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

Year 3 Report

This report focuses on the project progress between Jan 2022 and Jan 2023 by highlighting the key achievements, challenges and the progress made towards achieving the annual objectives. The main objective for the project in the third year was to ensure sustainability of the key project units such as; maintenance and operation of the 10 plastic capture devices installed in dispersed locations across river athi. To make the project more sustainable; Chemolex Company established an elaborate recycling infrastructure that converted 264 tons of plastic wastes into pavement blocks. 73% of these pavement blocks were sold within the Kenyan market while 27% were utilized to pave footpaths and walkways within the 3 community parks constructed in 2022. Within this period; Chemolex also trained and empowered 15 women and youth groups by assisting them to start sustainable economic activities that can sustain them beyond the project duration. Through the income generated from these economic activities, these community groups are able to operate the devices, manage the riparian ecosystem and improve the scope of their impacts.

The main challenge for the project in the third year was political interference especially when various elected leaders within the riparian community colluded with youths to vandalize the 2 plastic capture devices. Devastating weather conditions such as flooding also affected the operations of 4 devices installed along River Athi and its tributaries.

The Key lesson learnt for this project in the third year is the importance of developing an appropriate infrastructure for optimizing the resources and income that can be generated from the plastic and other wastes removed from the rivers. Chemolex Company also noted the importance of community project buy-in and collaborating with community based organizations for the management of plastic capture devices as well as in cleaning, drying and segregating wastes from the river sections.

Key Activities

1) Monitoring, Operation and Repair of the Plastic Capture Devices

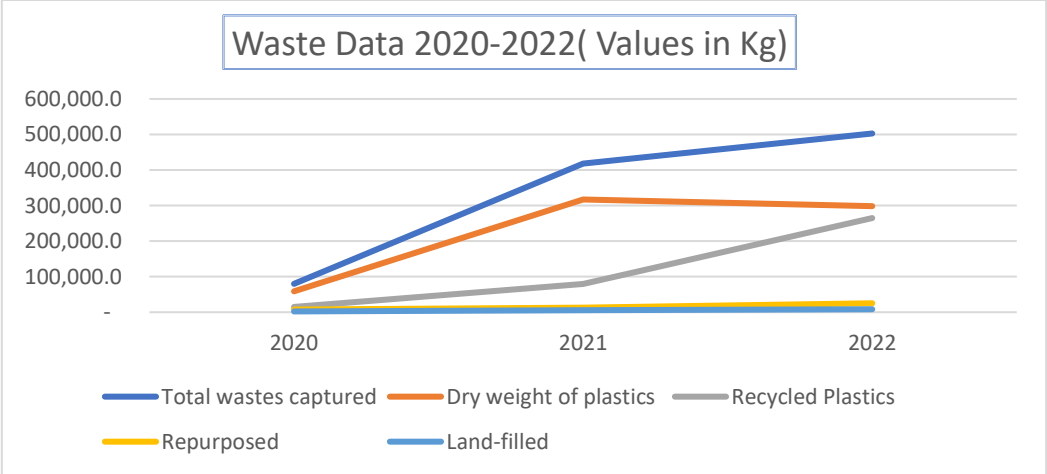
In the first and second year of the operation, Chemolex company focused on designing and installing 10 plastic capture devices. The main focus in the third year was therefore performance monitoring, as well as continuous research and development. Between January 2022 to June 2022, the following data were recorded;

- ✓ Daily dry wet weight of the wastes (plastic and non-plastics) trapped and captured by each device
- ✓ The amount of power consumed by each device
- ✓ The time taken to trap and remove a given amount of plastic and other wastes by each device
- ✓ The plastic flow rate along the river sections
- ✓ The daily segregation of different types of plastic polymer wastes captured trapped and removed by each device.
- ✓ The socio-economic impacts metrics by each of the device operated by women and youths' groups within the riparian community

Based on the data and performance metrics recorded for the first two quarter of 2023, Chemolex organization in collaboration with Smart Village Research Group designed and fabricated an improved plastic capture device that utilizes the hydraulic systems and can be powered by an innovative mobile

mini-grid Technology. The design, development and fabrication of the innovative and improved plastic capture device was due to the data driven conclusion that unreliable power supply especially in remote sections of River Athi is a major hindrance to the deployment of the plastic capture device in the downstream sections of the river. The physical testing of the performance of the solar powered plastic capture devices was undertaken from November 2022 to February 2023 where daily data and performance metrics were recorded and analysed by the engineering team. Based on the findings from the 3 months physical testing, the solar powered plastic capture device is currently undergoing modification and performance improvement after-which it will be deployed to the further downstream along R. Athi to trap and capture 100 tons of plastics wastes that currently flows into the Indian Ocean on a monthly basis.

Image 1: Testing of the Solar Powered Plastic Capture Device



Data on the amount of plastics and other wastes captured from 2020-2022

2) Recycling and Repurposing of wastes

Chemolex Company Limited utilized the first quarter of 2022 to fabricate more efficient recycling machines for purposes of recycling 80% of the plastic wastes removed from the different sections of R Athi and its tributaries. Some of the machines that were fabricated within this period include;

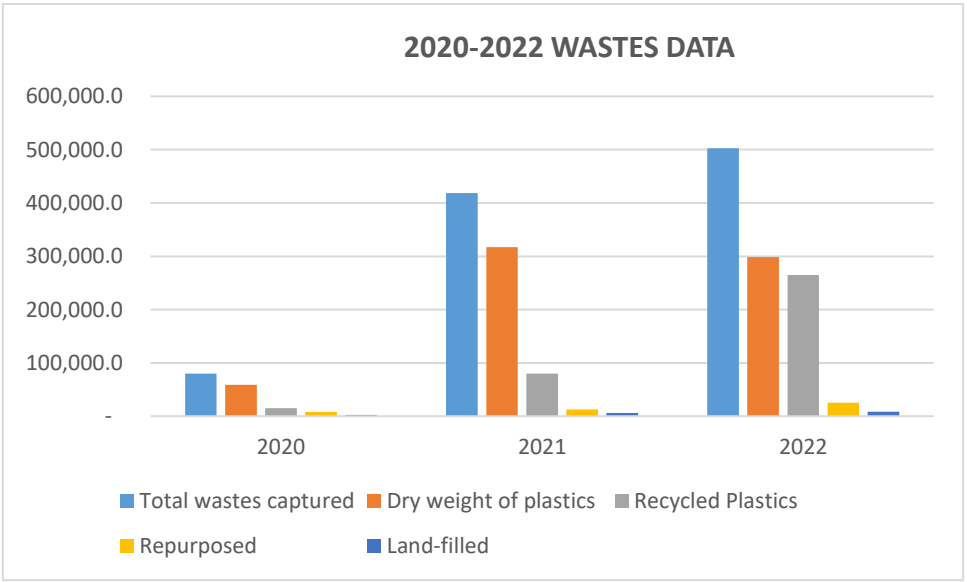
- ✓ three-fold hydraulic press which consist of three moulds hence capable of producing 3 bricks at a given time. This three-fold hydraulic press increased the production of the pavement blocks from 256 per day to 850 per day.
- ✓ Chemolex organization also modified the densification machine by introducing carbon fibres and LPG gas heating systems instead of electric coils. This modification significantly reduced the cost of energy needed for recycling plastic wastes by 65% which reduced the operational costs of the entire recycling process.
- ✓ The organization also redesigned and improved its plastic crashing machine by introducing a 65 HP geared motor that increased the capacity of the shredder to crash up to 7 tons of plastic wastes per day. This therefore enabled Chemolex Company to process more than 5 tons of plastic wastes making the recycling process more economically viable.

In the year 2022; Chemolex organization recycled 264 tons of plastic wastes into pavement blocks which was sold to the local Kenyan market. By training and collaborating with women and youth groups; 25 tons of plastic wastes were repurposed into artistic products and decorations that have been sold to both the local and international markets. As a result of the huge socio-economic impacts of the recycling and repurposing project in 2022, Chemolex will develop an online market-place where more than 100 women and youth`s groups will be able to display and sell different products made from the plastic polymer wastes. This online market-place will provide huge opportunities to community based organizations in Kenya to showcase their products and skills while also raising awareness of integrated solid wastes management at the household levels.

Image 2: A View of a Section of the Three Fold Hydraulic Press Machine

Image 3: Pavement Blocks from Plastic Waste used in Paving Foot-paths and Walkways

The below is a breakdown of the total plastic wastes removed from the river, total recycled and total repurposed for the year 2020-2022.



Data on 2020-2022 Wastes Captured by Plastic Capture Devices in Kg.

	Total wastes captured	Dry weight of plastics	Recycled Plastics	Repurposed Plastics	Land-filled
2022	**502,794.0**	**298,471.7**	**264,910.8**	**25,244.2**	**8,452.6**

Table 1: Wastes Removed from river sections in 2022 in Kg. (Yr. 3)

3) Communication and Outreach

For the past two years of project implementation; Chemolex organization noted that a successful and sustainable plastic wastes managed can only be realized through significant community buy-in and active participation of the urban riparian households. Active community participation is however encumbered by barriers such as limited knowledge and awareness, weak social norms, lack of responsibility and lack of rewards or incentives that encourage proper wastes management at the household levels. In view of these barriers, Chemolex company in collaboration with Smart Village Research Group implemented myriad of communication and outreach strategies including;

- ✓ Involving the community members in the key decisions making process. Chemolex Company conducted 15 open forums and town hall sessions where community members in every project site were invited to deliberate on key issues among them; the importance of the project in enhancing positive behavioural change towards integrated solid wastes management, the social impacts of the projects and the role of the community in the success of the project.
- ✓ School education and awareness creation events in primary, secondary and even tertiary institutions where school going kids participated in community clean-ups and were also trained on the different types of plastic wastes, effective waste management strategies, and the dangers of the plastic wastes to the marine ecosystem. The students also learnt the importance of adopting the 3Rs (Reduce, Reuse and Recycle) in managing plastic wastes and ensuring circular economy.
- ✓ Community reward system where we established 40 additional strategic waste collection points within informal settlements in major towns in Kenya. Through these wastes collection points; community members can deliver their household wastes and get redeemable points for each kilogram of plastic wastes brought to the collection centre. From the collection centres, the wastes are then transported to the recycling facility where they can be segregated and utilized for purposes of producing pavement blocks as well as repurposed into decorations and other useful products. The redeemable points can be used by the households for shopping which motivates to bring more wastes and eliminate the disposal of plastic and other wastes in the river sections.
- ✓ Chemolex conducted 5 sets of public surveys and prompts which enabled the organization to monitor the progress of its community sensitization programs as well as the perception of the community members in key organization`s programs. These surveys were critical in socio-economic impact assessment as well as in measuring the performance in relation to the annual key performance metrics for this project. The surveys also provided platform for Chemolex staffs to personally interact and sensitize the individual community members on plastic pollution and the role of the 3Rs (Reduce, Reuse and Recycle) in managing plastic wastes as well as other solid wastes within the low income settings in Kenya.

- ✓ Community goal setting: Based on the data on the plastic wastes generated from each households and each riparian community within the urban informal settlements; Chemolex organization was able to set targets and goals on the amount of wastes to be delivered to each strategic wastes collections points within the community every week and every month. This goal setting strategy was essential in mapping the plastic wastes from each households and thereby determining the wastes management rate and the amount of wastes that remain uncollected. Through this strategy; the communities within the informal settlements in Nairobi and Machakos achieved a waste collection of 85% and 95% for plastic wastes. This is a significant increase from the 32% for all wastes and 23% for plastic wastes before the start of this project.
- ✓ Online communication: Through consistent online communication; Chemolex company managed to heightened the positive behavioural change of more than one hundred thousand Kenyans that interacted with them in its 4 online platform. Chemolex also leveraged on the online platform to upskill 20 influencers and digital activists in plastic wastes communication and sensitization of the community for environmentally friendly policies and positive change among the Kenyan citizens. Through these platforms; Chemolex company was also able to run 15 sessions of online educational tutorials where they interacted with youths and engaged with them on effective strategies of plastic wastes management as well as the circular economy.

Image: Involving the Community Leaders in Key Project Decisions

Image: Community Leaders Participating in Surveys Organized by Chemolex Company

Image: School-Going Kids Training Session

Image: Senior High School Students Education Program

Image: Joint School Outreach Program with Smart Village Research Group Staffs

Image: Transporting Plastic wastes from one of the strategic waste collection centre

Image: Chemolex Staff in Exhibition Forum

Image: Involving Community Members in Environmental Clean-up

4) Training of community based organizations

Chemolex company conducted elaborate training to 15 community based organizations within the urban river riparian ecosystem. The practical training provided insights and knowledge for successful management of various ventures by these women and youth groups. After the training, these women and youths were helped to register their organizations then supported to acquire basic tools required for efficient management of their enterprises.

Image: Hydroponic System managed by one of the community organization supported by Chemolex through the project

Image: Vegetable and Fruit Seedling Production by one of the community based organization

Key Performance Metrics Evaluation

Broad Impact Category	Indicator	Target	Year 3 Achievement
Environmental	1. Plastics and other organic wastes captured in Nairobi-Athi river system	1.1. In Y1 - 3,120 tons of waste captured 1.2. In Y2 - 13920 tons of waste captured 1.3. In Y3 - 14440 tons of waste captured	The total amount of wet weight wastes removed the 10 river sections is 1000 tons. The dry weight of the plastic wastes is 560 tons. This is more than was collected in any previous year, demonstrating a positive trajectory. The shortfall compared to the original targets is due to a combination of over-ambitious target-setting, and also the success of the recycling and community sensitisation programmes.

Environmental	2. Increase in neighbourhood recycling in areas bordering Nairobi and Athi rivers	2.1 100 neighborhood recycling points created by first year project 2.2. 600 households recycle plastics by the end of the third year of the operation 2.3. 200 tons/month of direct recycling collected by these households in year 3	**15** additional recycling points created in Kibera slums along River Nairobi; **10** Recycling points created in Mathari along River Mathari; **6** Recycling Points created in Kariobangi South along River Ngong; **10** Recycling Points Created in Tassia along River Ngong; **12** Recycling sites created in Baba Dogo; **18 Recycling** Points Created in Ngomongo; **11** Recycling Points created in Kariadudu Total number of recycling and waste collection points created: **81 additional centres in the Urban riparian settlements.** Chemolex currently receives 158 tons of plastic wastes from these additional strategic collection/recycling points per month (in addition to the previous amount of up to 250t/month at the old sites)
Economic	3. Creation of direct employment opportunities	3.1. Create 150 direct employment opportunities in Yr1 3.2. generated up to 200 direct employment positions ourselves and in subcontractors by end of Yr3	**Direct employment created by the Project in 2022** 1. 10 women at the Chemolex recycling and sorting facility 2. 5 youths in the plastic recycling facility 3. 50 women in plastic wastes repurposing 4. 13 youths and women groups (100 youths and 160 women directly engaged in device operations and maintenance) 5. 1000 community members involved in managing strategic wastes collection points within the community **Total: 1325** direct employment opportunities created in the third year through the project. These people currently earn an average income of up to USD$250 per month
Social	4. 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	5 Creation of waste management social enterprises	5.1. 100 community and youth groups trained in social enterprise opportunities in year 1 5.2. 300 youth groups trained by the end of year 3 5.3. By the end of the 3 years, 200 waste recycling projects will have been established by these groups	In 2022(third year), 10 further youth groups were trained and empowered to start social enterprise within the waste management sector. This brought the total number of social enterprises (including youth and community groups) created within the three years to be 250.
Environmental	6. Resource conservation as a result of waste recycling	6.1 1000 tonnes/month of product sold/produced from collected wastes by project end 6.2 1000 tonnes/month of natural resources (eg wood, charcoal) saved as a result of using recycled product	In 2022, 55 tons of pavement blocks were produced and sold per month from the recycling facility. The difference in quantity from metrics is connected with the over-ambitious target-setting in metric #1 above.
Economic	7. Revenue generation from collected waste recycling	7.1 $40,000/month sales figures from waste products by project end	The total revenue generated per month through the sales of pavement blocks was an encouraging USD $ 2100. Differences from targets are, as above, connected with the ambitious target-setting in #1