

Benioff Ocean Initiative/Coca-Cola Foundation Project Reducing River Plastic Waste in Kenya

Year 4 (Extension) Report

This report focuses on the project progress between Jan 2023 and Jan 2024 by highlighting the key achievements, challenges and the progress made towards achieving the annual objectives of the original project as well as those specific activities funded by the extension funding granted to us.

The main objective for the project in the third year was the five specific activities planned under the auspices of the extension funding, as well as smooth operation and sustainability of the key existing project assets, including the plastic capture devices installed in dispersed locations across the River Athi and tributaries in Nairobi, the repurposing and recycling infrastructure to convert plastic wastes into saleable products, the support, training and empowerment of women's and youth groups in the riverside locations, and maintenance of the public profile and outreach function of the project.

The year 2023 was marked by new efforts to sustainably abate the river plastic pollution menace through technology innovation, community involvement and establishing sustainable recycling infrastructure that optimized resource recovery from different wastes removed from the strategic sections of river Athi and its four tributaries that flows through the densely populated informal settlements in Kenyan urban areas.

Part of this sustainability plan included moving the Chemolex facilities to a new, more affordable and purpose-built facility which should allow us to successfully maintain our equipment, store collected wastes, and remanufacture/recycle them successfully into the future.

This annual report provides an overview of the 2023 progress including notable impacts, key activities, challenges and lesson learned as well as future plans.

Key Extension Activities

1) Expansion of plastic repurposing infrastructure to produce fencing poles

As a result of the huge demand for eco-poles in Kenya, Chemolex together with Smart Village Research Group designed and fabricated a large plastic extrusion machine for making high quality fencing poles for the Kenyan market. This machine complements the existing pavement blocks making machines thereby increasing the volume of the recycled plastic wastes. The plastic extrusion machine is currently in the initial stages of performance testing where it is producing 35 fencing poles per day and has the capacity to produce 70 poles at maximum production capacity. The plastic fencing poles are desirable in the Kenyan market due to their unique and beneficial features such as durability, ease of installation, sustainability, and non-corrosive nature hence ideal for fencing in salty and harsh environment. Compared to other alternatives; the fencing poles from plastic wastes is more affordable and termite resistant thereby making it easier to maintain. The target market for the fencing poles include; construction companies in Kenya, Conservancies and ordinary Kenyans. There is considerable market interest for the fencing poles and we intend to start producing them in large scale by the start of February 2024.



Image: Production of the fencing poles by utilizing the Extrusion machine



Image: Fencing Poles from the Plastic Wastes



Image: Round Fencing Poles produced within the first week of the testing operation of the Extrusion machine.

2) Rehabilitation and Establishment of 2 Community Parks

According to the data released by the National Environmental Management Authority in 2021, 60% of the urban population lives in informal settlements along rivers such as Nairobi, Ngong, Mathare and Mbagathi. Due to the dysfunctional waste management systems in these areas, the residents dump their household wastes in illegal sites along the various rivers which then flow into river Athi and get carried to the marine environment. The physical survey and mapping of the wastes in River Athi also confirms that 99% of the plastic wastes that flows along the river comes from the illegal dump-sites that are situated within the urban river riparian ecosystem. To sustainably control plastic pollution in River Athi, Chemolex together Smart Village Research Group therefore began the process of rehabilitating and transforming these illegal dumpsites into community parks and green spaces. The transformation of the community parks was also accompanied by provision of appropriate and better alternative waste management infrastructure where the households can dispose their various wastes. Two illegal dumpsites were therefore transformed and rehabilitated into community green spaces and parks that have provided benefits such as improvement in air quality within the informal settlements, reducing noise from scavengers, and enhancing biodiversity. Additionally, local communities use green space for physical exercise, social interactions, relaxation kids playing ground and mental restoration. Currently; a total of 6 Community parks and green spaces have been established within the urban riparian informal areas which has directly benefited 400,000 residents of the informal settlements.



Image: Planting of Grass and rehabilitation of the illegal Dumpsites.



Image: Community Park that was Rehabilitated by March 2023.



Image: Dandora Community (People`s) Park Rehabilitated in 2023.

3) Community Cooker

Chemolex and Smart Village Research Group successfully designed, and constructed community cooker at Korogocho People`s Park. The community cooker is an efficient technology that transforms the organic segments of the wastes into heat energy that is currently utilized by women group at Korogocho informal settlement for operating businesses such as bakeries and eateries. The community cooker is also used by nearby preparatory school for heating warm water and preparing bread for the young kids from the informal settlements. Approximately 1.5 tons of dry organic wastes are utilized in the community cooker per day to bake bread and other products as well as prepare meals to 100 school going kids from Korogocho slum.

For the past 2 months that the community cooker has been in operation; more than 65 tons of organic and other wastes that normally end-up in landfills have been utilized in producing heat energy for purposes of baking bread and preparing meals for kids in the surrounding Korogocho slums. 15 Young women who previously did not have any source of income have been trained on culinary arts for the last 2 months and currently baking bread for purposes of selling to the nearby market. Each of the women are currently earning an average of USD\$25 per week which they use to take care of their young kids and families. Through partnership between Chemolex and the surrounding schools such as Kao La Tumaini and Haven Primary School, the community cooker is also used to prepare lunch

meals to more than 100 kids between the age of 3 years and 12 years. This has significantly improved school attendance of these kids since January 2024.



Image: Korogocho Community Cooker facility.



Image: Maureen Wanjiku who is among the Fifteen Young women who are baking bread for sale by utilizing the community cooker.



Image: Testing of the Bread Prepared by heat energy from the Community Cooker.

4) Plastic Capture Device

As part of the sustained efforts to remove the plastic wastes that already leaked into river Athi, Chemolex together with Smart Village Research Group designed and fabricated plastic capture device that was powered by solar energy. The design of the plastic capture device was inspired by the need to have an improved plastic capture device that can operate in remote off-grid strategic sections of the river. The first testing of the device was done on Korogocho site where senior government officials including the President of Kenya was invited and led the launch of the hydraulic plastic capture device. The physical and mechanical testing of the device was done from February to June 2023 where data on its operation efficiency including energy usage, cost of operations and ease of removing the captured wastes were assessed. The amounts of plastic wastes that the device traps per day was also compared to the average plastic waste flow rate in that particular section of the river. As per the data collected and assessment done on the plastic capture device, the plastic capture device was transferred further downstream in off-grid where it continues to trap and remove plastic wastes flowing from the lower sections of River Athi-Sabaki. The total amount of the plastic wastes trapped by the device between June to December is 48,000 kilogram dry weight.



Image: Launching of the Plastic Capture Device by the President in February 20

5) Supply of the Pavement Blocks to Daraja Academy

As part of the deliverables in the supplementary proposal submitted to. Benioff Science Laboratory, Chemolex delivered the first batch of 16,200 pieces of pavement blocks to Daraja Academy. This delivery helped Chemolex to pilot and test the production of colored pavement blocks which currently has huge demand in the Kenyan market. The last of the pavement blocks will be delivered to Daraja Academy by June 2024.



Image: Pavement Blocks Supplied to Daraja Academy

Challenges and Future Plans

The main challenge during 2023 was the fluctuating exchange rates occasioned by the devaluation of the Kenyan shillings. This therefore means that the cost of materials such as steel other construction materials increased by 30% which significantly affected the project delivery. The currency exchange fluctuation also affected the importation and supply of hydraulic systems which are very essential in the fabrication of extrusion machines for the production of the fencing poles.

The major plan for 2024 is to improve on the recycling infrastructure through renovation and performance improvement of key machines such as fencing poles extrusion bore, densification machine and moulding machine. This will significantly improve the amount of viable products from the recycling systems hence the ability to meet the huge demand for the fencing poles and construction blocks. The revamping of the recycling infrastructure will be accompanied by improved marketing and product placements to achieve the competitive sales targets and ensure enough revenue for expansion of the project to other countries in Africa.

Key Performance Metrics Evaluation

Broad Impact Category	Indicator	Yr 3 actuals	Year 3 Achievement
Environmental	1. Plastics and other organic wastes captured in Nairobi-Athi river system	2022: 1000 tonnes collected; dry weight 560 tonnes	The total amount of wet weight of wastes trapped and removed from the 11 sites is 1185 tons. The dry plastic wastes are 662 tons. This is a record collection, demonstrating a continued positive trajectory..
Economic	2. Creation of direct employment opportunities	2022: 1325 direct employment opportunities	A total of 1455 direct employment opportunities to community members in waste collection sites, recycling facility, community cooker, and the administration of the project. The people currently earn an average of USD\$ 235 per month.
Social	3. Creation of awareness on waste management and proper recycling techniques	4.1. 10,000 participants in outreach and awareness programs by the end of year 1 4.2. 30,000 youths and school going children sensitized on proper waste management by the end of year 2 4.3 Further 100,000 people sensitized by social media and other indirect methods	We conducted 10 community outreach programs with attendance of at-least 120 for each event. The total number of attendance for all the outreach programs therefore was 1250 people in year 3 The schools outreach programme was paused during the COVID pandemic. Since restrictions have been lifted, we have engaged with more than 7,000 school children, but it has been challenging to catch up with the original metric. Additionally, 200,000 people were engaged through social media platforms.

Socio-economic	4 Creation of waste management social enterprises	2020-22: total number of social enterprises (including youth and community groups) created within the three years to be 250.	In 2023, 6 youth groups were trained and empowered to start social enterprise within the waste management sector. This brought the total number of social enterprises created within the four years to be 256.
Environmental	5. Resource conservation as a result of waste recycling	2022: 55 tons of pavement blocks were produced and sold per month from the recycling facility	In 2023, 406 tons of pavement blocks were produced and sold per month from the recycling facility, demonstrating the significant scaling achievable now that quality and manufacturing challenges have been addressed.
Economic	6. Revenue generation from collected waste recycling	2022: \$24,000 generated through sales of pavement blocks.	In 2023; we generated a total of USD \$ 45,000 through sale of pavement blocks from the plastic wastes removed from different river sections.