

Data, Technology, People and Environment

How data led to breakthrough in innovation and technology, to impact people and the environment

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Abstract

A private company has stepped up to fill the gap in waste management in Nigeria while simultaneously working to address underlying social and economic issues.

Over six tons of recyclables have been diverted from dumpsites and over 20,000 units of consumer and industrial goods such as face shields, eco-panels, and flowerpots, have been produced from collected recyclables by the GIVO Africa team. Their technology is being used in Nigeria to address both pressing and lurking social issues. GIVO Africa, a *circular economy* company, is tackling the issue of poor waste management in the country, which is leading to environmental degradation and negative health issues. By valorising waste plastic through an IT-led approach and direct customer engagement, GIVO Africa has developed a viable business that is addressing women's and youth unemployment, as well as reducing recycling illiteracy and creating added value in communities.

In this paper, we detail our firm's engagement with GIVO Africa, in which we provided data, insight, and foresight to design a waste management solution that is digitalised, scalable and that has an impact on people and the environment. We began by analysing the *problem-solution fit* to prove the existence of a problem with waste disposal, as well as developing the *value proposition* of the company's solution for stakeholders. After validation of the problem, the company built pilot community recycling centres, which are run by formerly unemployed youth and women. Our firm's next step was to analyse the *product-market fit*; the extent to which the solution satisfies a strong market need for waste disposal and employment. We tracked specific key metrics over time across all the centres. The evaluation of these metrics suggested a very strong fit and this information encouraged the company to scale its operations, establishing additional centres across the country. Our final step was conducting consumer research to define the profile of *conscious consumers* in Nigeria and their likelihood of purchasing goods manufactured from recyclables.

Introduction

Nigeria, the African country with the largest youth population, about 100 million people between the ages of 15 and 35 years old (Balogun, 2021). as of 2020 has a youth unemployment rate of about 42%, with 42 million youth unemployed (National Bureau of Statistics, 2021). This means increased levels of poverty, insecurity and uprising, as well as challenges with physical and mental health. These are some of the most pressing issues in Nigeria. However, in the background lurks climate change and its significant effects, which are exacerbating the more pressing issues. Nigeria is experiencing rising sea levels, flooding, variable rainfall, droughts, land degradation, mudslides, an increase in temperature, and loss of biodiversity, all of which are exacerbating the pressing issues of poverty, uprisings, and insecurities.



Figure 1: Rising sea levels in Lagos, Nigeria July 2020. Image by Nimi Princewill from CNN.



Figure 2: Soil degradation in Anambra, Nigeria April 2021. Image by Kelechukwu Iruoma from Premium Times.

About 126 million tons of carbon emissions were emitted in 2020 in Nigeria (Ritchie & Roser, 2020); ranking 40th in the world and 4th in Africa. The highest emissions come from the oil and gas sector, with over 115 million tons emitted in 2020 (Ritchie & Roser, 2020). Nigeria is the 11th largest oil producer in the world, with 18 pipelines and average daily production of about 1.8 million barrels (Sasu, 2022). Cement production and coal usage are also high emitters of carbon in Nigeria, emitting over 8 million and 106 thousand tons in 2020 respectively (Ritchie & Roser, 2020).

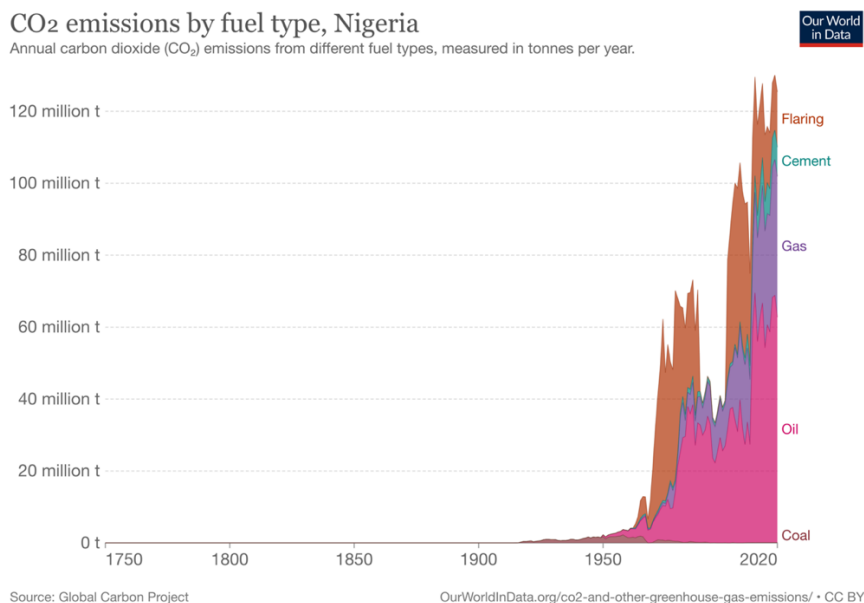


Figure 3: Carbon Emissions NG.

In addition to this, households also emit carbon: about 32 million tons of waste is generated annually, with 13% (4.2 million tons) being plastic waste (UNIDO, 2021). Yet net zero-emission is not a pressing issue in Nigeria. Nigeria's waste is disposed of indiscriminately in dumpsites, with less than 10% being collected and recycled (Keesman, 2020). The current solid waste system in Nigeria does not allow for the segregation of waste; recyclables, organic waste, and other wastes are co-mingled and deposited into dumpsites. This is mainly due to a poor national waste management system and a lacklustre national policy on reducing, reusing, and recycling.

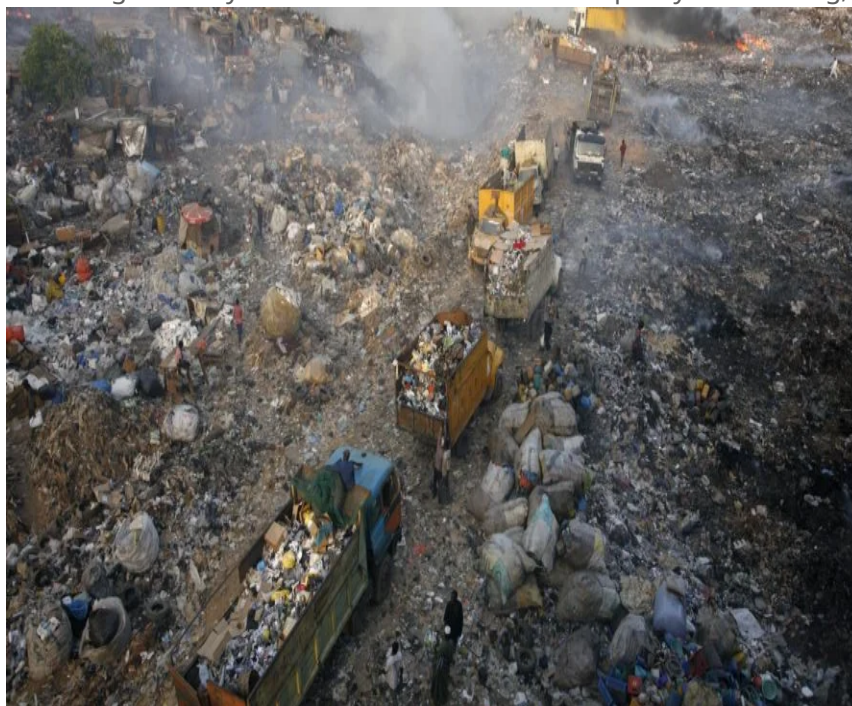


Figure 4: Olusosun dumpsite in Lagos, Nigeria April 2022.

Image by Suhaib Arogundade from BioEnergy Consult.



Figure 5: Neighbourhood gutter in Lagos, Nigeria March 2022. Image by Versa Research Team.



Figure 6: Canal in Lagos, Nigeria, March 2022. Image by Versa Research Team.

The challenge

A private company has stepped up to fill the gap on the waste management while simultaneously working to address underlying social and environmental issues through the valorisation of plastic waste. GIVO Africa, a *circular economy company*, is tackling the issue of poor waste management in the country which leads to environmental degradation and negative health issues and, through its business model, addresses women's and youth unemployment, as well as addressing recycling illiteracy and lack of awareness, in order to reduce environmental impacts and create added value in communities.

In this paper, we detail our firm's engagement with GIVO Africa where we provide data, insight, and foresight to design a solution that is digitalised, scalable and that has an impact on people and the environment.

The solution

GIVO Africa provides three main solutions which overcome some of the immediate challenges to the waste plastic recycling system:

Collections

Communities are provided with bins where post-consumption, separated recyclables will be placed. This ensures the quality of the *recyclate* that can be directly processed in *closed-loop applications*. The current waste management system contaminates the *recycling stream*; to regain some sort of value, *post-consumer recyclables* need to be cleaned. By engaging directly with communities and with segregation conducted at source, recyclables are diverted from the current system and are more valuable. The GIVO team goes to households and businesses to weigh the recyclables and passively collate quantitative data. Based on the weight of the recyclables, households and businesses are provided with reward points that can be exchanged for a cash incentive. Rewards and points can be tracked by households and communities using the GIVO app. The digital tracking of data and rewards for the plastic collected forms the basis of the GIVO Africa approach, generating reliable waste plastic data which can be trusted by regulators and commercial companies, thus eliminating risk of fraud with payments and waste plastic transactions.

GIVO centres

The collected recyclables are taken to the *internet of things*-enabled, solar-panelled, 40-foot GIVO centre, where the recyclables are separated and the type and quantity recorded, then baled, pelletised, or shredded. Each GIVO centre has a capacity of 250-300 kg of plastic recyclables daily and employs 10-15 youth and women from the community.

E-commerce

The processed recyclables are either sold to *off-takers* or taken to the GIVO factory where they are used in the production of finished or semi-finished consumer and industrial goods. These goods are sold on the GIVO Africa online store.

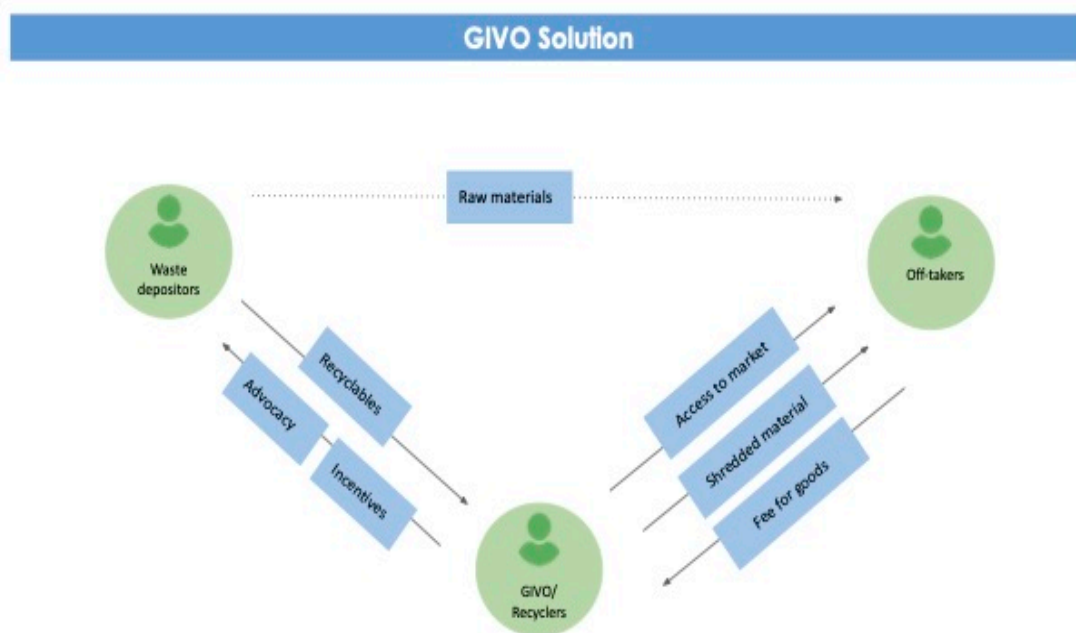


Figure 7: GIVO Africa Product. Image by GIVO Africa Team.

Problems with waste in Nigeria

As a population grows, and its income *per capita* increases, so does the level of waste generation, as waste generation is an essential behaviour for economic development and social advancement. In Nigeria, over the last 20 years, the population has grown, urbanisation has been a growing trend, and income *per capita* has increased, leading to higher consumption, which has also led to economic development, albeit with a massive increase in waste generation and pollution. Coupled with the lack of sufficient or effective waste management infrastructure and systems, Nigeria is one of the “top 20 nations that contribute 83 per cent of total volume of land-based plastic waste that end up in the oceans” (UNIDO, 2021). It is estimated that over 200,000 metric tons of plastic from Nigeria is discharged into the Atlantic Ocean annually.

With a population of over 200 million people, it is estimated that about 0.79 kg of municipal solid waste is generated daily by each Nigerian, with the majority of this waste being organic, plastic, paper, textiles, rubber, and glass (UNIDO, 2021). It is estimated that less than 20% of this municipal solid waste is collected through the formalised waste management system (which is managed by each of the 36 states in Nigeria) while the uncollected waste is dumped, burnt, buried or disposed of indiscriminately. Amongst the less than 20% collected through the formalised waste management system, the municipal solid waste is mixed waste (not separated) and, as such, ends up in the dumpsite where it is burned in a controlled manner or left to disintegrate.

Issues with recycling

About 23% of municipal solid waste is plastic waste, from which we can infer that about 36 million kg of plastic waste is generated in Nigeria daily, with less than 10% being recycled (Keesman, 2020). Unrecycled plastic waste is collected through the formal system and taken to the dumpsite or is deposited on the streets. Either way, it eventually ends up in the waterways and then the Atlantic Ocean.

The recyclable plastic waste that is collected is either picked-up by informal workers, who mostly ravage waste bins and sell the plastic waste to intermediaries, or it is collected by recycling companies licensed by State Waste Collection Authorities, through door-to-door collections, clean-up activities or dumpsite collections. However, their efforts are not scalable solutions that will increase the amount of collections and ensure post-consumption collections.

A study conducted in two counties in Washington, DC, to understand the barriers and benefits to recycling, found that there are specific barriers to recycling that can be used to develop waste management and communication initiatives (Waste Management of Washington, 2013). These barriers include:

- Uncertainty about what is recyclable or not
- The need to rinse or clean out recyclables
- Uncertainty about how to prepare recyclables
- A lack of monetary incentives to recycle
- Uncertainty about what happens to recyclables when they are picked up
- Forgetting to recycle
- Laziness and inconsistency, especially among children

Another major problem is that there are too few buyers of collected plastic waste. Plastic waste is upcycled to create recycled, semi-finished or finished products. However, given the fact that most food-and-beverage as well as manufacturing companies still use virgin plastic products, the market for off-takers is small. The circular economy sector is still in its infancy, with most of the collected plastic being exported for use, in comparison to other countries such as the United Kingdom (UK) where there are price constraints on export (in the UK recycled PET bottles are about £800 per tonne).

Research approach and findings: Problem-solution fit

Research aim

To investigate with a view to proving or disproving the existence of the problem with waste disposal, as well as develop the value proposition of the GIVO Africa's solution for stakeholders.

Research objectives

To identify the behavioural patterns amongst the stakeholders, in order to identify what solutions would work and why. To ensure GIVO Africa's solution solves the problem in a way that fits the situation of its stakeholders. And to increase the success rate of GIVO Africa's adoption by feeding into existing channels of behaviour.

Research questions

- What are the stakeholder's pain points with waste management?
- What is the frequency of this pain point?
- What is the root cause of this pain point?
- What are their triggers to act?
- What emotions are attached to this pain point?
- What are the current solutions they use to resolve this pain?
- How often do they use these solutions?
- What is the process of using these solutions?
- What are the pros and cons of these solutions?
- What are their thoughts about GIVO Africa's solution?

Sampling method

GIVO Africa provided us with two communities they were considering opening the GIVO centres in. Using a panel database, we recruited participants who are residents of these communities to join our online focus group discussions. For our in-depth interviews, we spoke to representatives of the state's waste management authority, companies that currently identify as recycling companies and off-takers of recyclables.

Methodology

Focus group discussions and in-depth interviews were the two qualitative research methodologies used. These methodologies were selected because of the exploratory nature of the objectives, requiring the ability to probe deeper and collate rich insights within a short period. Online focus groups were conducted with participants who were residents of households in two communities.

Findings

The main difficulty caused by waste management amongst households is overfilled bins, which crowd streets and roadsides. For the state's waste management authority, the main problem is that their dumpsite is becoming too full as the amount of waste diverted to dumpsites by households is too much. For recyclers, the difficulty is that there is a lack of awareness in the community on separation at source, affecting the number of recyclables received. And for off-takers, the main difficulty faced is a low quantity and quality of recyclables received.

The stated ideal solution for households to alleviate their pain is to reinforce (either with positive or negative reinforcement) proper waste management behaviour and provide educational outreach. For the state's waste management authority, they would like to introduce a Blue Bin Recycling program that creates awareness on separation at source. For recyclers and off-takers, the ideal situation is to increase educational outreach to households. About 92% of respondents are willing to become early adopters of the GIVO Africa solution.

Research approach and findings: Product-market fit

Research aim

To understand whether GIVO Africa's solution satisfies a strong market need for waste disposal and employment and to analyse the extent to which it satisfies this.

Research objectives

To ensure the actual, realised product being deployed fits within the needs of the target market. To develop fully functional systems, platforms and engagement mechanisms to incentivise recycling and collect waste. To open up pathways for sustainable incomes through waste collection and processing. To identify what percentage of users, believe the product is a "must have", based on their needs, their experience with the product, the product's value proposition and features identified during the pilot phase.

Research questions

- What is the main benefit of GIVO Africa's solution?
- What is the motivation for people to use the GIVO Africa solution?
- What alternative solutions is the GIVO Africa solution being replaced with?
- What kind of incentives would people find valuable?
- How can GIVO Africa's solution be improved to better meet their needs?
- Does the target audience consider GIVO Africa's solution a "must have"?
- How to determine the satisfaction with GIVO Africa's solution?

How to determine the likelihood of users to continue using as well as to recommend the solution?

Sampling method

GIVO Africa provided us with the contact details of all users of the GIVO Africa solution. We randomised this data-file and conducted phone surveys. The response rate was about 50%.

Methodology

A survey was the quantitative research methodology used; this methodology was selected because it provides structured, quantifiable data on attitudes, opinions, and behaviours. Surveys uncover patterns and trends in data that can be generalised to a larger population.

Findings

Participants mentioned that they benefit greatly from the incentives (cash is the preferred incentive) they receive from the programme. Without GIVO Africa's solution, most participants either do not separate their waste or, if they do separate their waste, they give the recyclables to vendors who sell home-made beverages. Increased incentives, cleaner community, added ease and convenience of disposing of waste are what motivate participants to be a part of the programme and to continue being a part of GIVO Africa's solution. And with an increased incentive, people will be motivated to keep using GIVO Africa's solution. Participants think GIVO Africa's solution

is of high quality and very important to them. They would recommend the solution to family and friends and will be disappointed if they could no longer use the solution.

Research approach and findings: Consumer research

Research aim

To define the profile of conscious consumers in Nigeria and their likelihood of purchasing semi-finished and finished goods manufactured from recyclables.

Research objectives

To determine the target group of GIVO Africa's finished products. To determine the best way to reach the target group. To identify new and existing viable and profitable products for GIVO Africa to produce. To carry out marketing research on semi-finished and finished products, particularly on pricing.

Research questions

- Do they buy products made from recyclables?
- What is the likelihood to buy specific products?
- How much would they pay for the specific products?
- What kind of products are they looking to buy?
- What is the best way to reach the target audience?

Sampling method

Using a panel database, we recruited participants who are residents of the areas where GIVO Africa's finished products are sold (market research) to complete our online survey. Once completed, we asked invited participants to join our focus group discussion. For our in-depth interviews, we spoke to potential buyers of GIVO Africa's semi-finished products.

Methodology

A mixed-methods approach including both quantitative and qualitative research methodology was used. Online focus-group discussions and telephonic in-depth interviews were selected because of the exploratory nature of the objectives and the ability to probe deeper and collate rich insights within a short period. Online surveys were selected because they provide structured, quantifiable data on attitudes, opinions, and behaviours. They uncover patterns and trends in data that can be generalised to a larger population.

Findings

The *business-to-business* (B2B) target audience includes other recycling companies, plastic fabrication companies (for sales of processed recyclables); construction, interior design companies (for semi-finished products); and foundations, aid organisations, corporate social responsibility (CSR) departments (for finished products). The *business-to-consumer* (B2C) target audience includes environmentally conscious consumers (they are looking for opportunities to impact the environment positively by buying; products bought must have an attachment to a charity); *minimalist seekers* (they are looking for ways to simplify their lives, give back, shop locally and support small businesses); *empowered activists* (they are looking for opportunities to be active in society and support other activists); and *inspired adventurers* (they are looking to try something new and choose experiences out of the ordinary). To reach the target audiences, different approaches are required. For B2B, a proposal explaining a win-win situation is essential. For B2C, social media filled with reviews and testimonials is the best way to reach them. For the B2C target audience, products must focus on meeting a real need. People's basic needs, such as food, water, clothing, shelter and security, have still not been completely met and that is where the focus should be. For the B2B target audience, bespoke product ranges work best. The need-state for the products tested is low, although interest in the product, likelihood to buy and likelihood to recommend are generally high. However, need is the driving force in this market.

Discussion

A low level of recycling is a problem for the waste authorities, who are trying to reduce the amount of waste in dumpsites. It is also a problem for recyclers and for off-takers who are looking to increase their supply in quantity and quality. Poor tracking and traceability are problems that affects recyclers and off-takers, although this is not a big problem, as they still operate domestically and on a small scale. For households, awareness, outreach and incentives are important for changing their lacklustre approach towards waste separation. And so, the desired end result for GIVO Africa is to be a circular economy company, digitalising, educating, incentivising, aggregating, processing and manufacturing products from plastic waste in Nigeria.

During the *problem-solution fit* stage, it was evident that, amongst households, the process of waste management is not a thought-out process and becomes a black box once the waste is picked up by waste management authorities. For them, their biggest problem with waste, overfilled bins, is caused by the Government and waste management authorities, because they do not pick up waste frequently. Waste is currently picked up once a week, but due to other circumstances this waiting time can be longer. The problem of overfilled bins is tied to cleanliness in their community, and cleanliness is directly tied to their impact on the environment. But they do not believe there is a relationship between overfilled bins and proper separation of waste (when plastic recyclables are separated from municipal solid waste, waste in household bins is reduced by 13%). However, they do believe that GIVO Africa's waste collection impacts the climate positively, and they want to be a part of it. The role of GIVO Africa at this point is to show how cleanliness and impact on climate starts from their households with waste separation.

As GIVO Africa's centres are now operational in communities, the perception of overfilled bins and their impact on the environment has begun to change. People are starting to see the connection between separation done at home, cleaner environments, and the impact on climate change by providing an easy and convenient way of disposing of recyclables. This is still not the main motivation or benefit however; the monetary incentives they receive from GIVO Africa remain the top reason for using the GIVO Africa's solution, followed by the job opportunities created.

Purchases of products manufactured from recycled materials, like those manufactured from virgin materials, are made based on need-state. The majority of consumers in Nigeria are still providing for their physical and safety needs. These needs, of subsidies, welfare and law enforcement, are not widely provided by the Government, and so many people must provide these needs for themselves, leaving many stuck at providing only for lower-level needs for the majority of their lives. If a product does not satisfy the basic needs of food, clean water, clothing, shelter, sleep, health, employment opportunities, resources, safety and security, all other products seem like luxuries, and people will be less likely to buy them. This makes the B2C market more difficult to serve in Nigeria. The B2B market has more liquidity and since businesses have a responsibility to show their climate change mitigation activities, is a better market for products made from recyclables.

The next steps

As GIVO Africa expands, onboards more citizens and builds more GIVO Centres, our firm has come onboard to track specific key metrics over time and evaluate their product-market fit, to ensure the product still satisfies a strong market need and to identify areas of innovation. We also use the backend operations- and profitability data collected by GIVO to aid in business intelligence and ensure all decisions are data-driven and digitally transformed. Both research and technology are being used as powerful tools for good.

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