil society, non-governmental organization partner. Contacting them and starting to build out a list of member organizations and other partners would be a great place to start understanding what level of interest exists at formally investing in infrastructure to create a bottle to bottle plant in East Africa. Establishing this initial relationship with PETCO Kenya and beginning the conversation of starting a regional bottle-to-bottle plant is a great first start to this recommendation. It would also be important to reach out to both governmental organizations within Kenya and the East African Community to start learning more about the Kenyan government's stance towards PET recycling. GLI already has some relationships with individuals within Coca-Cola. Starting conversations with those individuals would also be very valuable for moving this project forward. Future steps after these initial conversations would be to assemble an engineering and project management team. Some people to possibly reach out to within PETCO include

Recycling Program Manager Pearl Molepo, Recycling Program Officer Lugani Zwane, or Stakeholder Relations Manager Janine Osborne. While these personnel would be out of the current scope of GLI's staff, PETCO South Africa and brands working within South Africa have access to these teams. Replicating the framework that has proven to be successful within South Africa will not be an easy feat – however GLI can begin the process in East Africa to build a sustainable, resilient, and empowering circular economy for PET.

CONCLUSION

The Republic of Uganda current registers one of the highest global population growth rates at 3.3 percent population growth per year (*The Demographic Boom*, 2021). From the years 2020 to 2060, the Uganda population is expected to more than double from 46 million to over 100 million. A large chunk of that growth concentrated in the country's urban centers as Uganda currently registers the world's highest globalization rate, or the rate at which people are moving from rural centers to urban areas (*Most Urbanized Countries 2021*, n.d.). Not only is the region amongst some of the fastest swelling population centers – it is also exploding economically. East Africa is only behind Asia with GDP growth rates hovering around 6%. For comparison's sake, the US GDP grows at approximately at approximately 2.2% year over year. This booming economy and population is associated with higher levels of consumption as well as the production of municipal solid waste. Much of that waste, such as PET bottles, has the potential to find its way into the natural environment which poses health hazards as well as risks to the natural environment as a whole.

This increased rate of economic development also presents an exciting opportunity to establish sustainable practices within the region. As markets begin to realize that already existing plastic is a commodity to be leveraged in future products rather than waste that should be thrown to the wayside, investment in systems that encourage the reclamation and reincorporation of that product. The development of solutions that focus on creating a regionally resilient market for PET is at the heart of this report. The proposed solution to coordinate investment for a bottle to bottle plant to serve the region, providing economic opportunities for the region and the infrastructure necessary to develop a circular economic model for the PET value chain. This recommendation would largely model a plant in South Africa, which has already exhibited a high level of success for developing a regional solution to plastic recycling on the continent. Uganda and East Africa's broader level of growth in comparison to the rest of the globe makes it a fantastic candidate for investment in this plant now rather than later. The potential impact of this solution is high as it

could contribute to sustainable economic development, income opportunities for thousands of East Africans, and significantly increase the rate of recycling for PET within the region which could improve public health and decrease environmental degradation.

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