aviral
Reducing Plastic Waste in the Ganga

AVIRAL PLASTIC WASTE INNOVATION CHALLENGE

Reducing Plastic Waste in the Ganga

Compendium of 25 innovative businesses to showcase sustainable and replicable plastic waste management solutions

Powered by : ALLIANCE TO END PLASTIC WASTE

Implemented by: giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

In cooperation with:

CLIMATE COLLECTIVE

नगर निगम ऋषिकेश

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This compendium is based on the information collected from the selected top 25 businesses from the Aviral Plastic Waste Innovation Challenge. This information has been collected through the course of the Challenge through the channels of application form submission, pitch decks submission and additional information submitted for the purpose of providing visibility to the innovative plastic waste management solutions and selection of winners. The showcases presented are being published and circulated after taking each business's consent. Following GDPR regulations, written consent to collect and use data has been granted by the participating business at two stages: through the data protection statement in accordance with the GDPR as a participating condition in the Aviral Plastic Waste Innovation Challenge stated during the announcement of the challenge; and through a second written consent form for publishing this compendium.

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Contents

01. INTRODUCTION TO AVIRAL-REDUCING PLASTIC WASTE IN THE GANGA

1.1 What is Aviral?

Aviral - Reducing Plastic Waste in the Ganga is a project implemented by the German development agency GIZ and funded by the Alliance with the objective to reduce plastic waste entering the environment. The pilot project is developing sustainable and replicable plastic waste management solutions and demonstrating best practice examples through capacity enhancement activities at the local level. The initiative is building on the existing flagship programs of the National Mission for Clean Ganga (Namami Gange) and the Clean India Mission (Swachh Bharat Mission).

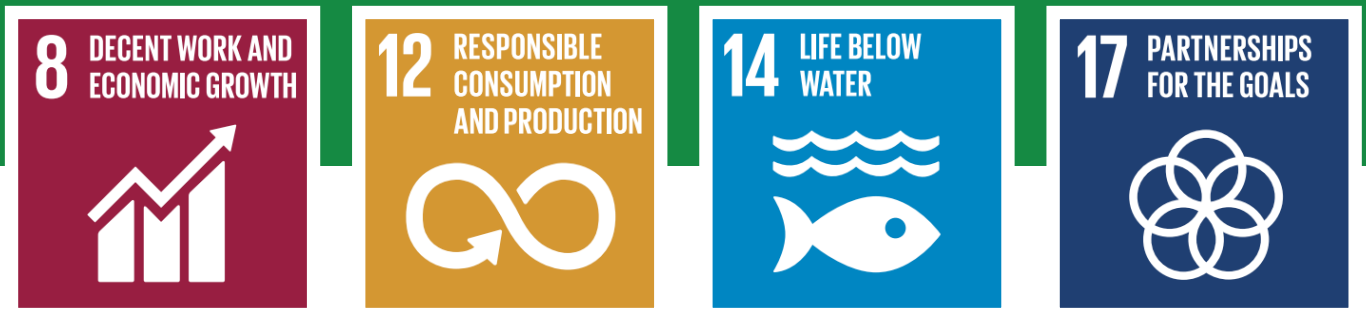
1.2 Why Aviral?

Aviral - the Hindi term for "continuous" - underlines the vision to establish a circular system for plastics and to regenerate natural habitats. The ever-increasing plastic waste and pollution threatens human health, wildlife, and biodiversity across the planet. Particularly cities face the challenge of managing the growing plastic waste generation and mounting landfills, often without harnessing the values and resources to their full extent. By supporting cities such as Haridwar and Rishikesh in strengthening sustainable plastic waste management practices, Aviral seeks to promote a new approach to plastics and to prevent riverine and marine litter, thus ensuring the continuous flow of the river Ganga.

1.3 What Aviral does:

Aviral works hand in hand with local stakeholders from Haridwar and Rishikesh Municipal Corporation while it is embedded in the broader plastic waste management ecosystem, collaborating with et al. the private sector, informal waste workers, schools, and local NGOs.

Aviral focuses on the following Sustainable Development Goals:



02. AVIRAL PLASTIC WASTE INNOVATION CHALLENGE IN A NUTSHELL

2.1 About the Aviral Plastic Waste Innovation Challenge:

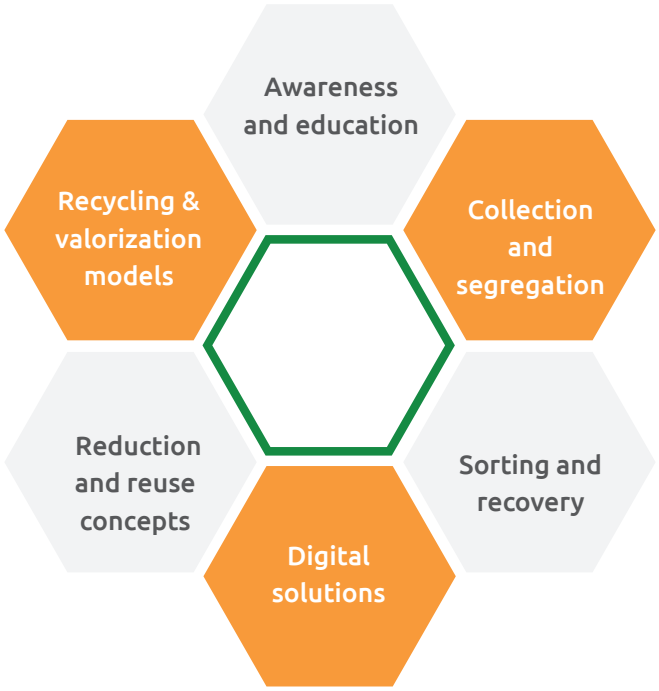
Aviral - the Hindi term for "continuous" - underlines the vision to establish a circular system for plastics and to regenerate natural habitats. The ever-increasing plastic waste and pollution threaten human health, wildlife, and biodiversity across the planet. Particularly cities face the challenge of managing the growing plastic waste generation and mounting landfills, often without harnessing the values and resources to their full extent. By supporting cities such as Haridwar and Rishikesh in strengthening sustainable plastic waste management practices, Aviral seeks to promote a new approach to plastics and to prevent riverine and marine litter, thus ensuring the continuous flow of the river Ganga.

2.2 Format of the challenge:

We conducted and accepted applications from around the globe for solutions that

- Create added value and improve the plastic waste value chain.
- Pertain to plastic waste to address the tourist population.

We reached out to and accepted applications for innovative technology and business solutions in plastic waste management in the fields of:



2.3 Process followed during the challenge:

Phase 1: Application Phase
(5th October 2020 to 29th November 2020)

We invited innovative business solutions from around the globe that have been in existence for at least 6 months as a legal entity and were at the technology readiness level of at least 5.

Subphase 1.1: Screening of applications
(29th November to 15th December 2020)

46 businesses were shortlisted based on screening criteria.

Subphase 1.2: Scoring of applications
(15th December 2020 to 15th January 2021)

25 businesses were selected as finalists and accepted into the pitch phase.

Phase 2: Pitch Phase
(15th January 2021 to 25th January 2021)

The selected top 25 businesses submitted pitch decks in a defined format.

Subphase 1.2: Scoring of applications
(15th December 2020 to 15th January 2021)

The pitch decks were scored by the jury board that consisted of members from 5 organizations (Annexure 4).

Announcement of the winners

The scores were analysed during Pitch Phase to select the 2 winners of the challenge for the cities of Rishikesh and Haridwar.

2.4 Further steps in the challenge:

Pilot testing of the selected solution:
The 2 winners, one for each city, are being supported with up to 50,000 EUR each by the Alliance to End Plastic waste as project finance for the pilot implementation in the two cities, supported by the Urban Local Bodies.

Compendium:
The documentation of the selected 25 innovative businesses and the description of their solutions is being undertaken in the form of a compendium.

03. MENTIONS

3.1 Partners of the Aviral Plastic Waste Innovation Challenge:

Powered by

Implemented by

In co-operation with

3.2 Jury members:

Rishikesh Nagar Nigam

Nagar Nigam Haridwar

The Alliance to End Plastic Waste

Karo Sambhav

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Climate Collective Foundation

3.3 Special mentions:

We would like to thank our key outreach partners for helping us reach out the potential and relevant businesses.

TIN - The Incubation Network

Invest India - Agnii

04. AIM AND SCOPE OF THE COMPENDIUM

4.1 What is the aim of this showcase?

To bring greater visibility to these deployment-ready solutions contributing to addressing the plastic waste problems in various cities through replicable and adaptive innovative businesses.

These enterprises can offer:

Capacity enhancement

Developing municipal capacities, improving the knowledge and strategic approach to plastic waste management.

Value chain

Infrastructure development for value chain improvement, aiming at enhancing technical resources with a specific focus on waste segregation.

Innovation

Piloting and fostering creative state-of-the-art solutions by local enterprises and startups.

Engagement & awareness

Awareness raising to change behaviour towards plastic waste of local population and visitors.

4.2 Who is this showcase for?

- Urban Local Bodies -
  who want to support innovative solutions to manage plastic waste in their cities.
- Venture Capitalists/Funders -
  who want to invest in circular economy and sustainable solutions.
- Corporates -
  who are looking for innovative solutions to strengthen their supply chain.
- Anyone looking to learn more about cutting edge solutions to solve the plastic waste problem.

05. Index of the top 25 businesses

5.1

Collection and Segregation

5.1.1.a Maclec Technical Project Laboratory Pvt. Ltd.

Smart solar-powered waste collection bin to collect and segregate municipal solid waste

Incorporation Delhi, December 2014

TECHNOLOGY READINESS LEVEL: 7 (System prototype demonstration in operational environment)

PRODUCT/SERVICE OFFERING

- Maclec Advance Swaccha-Bharat Trash (MAST) is a smart bin with 85 liters of capacity for plastic waste management at primary collection points.
- Scaled up version of MAST consists of 3 separate compartments for wet, dry, and non-recycling (glass bottles, coconut shell, etc. material which is neither recyclable nor compressible) trash collection with a capacity of 500 liters at a 1:6 compaction ratio for municipal waste collection.

Image 1: MAST bin

INNOVATION POTENTIAL

- MAST provides compressed garbage piles and saves up to 90% cost in the primary collection, transportation, and waste recycling.
- **MAST:**
  - Is a customizable and scalable solar-powered bin that segregates waste at the collection point as it has two separate inlets for wet and dry garbage, which lets users segregate the waste.
  - It is a system that can collect the garbage efficiently by compressing it up to 1:6 times and allowing It to be stored in a sealed compartment.
  - Is digitally monitored (real-time garbage level and location monitoring) with minimum manual handling.
  - Contains a waste treatment system comprising of organic suspension to slow down the decomposition process.
  - Has return on investment of less than 5 years.
  - Has Global System for Mobile communications (GSM) enabled in its scaled-up version and can be mounted on door-to-door waste collection vehicles.

NOTABLE PROJECTS

- **Technology testing – Indian Institute of Technology (IIT) Roorkee, 2019 and technical testing - IIT Delhi (2016)**
  - Brief: It was a technology developmental trial in which the Insititute engineer of IIT Delhi was involved to validate the electronics of the MAST compactor.
  - Size/Capacity: 2 dustbin compactors were developed and installed to validate the running efficiency of the machine.
  - Partners: Self-funded
- **Pilot installation at Festival of Innovation (FION)- President House, New Delhi (2017)**
  - Brief: MAST waste compactor systems have been showcased on behalf of Startup Incubation and Innovation Centre (SIIC) IIT Kanpur.
  - Size/Capacity: Demonstrated 1 working waste compactor.
  - Partners: SIIC IIT Kanpur
- **Procurement tender received for MAST dustbins by the Indian Railways – (2020)**
  - Brief: The MAST system identified by the Railway Board as an indigenous solution to collect garbage of single railway passenger coach.
  - Size/Capacity: The tender is of 17,500 dustbin compactors.

IMPACT

- Impact yet to be calculated with real-time monitoring of the project.

NOTABLE ACHIEVEMENTS AND AWARDS

- Technology showcasing and 'Best Young Innovator Award' at India Innovation Initiative National Fair (2016).
- 'Climate Solver Award' under 'GHG reduction' category by World Wide Fund for Nature (WWF) (2018).
- 1st prize at 'Swachch Bharat Grand Challenge' under 'Air Management' domain (2018).
- 'Global green business idea award' at ClimateLaunchpad 2019.
- RECOGNITION:
  - Recognized under 'X-factor innovation on earth' during NASA iTech (2020).

TEAM

Narayan Bharadwaj *(Founder & Innovative Chief Managing Director)*

Balram Bharadwaj *(Co-founder)*

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5.1.2.a Geocycle India Services

geocycle
For a zero-waste future

End-to-end solution of plastic waste disposal by combining bubble barrier with co-processing technology

Incorporation Geocycle India Services is registered in 2014 as a brand under ACC (Associated Cement Companies Limited) - Ambuja Cement Group, Mumbai, Maharashtra*

TECHNOLOGY READINESS LEVEL: 6 (Technology demonstrated in relevant environment)

PRODUCT/SERVICE OFFERING

- A perforated tube is installed across the bed of water body, and air passing through the tube brings the lighter particles (such as plastics) to the surface.
- The tube is positioned such that the natural flow of water brings the waste towards the bank. At this point, plastic waste is collected, segregated, and transported for recycling or co-processing.

INNOVATION POTENTIAL

- Proven technology: Technology captures all objects larger than 3-5 mm floating on surface.
- Simple process: Compressor, piping, and collection system.
- Low cost: Low capital expenditures and operating expenses, low energy consumption (± 300 kW/day), and low maintenance.
- Flexible process: Can be designed for all types of rivers.
- Non-invasive technology: No hinderance of surface boat traffic or fish movements.
- Energy recovery: The recyclable plastics collected through the Geocycle Bubble Barrier technology are directed to approved recyclers. The non-recyclable plastics are sent to cement plants for energy recovery.

NOTABLE PROJECTS

- **Geocycle India Services supported the 'Swachhata Hi Seva Campaign' (October 2019)**
  - Brief: A 40-day interactive program.
  - Size/Capacity: Assisted in outreach to 17 states, 377 villages, and 102,256 people in phase 1.
  - Impact: In phase 2, Geocycle India Services and other partner companies could dispose of 7,835 tonnes of plastic.
  - Partners: Cement Manufacturers Association (CMA)

- **Bubble barrier – Agra, Uttar Pradesh (Commissioned in April 2021)**
  - Brief: Setup on Mantola creek on the banks of Yamuna River.
  - Partners: Supported by Municipal Corporation of Agra city.

IMPACT

- Safely co-processed more than 928,399 tonnes of waste in the year 2019.
- Co-processed (disposed) 691,703 tonnes of Refuse-Derived Fuel (RDF) and plastic since 2012.
- Plastic waste collected from bubble barriers can be segregated into recyclable and non-recyclable streams. Both streams of plastic can be directed towards either recycling or co-processing, respectively.

Image 2 : Agra bubble barrier location Mantola creek flowing in Yamuna River

**Geocycle India Services is not a stand-alone legal entity, but a part of ACC-Ambuja Cement Group in India. They are legally allowed to operate as a waste management function for and under the ACC-Ambuja Cement Group.*

TEAM

Varun Dilip Boralkar *(National Head of Sales, Advocacy, & Growth)*

Deepak Ahuja *(National Production Head)*

Sharmistha Nandi *(Senior Market Expert)*

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5.1.2.b Sagar Defence Engineering Pvt. Ltd.

Unmanned Marine Surface Vehicle (UMSV) for garbage collection, water filtration, and real-time hydrological environment monitoring

Incorporation Mumbai, Maharashtra, May 2015

TECHNOLOGY READINESS LEVEL: 9 (Actual system proven in operational environment)

PRODUCT/SERVICE OFFERING

- Sagar Defence Engineering offers Unmanned Garbage Cleaning Marine Surface Vehicle (UGCMSV), a large drone with an underwater 'mouth' capable of collecting up to 500 kg of waste.

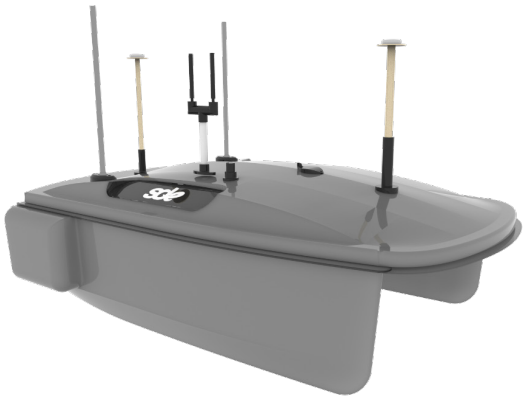

Image 3: Unmanned Garbage Cleaning Marine Surface Vehicle

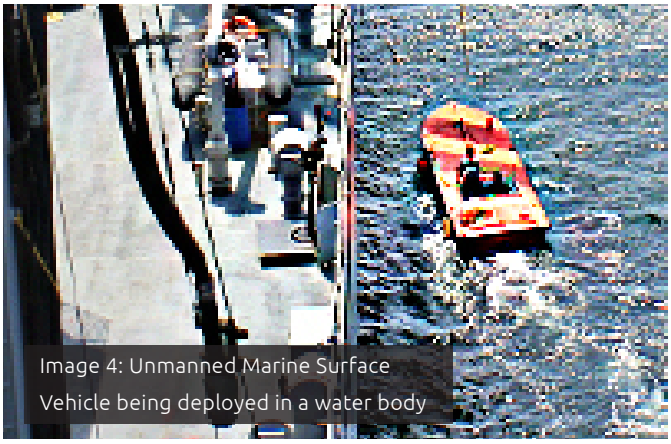

Image 4: Unmanned Marine Surface Vehicle being deployed in a water body

INNOVATION POTENTIAL

- Agile, autonomous, and with zero greenhouse emissions as it runs on battery and can be solar-powered.
- Returns information to ground authorities on the quality of water, weather, marine environment, and the depth of the river/harbor.
- Intelligent and responsive learning machine that can study environments to become more efficient at creating routes the longer it is in water.
- Can communicate with the Internet of Things (IoT) to create a self-organized network.
- Remotely controlled.
- Designed to be efficient, long-lived, non-threatening, and unobtrusive.
- Can tackle massive garbage clean-ups (often seen after heavy storms, winds, or flooding) and navigate swells.
- Carries different internal mechanisms to filter oil spills and other contaminants from water.
- Manoeuvrable, designed for trafficked water and tight spaces.

NOTABLE PROJECTS

- **Deployed in Pune region, Bandra lake, and Prayagraj.**
  - Size/Capacity: Collected 18 tons of garbage during 15 days of operation.

NOTABLE ACHIEVEMENTS AND AWARDS

- Ranks in the top 4 startups in 'Global Cleantech Innovation Program 2017' by United Nations Industrial Development Organization (UNIDO) and Global Environment Facility (GEF).
- Winners of the 'Technology Accelerator Award (2017)' at XLr8 'Andhra Pradesh State Technology Innovation Challenge', joint initiative of Government of Andhra Pradesh, Federation of Indian Chambers of Commerce and Industry (FICCI) and IC^2 University of Texas.
- Awarded with 'Most Promising Startup Award' by Indian Electronics and Semiconductor Association (IESA) (2017).
- Awarded certificate of excellence for 'Clean energy, water and waste management' at the Maharashtra Startup Week 2018 by Maharashtra State Innovation Society.
- Selected by Directorate General of Civil Aviation (DGCA), Ministry of Civil Aviation (MoCA), and Airports Authority of India (AAI) for conducting Beyond Visual Line of Sight (BVLOS) operations in India (2020).
- RECOGNITION:
  - Sagar Defence Engineering was featured in Inc42 (19th December 2016), Deccan Chronicle (1st March 2017), The Indian Express (4th December 2018), YourStory (18th December 2018), and The New York Times (6th February 2019).
  - Sagar Defence Engineering comes in the 'Top 20 Finalist Maritime Startups All Round the Globe by PortXL'.

IMPACT

- Garbage collection by Unmanned Garbage Cleaning Marine Surface Vehicle in 1 year is 2,160 tons.
- Unmanned systems generate interest involving technical work, directly and indirectly at a large scale ranging from school kids to higher authorities.

TEAM

Captain Nikunj Parashar *(Co-founder)*

Lakshay Dang *(Co-founder & CTO)*

Manoj Agarwal *(Co-founder & CFO)*

Mridul Babbar *(Co-founder)*

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5.1.2.c SEADS - Sea Defence Solutions Ltd.

(Local partner: WATSAN Envirotech Pvt. Ltd.)

The Blue Barriers: Riverine waste collection and waste treatment system

Incorporation London, United Kingdom, July 2018

TECHNOLOGY READINESS LEVEL: 8 (System complete and qualified)

PRODUCT/SERVICE OFFERING

- The Blue Barriers:
  - A turnkey solution to collect plastic in rivers that also sorts and transforms the collected waste into energy.
  - SEADS offers pyrolysis plants to produce naphtha and solutions to produce energy from biomass or shredders to produce and sell wood chips for transforming waste to energy.

INNOVATION POTENTIAL

- Self-financing: Conversion of waste to energy by The Blue Barriers repays the installation in full.
- Turnkey solution: The Blue Barriers can be easily installed and start collecting plastic waste and debris.
- 100% effective in collecting mixed plastic.
- No impact on river life or boat navigation.
- Low maintenance due to simplicity and robustness of the structure.

Image 5: The Blue Barriers

NOTABLE PROJECTS

- **A pilot test was installed in the Lamone river - North Italy, Province of Ravenna (April 2019 - tested for 3 years and then removed)**
  - Brief: The Blue Barriers efficiency was verified, collecting 100% of the plastic tested.
  - Size/Capacity: 2 barriers of 10 meters each were deployed. In 48 hours, the barriers collected 37 pieces of different kind of plastic for a total of 0.4 kg.
  - Partners: Self-funded and private sponsorship (EUR 10,000) by B.Lab Italia Srl supplier of Bvlgari.
- **Installation - Tiber River (Start date: 18 June 2021)**
  - Size/Capacity: 20 meter barriers
  - Partners: Bolton (sponsor), MareVivo (Non-Governmental Organization for ocean protection), Rotary international (organizer), Lazio Region (organizer and permissions for installation), EDI Progetti e Sviluppo (engineering consultant).

IMPACT

- To reduce the transportation impact, SEADS manufactures the barriers locally, also produces a positive impact by creating local employment. 2 months of manpower per installation is required to produce the barriers and collections structure.

NOTABLE ACHIEVEMENTS AND AWARDS

- SEADS - Sea Defence Solution Limited:
  - Runner up at the 'Impact Hub Milano Fellowship on Ocean Cleanup 2018', organized by Impact Hub Milano with World Wide Fund for Nature (WWF) under the patronage of
  - Bvlgari.

    'Building A Sustainable Future Award 2018' by
  - Seeds&Chips.
- WATSAN Envirotech Private Limited:
  - Council of Scientific and Industrial Research (CSIR) award for Science and Technology (S&T) Innovations for Rural Development (CAIRD) – 'CAIRD award for the year 2018 for innovating cost-effective modular toilets to provide rural masses with better sanitation facilities. An innovative solution to improve rural hygiene'.
  - First position under the category of 'Innovation in Water Technology' at the 'Federation of Indian Chambers of Commerce and Industry (FICCI) Water Awards 2018' organized by FICCI in association with the Ministry of Water Resources, River Development and Ganga Rejuvenation.

Image 6: The Blue Barriers pilot test installed in the Lamone River

TEAM

Fabio Dalmonte *(Founder & MD)*

Mauro Nardocci *(Communication Director)*

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5.2

Information Technology/Data Based Solutions

5.2.a Kabadiwalla Connect Pvt. Ltd.

ISWMTrak (Integrated Solid Waste Management Track): A data-driven approach for waste management in India's urban settlements

Incorporation Chennai, Tamil Nadu, May 2016

TECHNOLOGY READINESS LEVEL: 6 (Technology demonstrated in relevant environment)

PRODUCT/SERVICE OFFERING

- ISWMTrak provides Urban Local Bodies (ULBs), Producer Responsibility Organisations (PROs), and Development Agencies (DAs) with granular and location-specific waste management baselines in India's urban settlements. This supports decision-making with regards to Solid Waste Management (SWM) interventions and policies.
- A web-based data platform that provides the following to the ULBs, PROs, and DAs:
  - Waste generation, infrastructure, material flow, and governance baseline data.
  - Periodic data updating (3 months).
  - Crowd-sourced data on plastic pollution hot-spots and illegal dumpsites.
  - Issue tracking and resolution.
- Smartphone app for citizen engagement that provides:
  - Information dissemination to citizens from ULBs/PROs/DAs.
  - Ability to request waste management solutions from ULBs, PROs, private companies, or local Non-Governmental Organizations (NGOs).
  - ULBs can respond to citizen queries about SWM.

INNOVATION POTENTIAL

- Understanding and mapping informal networks and developing integration strategies.
- Web-based dashboard for data access, analysis, and custom report generation.
- Round-the-clock data access and analysis support.

Image 7: Material Recovery Facility by Kabadiwalla Connect.

NOTABLE PROJECTS

- **Chennai, Tamilnadu (2017)**
  - Size/Capacity: 2,500 informal stakeholders responsible for collecting and aggregating over 15,000 tons of post-consumer plastic monthly were mapped and enumerated.
  - Partners: Funded by Global Partnership for Sustainable Development Data, Expo 2020 in Dubai, and the Plastics Data Challenge by The Incubation Network.
- **Semarang, Indonesia (2018)**
  - Size/Capacity: Mapped over 300 informal aggregators (selling over 30 tons of Polyethylene Terephthalate (PET) monthly) and deployed a technology platform at one shop to enable material traceability (40 tons digitalized monthly).
  - Partners: Funded by Veolia Water Technologies (Indonesia).
- **Mumbai, Maharashtra (2018)**
  - Size/Capacity: Mapped over 180 informal aggregators in selected wards of Mumbai.
  - Partners: Funded by Veolia Water Technologies (India)

IMPACT

- 600 tons of plastics recycled over 3 years.

NOTABLE ACHIEVEMENTS AND AWARDS

- Recykle – Winners at Massachusetts Institute of Technology (MIT) Climate CoLab (2016)
  - A smartphone app to manage household waste responsibly.
- ISWMTrak – Winners at 'Plastics Data Challenge 2020' by The Incubation Network.
  - A Geographic Information System (GIS) enabled data dashboard that creates a baseline and monitors the progress made in delivering effective and inclusive Integrated Solid Waste Management (ISWM) in a city or region.

Image 8: An 'Urbin' developed by Kabadiwalla Connect. The bins are fitted with built-in field sensors which will send a text message to the neighbourhood kabadiwalla once it is full.

TEAM

Siddharth Hande *(Founder & CEO)*

Ganesh Kumar Subramanian

(Co-founder & CTO)

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5.2.b Recykal

Enabling end-to-end 'waste commerce' through a digital marketplace and Software as a Service (SaaS) solutions across the waste value chain

Incorporated as Rapidue Technologies Pvt. Ltd., Hyderabad, Telangana State, November 2015

TECHNOLOGY READINESS LEVEL: 9 (Actual system proven in operational environment)

PRODUCT/SERVICE OFFERING

- Recykal connects waste generators (businesses, consumers), waste processors (aggregators, informal sector), and recyclers digitally.
- Digital product offerings:
  - **Recykal marketplace** enables buying/selling of recyclables between aggregators, recyclers, end-to-end logistics, and transaction support.
  - **Recykal smart centre** a SaaS solution that digitizes record-keeping, payments, and settlements and increases visibility in collection centre operations.
  - **EPR Loop** is a marketplace for brands managing their end-to-end to Extended Producer Responsibility (EPR) fulfillment process.
  - **Take-back Solutions** for retailers, brands to initiate e-waste, plastic waste take-back programs.

Image 9: Recykal marketplace - How it works?

INNOVATION POTENTIAL

- **Recykal's solutions:**
  - Ensure smooth supply for material to recyclers.
  - Help aggregators, waste management companies to get complete visibility of material.
  - Provide data-driven anticipation of demand and supply.
  - Provide transparency and traceability to all stakeholders.
  - Formalize the informal sector and help them earn extra income for their waste collection.

NOTABLE ACHIEVEMENTS AND AWARDS

- Winners of 'Emerge 50 Awards 2019' by the National Association of Software and Service Companies (NASSCOM).
- RECOGNITION:
  - 'Most innovative software product companies in India' under Indian Circular Economy Awards (Startup) by Federation of Indian Chambers of Commerce and Industry (FICCI) (2019).
  - 'Best waste management digital technology provider' by the Associated Chambers of Commerce and Industry of India (ASSOCHAM) (2019).

NOTABLE PROJECTS

- **Rethink+ (2019 - Present)**
  - Brief: Plastics take-back program to prevent post-consumer plastic waste from going to landfills using Recykal's digital interventions.
  - Size/Capacity: 810 MT of plastic waste channelized by engaging 800+ bulk generators, 0.1 million+ citizens, 80+ informal aggregators, and 20+ schools.
  - Partners: The Dow Chemical Company, Chitale

- **Project Prithvi (2020 - 2021)**
  - Brief: Development of sustainable plastic waste management practices. Recykal's digital applications raise awareness among consumers, bulk generators, informal sector, and enable collection.
  - Scale/Capacity: Channelization of 5,000+ MT of plastic waste to registered recyclers.
  - Partners: Hindustan Coca Cola Beverages and the United Nations Development Programme

IMPACT

- 4,165 metric tons of plastic diverted from landfills and sent for recycling till the 1st quarter in 2021.
- 40+ direct and 500+ indirect jobs created till the 1st quarter in 2021.
- Empowerment of informal sector by digital and financial inclusion, access to better health facilities, and improvement in income levels.
- Suite of web and mobile apps have facilitated the channelization of more than 30,000+ metric tons of plastic waste over the last 3 years.
- Impact created in the fiscal year 2020-21:
  - Energy saved: 415,728,345 kW h
  - Plastic waste managed: 72,000 tons
  - Landfill space saved: 58,320,000 cubic ft.
  - Water saved: 130,824,000 liters

Image 10: Recykal marketplace

TEAM

Abhay Deshpande *(Founder)*

Abhishek Deshpande *(Co-founder & CCO)*

Anirudha Jalan *(Co-founder & VP-Strategy)*

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5.2.c SweepSmart Waste Management Pvt. Ltd.

Offering waste management with Software-as-a-Service (SaaS)

Incorporation of Indian subsidiary in Bengaluru, Karnataka, July 2017. Incorporation of the Dutch mother company: SweepSmart B.V. in Amsterdam, June 2016.

TECHNOLOGY READINESS LEVEL:

Smart Waste Centre: 9 (Actual system has proven through successful mission operations)

Smart Waste Management Information Technology (IT) Platform: 5 (Technology validated in relevant environment)

PRODUCT/SERVICE OFFERING

- SweepSmart Waste Management provides turn-key 'Smart Waste Centres' for waste sorting and pre-processing, supported by a toolkit of equipment, IT, and training. They consult, design, build, implement, and transfer the facilities and provide long-term maintenance and service.

  Their offerings include:
  - Solutions to manage Material Recovery Facilities (MRFs) with capacities ranging from 3 to 50 tons per day.
  - Pre-processing equipment, like balers, shredders, and extruders.
  - Smart waste management technology platform with data tracking tools (apps and devices), dashboards and reporting, to track waste flows, on-ground operations, and financials for waste collection and sorting.
  - Training packages on:

    -Operations and maintenance.

    -Data tracking and information technology.

    -Quality, Health, Safety and Environment (QHSE).

INNOVATION POTENTIAL

- Flexible integration, deployment, and adaptation.
- Transparency in waste flows for Extended Producer Responsibility (EPR).
- For waste operators:
  - Lower plastic recovery cost per ton in the long-term due to continuous efficiency improvements.
  - Optimized space and resources.
- **For waste regulators:**
  - Low-value waste streams can be sorted economically.
  - Real-time insight into:

    - Waste flows, performance, and impact creation of waste centres.

    - Operational KPIs to allow for better planning and budgeting of (future) waste centres.

    - Costs and revenues of waste handling to set waste collection tax/user fees.

Image 11: BBMP Bangalore

NOTABLE PROJECTS

- **Electronics City Industrial Township Authority (ELCITA) waste facility dashboard - Bengaluru, Karnataka (November 2016 - February 2017)**
  - Size/Capacity: 1 pilot facility of 2 tons per day capacity (now 5 tons per day)
  - Partners:
    - Dutch Good Growth Fund - Funder
    - ELCITA - Owner of the site
    - Waste Wise Management & Consultancy
    - Services Private Limited (WWMNCS)- Operator of the site
    -I Got Garbage - IT partner
- **Upgrading 10 waste facilities for Bruhat Bengaluru Mahanagara Palike (BBMP) - Bengaluru (2019 – 2021)**
  - Total capacity added: Approximately 11,000 tonnes per year (assuming two shifts).
  - Partners: BBMP, Dutch Good Growth Fund, and Government of Karnataka

GLOBAL EXPERIENCES

- **Smart Waste Centre for Systemiq Limited - Muncar, Indonesia (July - October 2018)**
  - Size/Capacity: 4 tons per day
  - Partners: Systemiq Limited - Owner and operator of the centre

IMPACT

- Improved Key Performance Indicators (KPIs) based on dashboards, like service quality from 40% to >98% within 2 months and collection efficiency quadrupled in 1 year.
- Installed 38,000 tonnes per year of dry waste handling capacity by setting up 13 centres (12 in India and 1 in Indonesia) over 5 years.
- Trained 565 waste workers, of which 49.7% were women, and 21.5% were informal workers over 5 years.

NOTABLE ACHIEVEMENTS AND AWARDS

- International winners at the 'Social AdVenture Awards' by Cordaid (2016).
- Winners at 'The Social Impact lab 2017' by PricewaterhouseCoopers (PwC).
- Semifinalists at 'Plastics Data Challenge 2020' by The Incubation Network.
- **RECOGNITION:**
  - Silvia de Vaan, as the founder was selected as 'one of the 12 leading female entrepreneurs' as part of the 'Global Ambassadors program' in Paris in 2019 by Bank of America and Vital Voices Global Partnership.
  - Received subsidy by the Dutch Good Growth Fund in the years 2016 and 2019.

TEAM

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Silvia de Vaan *(CEO & Co-founder)*

Siddharth Agarwal *(Urban Analyst, Business Development & Marketing Associate)*

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5.3

Material Recovery Facilities and Recycling

5.3.a Conserve

Plastiskul: Upcycling plastic waste for localized manufacturing needs

Incorporation Delhi, 1998 as non-profit and 2005 as for-profit

TECHNOLOGY READINESS LEVEL: 9 (Actual system proven in operational environment)

PRODUCT/SERVICE OFFERING

- Micro-factories that operate under the brand 'Plastiskul' contain all the machinery required for shredding all kinds of plastics waste, transforming it into new products by extrusion, sheet press, injection and creating 3D filament to be used in 3D printers.
- Upcycling plastic waste for localized manufacturing of packaging materials, fashion, interiors, and construction materials in a closed-loop process.
- Offering training to upskill waste workers and unskilled workers to be equipped for circular economy jobs.

Image 12: Upcycled plastic waste product

INNOVATION POTENTIAL

- **Plastiskul micro-factories are:**
  - Designed to recycle different types of plastics using dedicated methods which depend on access to collected plastic and the final products in line with local needs.
  - Easy to set up and replicate.
  - Patented process to create fabric from Low-Density Polyethylene (LDP) plastics.

NOTABLE PROJECTS

- **Perrier partnership product – Micro-factory mobile - Africa (Design and setup in 2021)**
  - Brief: With experimentation as a goal, plastic recycling micro-factory is being shared between the African members of the consortiums to:
    - Recycle as close to the waste as possible.
    - Educate and sensitize on recycling.
    - Formation on the technologies developed by Fablabs.io
    - Produce objects with a local impact.
  - Partners: Funded by Perrier®, France

- **Handmade Recycled Plastic (HRP) – Replicated over 6 areas in National Capital Region, Delhi (2008 – present)**
  - Brief: Conserve has a patented process to convert LDP plastics into fabric from which fashion accessories like bags, wallets, footwear, etc. are handcrafted and exported to western markets and sold via their brand www.LIFAFFA.com.
  - Size/Capacity: Empowered 2,800 waste workers and upcycled 360 tonnes of plastic waste.
  - Partners: Previously supported by Ashoka and C&A Foundation and other small corporate grants.
- **OTHER PROJECTS/INITIATIVES**
  - Innovation in textile recycling to recycle used garments into newly spun fabric. Blending with natural fibers to increase the strength of the material.
  - Currently working on the formalization of training programs for waste pickers to help them build on their skills of collecting, segregating, cleaning, and adding value to the waste.

Image 13: Upcycled plastic waste products

Image 14: Upcycled plastic waste product

IMPACT

- 53,000 kg of carbon dioxide emissions avoided due to 360 tons of plastic waste recycled since 2008.
- 2,800 people trained, and the income of waste pickers increased through the process of upcycling since 2008.
- 24,000 kg of plastic recycled per year.

NOTABLE ACHIEVEMENTS AND AWARDS

- Awarded as 'Mentor of Change' by Atal Tinkering Labs, National Institution for Transforming India (NITI) Aayog (2017).
- Received 'Bharatiya Manavta Vikas Puruskar' for creating a social brand (2018).
- **RECOGNITION:**
  - Received 'Female Fair Trade Leader Scholarship' by Isabel Martin Foundation (2019).
  - United Nations ambassador for 'Circular Economy (Advocacy and Policy)' (2020).
  - Certification for 'Training of Trainers' at International Labour Organization (2020).

TEAM

Anita Ahuja *(Founder)*

Kanika Ahuja *(Executive Director)*

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5.3.b Ecowrap Impact Pvt. Ltd.

End-to-end integrated channel for Hotel, Restaurant, Café, Bar, etc. (HORECA) for waste management using Internet of Things (IoT) and Software as a Service (SaaS)

Incorporation Jaipur, Rajasthan, October 2020

TECHNOLOGY READINESS LEVEL: 8 (System complete and qualified)

PRODUCT/SERVICE OFFERING

- Ecowrap is a waste management cum Fast-Moving Consumer Goods (FMCG) supply chain platform that provides the HORECA sector infrastructure (smart dustbins, tech inclusion, and training to staff) for primary waste segregation at source.

Image 15: Upcycled products from segregated waste

Image 16: Upcycled products from segregated waste

INNOVATION POTENTIAL

- The real-time data provided by their Internet of Things (IoT) dustbins is used to schedule instant pickups, segregated waste, which is then sent to recyclers and women Self-Help Groups (SHGs) for upcycling.
- Incentives in the form of digital tokens to buy FMCG products from partner vendors are distributed between HORECA clients (80% incentive) and Green Champions* (20% incentive).
- They utilize IoT and SaaS as their tech intervention to optimize logistics through the shortest route tracking application programming interface.
- They offer financial viability through sustainable and diverse revenue streams and scalability due to an asset-light model due to elimination of labour-intensive task of segregation post collection and not building in-house treatment process.

Image 17: Ecowrap dustbins dustbins

NOTABLE PROJECTS

- **Waste management project under Jaipur Smart City Project – Jaipur, Rajasthan (April 2018 – present)**
  - Size/Capacity: 150+ HORECA entities partnered.
  - Key partners: OYO Rooms (40 properties) and Barbeque Nation-Jaipur (2 outlets).
- **Project Muskaan - Shahpura, Rajasthan (June 2020 – present)**
  - Aim: To employ women in rural areas through upcycling of waste material.
  - Brief: The source segregated recyclable material is collected and sold to recyclers in exchange for revenue. To improve the financial viability and create a more significant impact, they formed SHGs of women in rural areas and trained them to make upcycled products out of waste material.
  - Impact: Trained 24 women during 3-month training, and every woman upcycles 200 kg waste every month.
  - Partners: Yes We Can foundation and other local non-governmental organizations.

**Appointed persons from concerned HORECA unit's housekeeping staff, who take care of segregation and are the point of contact for Ecowrap.*

IMPACT

- Currently managing 1,300 metric tons of waste annually.
- During project Muskaan, 2 SHGs were formed of 12 women each - income generated per SHG involved in upcycling waste per metric ton was INR 46,000 (30% of the revenue shared with the SHGs).

NOTABLE ACHIEVEMENTS AND AWARDS

- Winners at 'iPrenuer' by Tata Institute of Social Sciences (2019).
- Finalists of 'World Tourism Forum Lucerne (Indian Camp)' (2019).
- Finalists at 'The Ten Minute Million (TTMM)' by the Indian Institute of Technology, Bombay (2020).
- Finalists at 'ClimateLaunchpad 2020' by the European Institute of Technology Climate - Knowledge and Innovation Community (EIT Climate-KIC).
- Finalists from India at 'Circular Innovation Jam 2020' by The Incubation Network.
- Winners at 'Youth Co:lab 2020' by the United Nations.
- Global finalists in 'Start-Up Innovation Camp 2021' at 'World Tourism Forum Lucerne (WTFL) Innovation festival 2021, Switzerland' (Finals to be held in November 2021).

TEAM

Angraj Swami *(Founder)*, Ajay Buri *(Co-founder & Incharge - Product development)*, Chandrakant Swami *(Chief - Waste Handling)*, Deepak Kumar *(Head - Waste Handling)*

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5.3.c Plastics for Change

Provides ethically recycled plastic from fair trade supply chains as a service to brands and manufacturers

Incorporation in 2018 as Buoyancy Plastics for Change Recycling Pvt. Ltd. in Bengaluru, Karnataka.

TECHNOLOGY READINESS LEVEL: 9 (Actual system proven in operational environment)

PRODUCT/SERVICE OFFERING

- Plastics for Change provides the recovery of plastic from coastal areas through a network of informal waste-collectors and scrap entrepreneurs which is called their 'fair trade supply chain'.
  - This material is aggregated in their in-house collection sites, which then goes through a segregation process.
  - They work with recycling partners to convert the pre-segregated material into pellets/ flakes to be used by brands.
- Plastic types recycled:
  - High-density polyethylene (HDPE)
  - Reinforced Pyrolytic Plastic (RPP)
  - Recycled polyethylene terephthalate (rPET)
  - Recycled Low-Density Polyethylene (rLDPE)

INNOVATION POTENTIAL

- Their technology platform:
  - Catalyses the recovery and recycling of ocean-bound plastic profitably and helps brands meet their producer responsibilities.
  - Has an external app interface that captures all buy/sell transactions along with trading information.
  - Ensures that plastic is ethically sourced and suffices their quality check by tracking transparency in the supply chain by a team of field staff that monitors operations and accuracy of the input data.
- The franchise model fortifies recycling businesses that pay waste pickers' incomes and train them in techniques that boost their incomes and facilitate investment.
- Their in-house sourcing managers and social workers engage with partners on a continuous developmental process and provide services to ensure social and environmental compliance/ behaviour change in the supply chain, which provides confidence to global brand partners.

NOTABLE PROJECTS

- **Currently has 4 fully operating aggregation centres across southwest coastal India - Mangalore, and Hubli-Dharwad**
  - Size/Capacity: 60-100 metric tons per month per centre.
- **Plastics for Change holds a 3-year renewable basis purchase contract partnership with The Body Shop International Limited and is currently the only supplier of their global rPET requirements – (Since May 2019)**
  - Size/Capacity: Recycled a total of 750 metric tons of plastic for The Body Shop International Limited
  - Impact: Diverted a total of 1,500 metric tons of plastic from entering the ocean till the 1st quarter in 2021.

IMPACT

- Direct impact on 25 livelihoods and social/ community support provided to 100 families of informal waste collectors till the first quarter in 2021.
- 120 informal stakeholders onboarded, among which 60 received income opportunities till the first quarter in 2021.
- Organization-wide, Plastics for Change has recycled 1,000 metric tons of plastic waste and diverted 2,000 metric tons from entering the ocean/water bodies till the first quarter in 2021.

NOTABLE ACHIEVEMENTS AND AWARDS

- Winners of the 'Massachusetts Institute of Technology (MIT) Inclusive Innovation Challenge 2018'.
- Winners of the '2019 Transforming Lives Award' by the Alquity Transforming Lives Foundation in concert with Alquity Investment Management.
- Winners of the 'Social Innovation Challenge on Plastics 2019' by Acumen, in partnership with Unilever.
- Winners of the '$1m Global Maker Challenge 2020' by the Mohammed bin Rashid initiative for global prosperity.
- **RECOGNITION:**
  - The founder, Andrew Almack, is on the 'Forbes 30 Under 30' list in 2018.
  - Plastics for Change is a cohort member in 'Future of Flexibles' by The Incubation Network.

Image 18: The plastics types recycled by Plastics for Change

TEAM

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5.3.d Shakti Plastic Industries

THE SHAKTI PLASTIC INDUSTRIES
Turning waste to value

Recycle post-consumer plastic waste to value-added products

Incorporation Mumbai, Maharashtra, November 1969

TECHNOLOGY READINESS LEVEL: 9 (Actual system proven in operational environment)

PRODUCT/SERVICE OFFERING

- Recycle Multi-Layered Plastics (MLP) into granules that are sold to plastic producers.
- Some of the key product sectors that use products from recycled post-consumer plastics include construction, furniture, landscaping, shipping, and soft toys.

INNOVATION POTENTIAL

- High range of Material Flow Index (MFI) which defines viscosity of the plastic. MLP that they recycle into plastic granules is available in a wide range of MFI.
- Unique solution of making granules from MLP.
- Blending recycled plastics with fillers and additives enhances the strength and usability, leads to value-added products.

Image 19: Value added products made by recycling plastic waste

Image 20: Products made of the recycled plastic

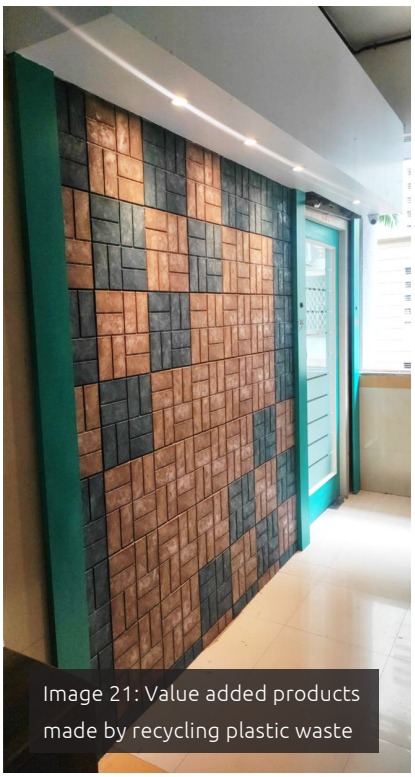

Image 21: Value added products made by recycling plastic waste

NOTABLE PROJECTS

- **Recycling plant - Palghar, Maharashtra (1969 – present)**
  - Brief: Currently operational, which recycles all categories of plastic, including MLP.
  - Size/Capacity: 27,000 Million Tonnes Per Annum (MTPA)
  - Area: 50,000 sq. ft.
  - Partners: Self-funded

NOTABLE ACHIEVEMENTS AND AWARDS

- Swachh Bharat Award 2019 for 'Waste Management - Collection, Logistics and Recycling' at National Swacchta Summit & Awards 2019.
- Economic Times Polymers Award 2020 for 'Excellence in Recycling' and 'Next Generation Leader of the Year Award'.

IMPACT

- Utilized 2,700 metric tons of MLP and converted that into granules over the last 2 years.
- Created 80 direct jobs and 5,000 indirect jobs, including rag-pickers, transport operators, weigh scale operators, etc., across all states in India.

Image 22,23,24: Plastic waste recycled into granules and

TEAM

Vinod Podaar *(Chairman)*

Prateek Podaar *(MD)*

Rahul Podaar *(MD)*

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5.3.e 21 Century Polymers

Community-led, integrated plastics waste management, which includes segregation at source, collection, material recovery, and recycling

Incorporation Delhi, July 2017

TECHNOLOGY READINESS LEVEL: 7 (System prototype demonstration in operational environment)

PRODUCT/SERVICE OFFERING

- 21 Century Polymers use material recovery plus recycling concept to segregate, recycle, and make products.
- Their work with the community includes baseline data collection of households for better source segregation and awareness. These households are their target customers for products made up of recycled plastics, including Multi-Layered Plastics (MLP).

Image 25: Recycled 70% Multi-Layer Plastic and 30% low density polyethylene extruded into planks for pallets

INNOVATION POTENTIAL

- Offer recycled products from all kinds of plastic waste, including MLP.
- Technology and machines used by them in the recycling process: identification, segregation with Artificial Intelligence (AI) based automatic machines, density separation, extrusion with additives, and molding-extruding-blowing heat compression for recycled products.
- 21 Century Polymers has developed:
  - Technology to segregate recyclable MLP with density separation and compound it with Flame retardants (FR) additives to make FR compound for Aluminium Composite Panel (ACP) sheets.
  - 1 shot per time heat compression machine for decentralised Material Recovery Facilities (MRFs).
- They extrude lumber and planks from MLP waste and use them to make furniture products.

NOTABLE PROJECTS

- **Recycling unit – Delhi (1989 - present)**
  - Size/Capacity: 26 tons per day, waste collected: 117,600 tons
  - Partners: funded by 21 Century Polymers.
- **MRF plant - Cacora, Goa (2020 - present)**

  Size/Capacity: 5 tons per day, waste collected:
  - 1,240 tons
  - Partners: Funded by United Nations Development Programme (UNDP) India and Hindustan Coca-Cola Beverages Private Limited.
- **MRF plant – Panaji, Goa (2020 - present)**
  - Size/Capacity: 8 tons per day, waste collected:
  - 2,100 tons

  Partners: Funded by UNDP and HDFC Bank Limited.
- **MRF plant - Mathura-Vrindavan (2020 - present)**
  - Size/Capacity: 10 tons per day, waste collected:
  - 870 tons

  Partners: Funded by 21 Century Polymers.

IMPACT

- Waste collection/segregation in Cacora, Panaji, and Mathura has covered approximately 200,000 households throughout the projects over 1 year.
- Segregating 20 metric tons post-consumer dry waste per month in MRFs.
- Reduced 327,600 metric tons of carbon gases exclusively through recycling since inception (10 years).

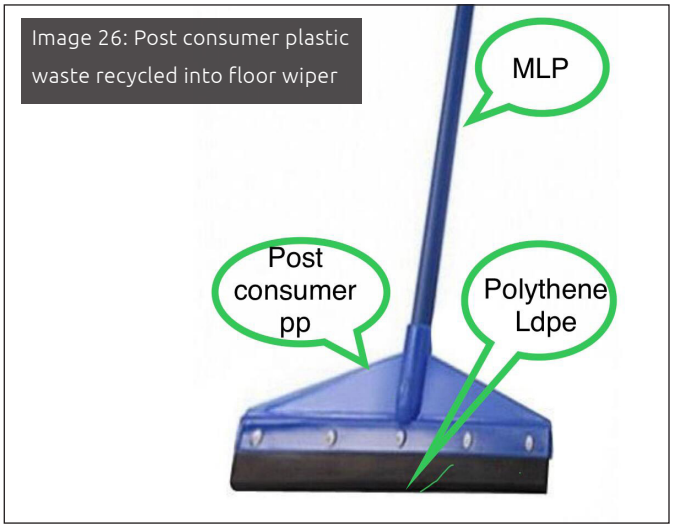

Image 26: Post consumer plastic waste recycled into floor wiper

TEAM

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5.4

Reuse Economy and Alternatives to Plastics

5.4.a Astu Eco Pvt. Ltd.

Sustainable alternatives to single-use plastics

Incorporation Bengaluru, Karnataka, October 2019

TECHNOLOGY READINESS LEVEL:

7 (System prototype demonstration in operational environment)

PRODUCT/SERVICE OFFERING

- Fast-Moving Consumer Goods (FMCG) packaging: Designing and producing naturally compostable takeaway boxes, plates, cups, and spoons made of areca tree sheaths.
- Tote scarf: A scarf that turns into a reusable tote bag. It is made from recycling 2.2 Polyethylene Terephthalate (PET) bottles.
  - Future plan:
    - New prototype to replace single-use bags in nurseries and forestry for storing the saplings.
    - New use cases for 100% circular products, piloting areca container use for a dedicated chain of restaurants.

Image 27: Nursery plant containers made of areca tree sheaths

INNOVATION POTENTIAL

- The products:
  - Are a sustainable alternative to plastic in a competitive pricing.
  - Can be reused as manure, fodder and can be recycled as pulp.
  - Are sourced and produced locally (places where areca tree grows; primarily tropical areas, although can be harvested everywhere).
  - Are stackable, storable, and sturdy.

Image 28: Cutleries made of areca tree sheaths

NOTABLE PROJECTS

- Currently supplying FMCG scoops (measuring cups) which are 100% circular.
- Prototype stage for FMCG packaging from dry organic produce is in progress.

OTHER INITIATIVES

- Awareness: 'EcoBEAT' is a series of 2-minute educational videos on adoptions to decrease everyday plastic footprint (2019 – present).
- Mentoring school and college students on sustainable projects and having them make research papers and case studies on sustainability market.

NOTABLE ACHIEVEMENTS AND AWARDS

- Winners of the 'Ocean Plastic Innovation Challenge' by National Geographic-Washington, United States (2019).
- Top 10 in the 'Sustainable Packaging Disruptive Ideas 2019'- London, United Kingdom.
- Tote scarf is a finalist in the Lakmé Fashion Week 'Circular Design Challenge 3.0' (2021).
- RECOGNITION:
  - Invited by the National Institution for Transforming India (NITI) Aayog and the Government of India to be on the 'Council for Circular Agriculture Economy' to propose actionable policies for the same in March 2021.

IMPACT

- Prevented more than 5.4 million pieces of plastic through sales and usage of Astu Eco products since inception till the 1st quarter in 2021.

Image 29: Product image: Scoops

TEAM

Anitha Shankar *(Co-founder)*

Uday Shankar *(Co-founder)*

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5.4.b Evlogia Eco Care Pvt. Ltd.

Single-use organic cutleries from agricultural waste

Incorporation Bengaluru, Karnataka, August 2018

TECHNOLOGY READINESS LEVEL: 9 (Actual system proven in operational environment)

PRODUCT/SERVICE OFFERING

- Evlogia Eco Care offers single-use organic cutleries from agricultural waste to food business operators/chains.
- Their products range from straws, takeaway container boxes to coffee cup lids.
- Product, 'Leafy Straw' – Evlogia Eco Care, has patented solutions for regular and tetra-pak forms of organic and biodegradable drinking straws.

INNOVATION POTENTIAL

- Leafy straws:
  - Are biodegradable in 90 to 180 days on both land and ocean.
  - Have protective coating inbuilt with natural plant wax.
  - Stays intact in both hot and cold beverages for more than 6 hours.
  - Have 1 year of shelf life.

Image 30: Product: Leafy straws

Image 31: Product: Leafy straws

NOTABLE PROJECTS

- **Pilot production unit – Bengaluru, Karnataka (January 2019 – present)**
  - Size/Capacity: Run by 15 full-time women staff making 10,000 straws per day.
- **Production expansion with Women Self Help Groups (SHGs) – Madurai, Tamil Nadu (October 2019 – present)**
  - Brief: Working with Entrepreneurship Development Institute of India (EDII) and TVS Arogya Welfare trust supported women SHGs in Madurai to train the women from rural India to produce Leafy Straws.
  - Size/Capacity: Training has been provided to 20 ladies.
  - Partners: EDII, TVS Arogya Welfare Trust.

Image 32: Product: Leafy straws

IMPACT

- Remedied 5.25 tons of plastic through Evlogia Eco Care's sales over 6 months.
- Providing additional income and work flexibility for agricultural laborers from Hosadurga, Palani, and Nagercoil districts of Karnataka.
- Providing employment opportunities to women in production processes.
- Preventing burning down of coconut leaves in agricultural landfills.

NOTABLE ACHIEVEMENTS AND AWARDS

- Winners of 'Pratiksha Trust Award for Top Manufacturing Start-Up of the Year 2018' at Confederation of Indian Industry (CII) Startupreneur Awards 2018.
- Winners of 'Social impact & location-based solutions Award' at ClimateLaunchpad 2018 grand finals.
- 'Best Business Plan' at BigLeap 2020.
- Grand winners at 'Circular Innovation Jam 2020' by The Incubation Network.

TEAM

Manigandan Kumarappan *(CEO)*

David Biju *(Business Development Lead)*

Joshy John *(Operations Lead)*

Leo V J *(R&D Lead)*

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5.4.c Recube Circular Solutions Pvt. Ltd.

Smart packaging and reusable systems to provide alternatives that reduce single-use disposables

Incorporation Mumbai, Maharashtra, February 2019

TECHNOLOGY READINESS LEVEL: 7 (System prototype demonstration in operational environment)

PRODUCT/SERVICE OFFERING

- Recube Circular Solutions is a social enterprise that aims to bring change in the circular economy by introducing:
  - A reusable system, namely 'Refillable.'
  - Biodegradable products made of pelletized crop, namely 'Cupable.'
- Refillable offers refills at customers' doorstep through their e-vehicle dispensing mechanism.
- They work with brands helping them become zero waste.

INNOVATION POTENTIAL

- Customer convenience through doorstep delivery and pay-per-use model.
- Each product has a unique code that helps track:
  - The product life.
  - Raw material source and product manufacturing details.
  - Delivery of the product to brand, distributor, retailer, and consumer.
  - Reuse and washing centres.

Image 33: Project 'Refillable' being carried out by Recube Circular Solutions

Image 34: Project 'Refillable' being carried out by Recube Circular Solutions

NOTABLE PROJECTS

- **Cupable: Installed deposit boards at 5 restaurants and 100 events to collect packaging from consumers - Mumbai, Bengaluru, and Delhi (2019 - present)**
  - Brief: Project in which products are created from bio-based materials like pelletized crop waste. These products are kept in a closed-loop system by collecting, washing, sanitizing, and restocking. Their Life Cycle Analysis (LCA) is conducted through their Internet of Things (IoT) enabled system.
  - Size/Capacity: 200,000 units per month
  - Partners: Burger King India Limited, Baskin-Robbins, and AB InBev India
- **Refillable: Mumbai (2021 – present)**
  - Brief: System to dispense home care and personal care products in dispensable containers with a retention rate of 71% of consumers. The system can refill home care and personal care liquid through an e-refill truck.
  - Size/Capacity: Dispensed over 500 liters monthly and servicing 1,200 households. Each truck can service 3,000 liters or 600 consumers monthly.
  - Partners: Herbal Strategi, Rossari Biotech Limited, German Laundry, and EcoSys

IMPACT

- Diverted more than 8 million disposables from the landfill by helping 150 brands go zero waste during the first year of operations.
- Cupable collection: Collection rate of 77% items for reuse and an additional 91% are recycled at the end of its life cycle. 30 tonnes of plastic diverted and worked with 1,000+ farmers from October 2019 to February 2020.
- Refillable: 10,000 bottles diverted – 300 customers adopted zero waste practice over 2 months.

NOTABLE ACHIEVEMENTS AND AWARDS

- Finalists at the 'Sankalp Global Awards 2020' by Sankalp Forum.
- Winning idea under 'Ending Waste Entering the Ocean' category at the 'Reboot the Ocean challenge 2020' by the United Nations.
- **RECOGNITION:**
  - Cohort member in 'Future of Flexibles' by The Incubation Network.
  - Story covered by UnLtd India in 2020 and Mid-Day in 2021.

TEAM

(Co-founders of Cupable and Refillable)

Lokesh Sambhwani, Anupriya Nayyar

Nishith Jardosh, Purav Desai

Purav Desai, Rahul Batra

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5.4.d Searious Business B.V.

Initiative to help hotels and restaurants adopt plastic waste-free practices by supporting them to switch to reusables

Incorporation The Netherlands, March 2016

TECHNOLOGY READINESS LEVEL: 9 (Actual system proven in operational environment)

PRODUCT/SERVICE OFFERING

- Searious Business provides services to hotels, restaurants, and eateries by supporting them to switch to reusables reducing plastic waste in exchange for a service fee.
  - Provides toolkit and determines best options to replace single-use plastic, including bottles for beverages, takeaway food containers, toiletries, and cleaning products with refillable and reusable containers.
  - 1-to-1 coaching support to help switch to reusables which covers supplier contacts, communications, and staff training through a manual.
  - Monitor and evaluate reduced operational costs and plastic waste reduction. Provide additional guidelines as required.

Image 35: Reusable food package by Searious Business

INNOVATION POTENTIAL

- The replacements suggested are low-cost and smart investment.
- Once used and returned, containers are then professionally cleaned and can be reused up to 500 times.

Image 36: Bottle collection by Searious Business

NOTABLE PROJECTS

- **MOSSUP - Moroccon supermarkets tackling single-use plastics – Rabat, Morocco (2019 – 2021)**
  - Brief: Set up a reusable packaging scheme for ready meals and wet food in supermarkets. Tested it in a 4-month pilot.
  - Partners:
    -Supermarkets: Carrefour, Marjane
    -Funded by: The Netherlands Ministry of Foreign Affairs programme for Small Business Innovation Research
    -Non-Governmental Organizations and National Institutes: Ministry of Industry, Trade and Investment and the Digital Economy - Morocco
    -Association Marocaine pour la Protection de l'Environment et du Climat (ASMAPEC)
- **Plastic waste free islands – 6 Caribbean and Pacific islands (2019 – 2021)**
  - Brief: Set up refillable and reusables in hotels and restaurants, reusable packaging schemes for ready meals and wet food in supermarkets, and develop a toolkit as part of the global blueprint for hospitality businesses to follow suit.
  - Partners:
    Global Island Partnership, World Wide Fund for Nature (WWF), United Nations Environment Program (UNEP)

IMPACT

- 3,000 tonnes of plastic waste avoided through around 35 projects over the last 5 years.

NOTABLE ACHIEVEMENTS AND AWARDS

- Winners under the category of 'Plastics Recycling Ambassador of the Year' at the 'Plastics Recycling Awards Europe 2018'.
- Winners at 'Dutch Design Awards 2019 (Product category)'.
- Finalists under the category of 'Circular Economy Innovation of the Year' at the 'Sustainability Leaders Awards 2020' by Edie - Empowering Sustainable Business.
- **RECOGNITION:**
  - Green solutions partner of the European Commission.
  - Leader in the 'Sustainable Top 100' in the Netherlands.

TEAM

Willemijn Peeters *(Founder)*

Rosemarie Wuite *(Project Leader)*

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5.5

Waste to Resources

5.5.1.a Angirus IND Pvt. Ltd.

Converting plastic waste with Construction and Demolition (C&D) waste into bricks and paver blocks through their in-house developed technology

Incorporation Udaipur, Rajasthan, October 2020

TECHNOLOGY READINESS LEVEL: 7 (System prototype demonstration in operational environment)

PRODUCT/SERVICE OFFERING

- Angirus IND has developed a technology that converts plastic waste and demolition waste into bricks; this product is named 'Wricks', which is an alias for waste material bricks.

INNOVATION POTENTIAL

- Wricks:
  - Help reduce pollution from brick kilns and risk of health hazards due to inefficient Construction and Demolition (C&D) waste management.
  - Are waterproof.
  - Are lightweight compared to the traditional bricks.
  - Are in line with the affordable housing schemes of the government in the country.

Image 37: Product image: Wricks

NOTABLE PROJECTS

- **Operations of C&D waste treatment plant – Udaipur, Rajasthan (January 2021 – present)**
  - Brief: C&D waste generated in the Udaipur city gets recycled and consumed to make building materials like brick, paver blocks, and aggregates.
  - Size/Capacity: 50 tons per day
  - Partners: Udaipur Municipal Corporation

NOTABLE ACHIEVEMENTS AND AWARDS

- Grants provided for development and prototyping for 12 months during Smart India Hackathon 2019 (Hardware Edition) by the All India Council of Technical Education (AICTE).
- Awarded prize money for securing second position in 'Together 21' venture competition organized by Schulich School of Business and Startup India (2021).
- **RECOGNITION:**
  - The business is recognized under Department for Promotion of Industry and Internal Trade (DPIIT), an initiative by Startup India.

IMPACT

- 150 kg of plastic waste utilized to make around 100 bricks and paver blocks for product validation over 4 months.
- 160 tons of C&D waste recycled to make useful building material at waste treatment plant over 2 months.

Image 38: Processing of the plastic and demolition waste

TEAM

Kunjpreet Arora *(Co-founder)*

Lokesh Puri Goswami *(Co-founder)*

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5.5.1.b Rhino Machines Pvt. Ltd.

Converting plastic waste and Construction and Demolition (C&D) waste into construction material like bricks, paver blocks, and other merchandise

Incorporation Anand, Gujarat, April 1996

TECHNOLOGY READINESS LEVEL: 8 (System complete and qualified)

PRODUCT/SERVICE OFFERING

- The Rhino - Waste to Wealth Silica Plastic Blocks (W2W SPB®)
  - Solid waste like foundry/marble/industry dust (70-80%) and single/multi-use plastic waste (20%-30%) is converted into bricks, paver blocks, benches, stools, and pedestal heater base at the processing plant designed, produced, and stabilized by Rhino Machines.
  - Value is added at each stage from input beneficiaries like waste generators, processing beneficiaries like micro-enterprises, waste collection agencies to output beneficiaries like construction and furniture agencies, art, and sculpture makers.

Image 39: Products: construction material

INNOVATION POTENTIAL

- SPB®:
  - Are flexible, mouldable, recyclable, and reusable.
  - Use single-use as well as mixed plastics without segregation.
  - Can be machine and hand-moulded.
  - Offer the possibility to convert industry waste varying from 50 to 80%.


Image 40: Products: construction material

NOTABLE PROJECTS

- Pilot at Rhino Works - Anand, Gujarat (June 2019)
  - Size/Capacity: 100 kg/hr
  - Partners: Self-funded
- First commercial products - Delhi, Anand (October 2020 - January 2021)
  - Size/Capacity: INR 6 -10/kg
  - Partners: Harihar Agencies - Delhi and Concept Biotech – Vadodara
- First commercial project - Ahmedabad, Gujarat (December 2020)
  - Size/Capacity: 100 kg/hr
  - Partners: AIA Engineering Limited/Ahmedabad Induction Alloys Private Limited (Client)
- **Second commercial plant order to supply received - Guntur (March 2021)**
  - Size/Capacity: 100 kg/hr
  - Partners: Padmaja Renewables

IMPACT

- About 13,943.27 kg of waste has been collected and converted to products over various projects to date.
- Impact of SPB® pilot project over production of 200 metric tons per year from June 2019:
  - Waste consumed:
    -Plastic consumed: 70 metric tons per year
    -Dust consumed: 130 metric tons per year
  - Employment generated:
    -Direct employment: 10 workers
    -Indirect formal employment: rag pickers, waste handlers
  - Tangible local advantage:
    -Additional tourist attraction
    -New product portfolio

NOTABLE ACHIEVEMENTS AND AWARDS

- **RECOGNITION**:
  - Recognized as 'Efficient Solution' by the Solar Impulse Foundation (August 2020).

TEAM

Manish Kothari *(Founder & MD)*

Rajnikant Paghadar *(R&D Head)*

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5.5.1.c Saltech Design Labs Pvt. Ltd.

Transforming single-use plastics, industrial, and cConstruction and Demolition (C&D) waste into polymer composite building materials

Incorporation Anand, Gujarat, June 2018

TECHNOLOGY READINESS LEVEL: 8 (System complete and qualified)

PRODUCT/SERVICE OFFERING

- Recycler India – Saltech Design Labs Private Limited is a waste management company that manufactures polymer composite building materials like paver blocks and pavement tiles by extracting value from recovered waste material.

Image 41: Product image: Pavement tiles

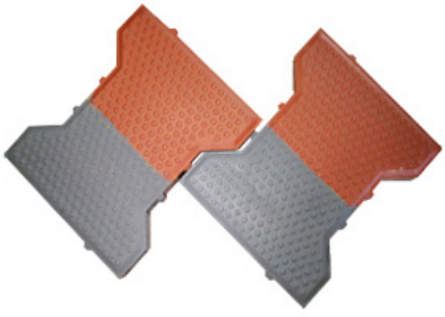

Image 42: Product image: Paver blocks

INNOVATION POTENTIAL

- Saltech Design Labs sources their waste, including mixed plastics, recovered aggregates, and fly ash/dry slurry/minerals from the city waste stream and industrial waste stream.
- Their product offerings specifically target low-cost (affordable) housing and infrastructure development. Providing a better alternative to precast cement concrete products such as block, brick, and tiles can be used for pavement/ roofing/flooring applications.
- Saltech Design Labs' technology:
  - Uses no water in product development.
- Saltech Design Labs' product:
  - Is lightweight and thermally stable up to 150 degrees Celsius.
  - Is convenient for installation due to modular design.
  - Has high load-bearing capacity and performance properties.
  - Uses precast and modular designs.

NOTABLE PROJECTS

- **Self-funded demo scale manufacturing unit (pilot) – (October 2019 - February 2020)**
  - Size/Capacity: 2 tons per day
  - Partners: (Product installed at various sites with the following collaborators).
    -Godrej Properties Limited, Pune, Maharashtra
    -Kaushal Bhaav Skill Solutions Private Limited, Nawalgarh, Jaipur, Rajasthan
    -Tata Housing Development Company Limited, Thane, Mumbai, Maharashtra
    -Gujarat Ecological Education and Research Foundation (GEER) Foundation, Cactus -Garden at the Statue of Unity, Kevadia, Gujarat
    -Rajkot Municipal Corporation, Rajkot, Gujarat
    -Shrutina Foundation, Manvadar, Junagadh, Gujarat
    -Pandit Deendayal Petroleum University (PDPU), Gandhinagar, Gujarat

- **Impact:**
  - Employment: Direct jobs created: 12 and indirect jobs created: 50+
  - Waste recycled: Plastic: 64 metric tons and industrial: 96 metric tons

IMPACT

- Technology cuts carbon emission by 60% - 80% compared to other plastic end-of-life disposal systems.
  - Creating circular economic models which can fight climate change while providing economic feasibility by offsetting 0.93 metric ton carbon dioxide emission for 1 metric ton of composite material recycled from plastic and other waste.
- Generating employment by improving the waste value chain and recycled product offerings to provide sustainable income.

NOTABLE ACHIEVEMENTS AND AWARDS

- One of the winning teams of the 'Affordable Sustainable Housing Accelerators - India (ASHA-India) program (post prototype)' under 'Global Housing Technology Challenge – India' by the Ministry of Housing and Urban Affairs (2021).
- RECOGNITION:
  - The founder, Aditya Shukla, is recognized under the 'Leaders in Innovation Fellowship (LIF)' by the Royal Academy of Engineering (2019 - 20).
  - The business is recognized under Department for Promotion of Industry and Internal Trade (DPIIT), an initiative by Startup India (DIPP number: DIPP24375) (2019).
  - Inter Ministerial Board (IMB) Certificate Holder (DIPP24375/IMB).

TEAM

Aditya Shukla *(Founder)*

Sudhir Shukla *(Co-founder & CTO)*

Yogesh Sharma *(Co-founder & Director)*

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5.5.1.d TrashCon Labs Pvt. Ltd.

TRASHCON

Sorts and recycles Multi Layered Plastic (MLP) and Low-Value Plastic (LVP) waste into sheets

Incorporation Bengaluru, Karnataka, October 2017

TECHNOLOGY READINESS LEVEL: 9 (Actual system proven in operational environment)

PRODUCT/SERVICE OFFERING

- TrashCon offers proprietary sorting technology called TrashBot® to sort plastic waste, which includes Multi-Layered Plastics (MLP), laminates, Low-Value Plastic (LVP), and recycling technology called WoWBoards® which converts the waste into recycled sheets (like ply/particle board).
- The recycled sheets are used to create furniture, floors, and roofs/ceilings.

INNOVATION POTENTIAL

- Plastic is processed locally at minimum operational costs.
- No resin or water is used during the recycling.
- The recycled sheets are waterproof, termite-proof, and further re-recyclable.
- TrashCon's business model generates dignified employment to unskilled manpower and creates micro-entrepreneurs.

NOTABLE PROJECTS

- **Completed project of recycling non-recyclable plastics like MLPs, soiled and low-value plastic from streets and landfills - Bengaluru (January 2019 - present) and Dhapa, West Bengal (November 2020 - present)**
  - Size/Capacity:
    -Dhapa: Recycled sheets – 700-800 tons per year
    -Bengaluru: Recycled sheets – 600 tons per year
  - Partners for Dhapa project: Starlite India
  - Partners for Bengaluru project: Unilever, Department for International Development United Kingdom (DFID UK), TrashCon, Bommasandra Town Municipal Council
- **Recycling plastics recovered from households - Bengaluru, Karnataka (June 2021 - present)**
  - Size/Capacity: 600 tons per year
  - Partners: Funding partner: Mondelez International, Implementation partner: Hasiru Dala Non-Governmental Organization and Ubuntu
- **24 villages became zero waste, and the plastics were used to make benches and desks for the government schools in the same districts - Hosur Gram Panchayat, Zilla Panchayat Chickballapur, Bengaluru (Established in May 2020)**
  - Size/Capacity: 2 tons per day
  - Partners: Hosur Gram Panchayat and Gauribidanur Grama Panchayat

NOTABLE ACHIEVEMENTS AND AWARDS

- Awarded 'Women Start-up of the Year 2018' by JCB India Limited at 'Startupreneur Awards 2018'.
- 'Manufacturing-(Municipal Solid Waste Segregator) Award' at Indywood Built in India Excellence Awards 2018 - National Chapter.
- Winners at 'Global Problem Solver Challenge' by Cisco in 2019.
- Winners of the 'Xynteo Exchange Impact Maker Award' in 2019. Awarded by the trade minister of Norway.
- One of the top 12 innovations chosen at the 'Informal Plastic Collection Innovation Challenge (IPCIC) 2020' to solve plastic menace by Indonesia National Plastic Action Partnership (NPAP) and the Ocean Plastic Prevention Accelerator (OPPA).
- **RECOGNITION:**
  - Recognized as one of the top 10 most innovative companies by the United Nations Development Programme (2018).
  - Recognized as one of the winners among the top 30 at 'ET Power of ideas' by The Economic Times (2019).
  - Solar Impulse Label awarded to TrashCon's technology.
  - One of the top 5 innovations presented before UN Deputy Secretary-General at the Destination Climate Action Summit (2019).

IMPACT

- Currently, with 15+ commissioned plants across 5 states in India, TrashCon is cutting the leakage of nearly 90-100 tons of mixed municipal waste into the landfills every day and saving an equivalent amount of fertile land from being degraded further.
- 10 tons of dry plastic waste and 55+ tons of organic waste per day is prevented from entering the environment and has been recycled or converted into fuel.

Image 43: WoW Products

Image 44: Toilet made with recycled sheets

TEAM

Nivedha RM *(CEO & Founder)*

Saurabh Jain *(COO & Co-founder)*

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BUSINESS INFORMATION

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5.5.2.a Goenvi Technologies Pvt. Ltd.

Decentralized conversion of plastic waste to fuel

Incorporation Thane, Maharashtra, September 2019

TECHNOLOGY READINESS LEVEL: 9 (Actual system proven in operational environment)

PRODUCT/SERVICE OFFERING

- Goenvi Technologies convert plastic waste, including waste Personal Protective Equipment (PPE) kits, into an alternative fuel using Catalytic Thermal Decomposition Pyrolysis Technology (CTDT).
- Products obtained through CTDT:
  - Petro alternate fuel (40-80% of the total products obtained)
  - Carbon char (17-32% of the total products obtained)
  - Heating fuel (3-18% of the total products obtained)
- Goenvi Technologies offers a service for the buyback of fuel.

INNOVATION POTENTIAL

- The modular design of a CTDT plant can be assembled and installed in a minimum time frame (30-45 days inclusive of installation, commissioning, and training).
- System has been successfully scaled up from 2 kg per day to 8 tons per day, further plans to scale up to 20 tons per day per module.
- The resulting fuel is:
  - Proprietary low-cost catalyst that reduces the operational cost and makes the entire process financially viable.
  - 20% cheaper alternative to crude oil.

Image 45: 10 TPD plastic pyrolysis plant for municipal solid waste that mainly consists of multi-layered plastics and zero-micron plastic bags

Image 46: 10 tons per day reactor setup at Wada, Maharashtra

NOTABLE PROJECTS

- **Kumaun University - Nainital, Uttarakhand (August 2018 - present)**
  - Size/Capacity: 50 kg per day
- **Council of Scientific and Industrial Research (CSIR) - Central Mechanical Engineering Research Institute (CMERI) – Durgapur, West Bengal (November 2018 - present)**
  - Size/Capacity: 100 kg per day
- **Petlad Nagar Palika - Anand, Gujarat (February 2019 - present)**
  - Size/Capacity: 0.5 tons per day
- **Akshay Industries - Sangli, Maharashtra (March 2019 - present)**
  - Size/Capacity: 5 tons per day
- **Green Oil India - Wada, Maharashtra (September 2019 – present)**
  - Size/Capacity: 10 tons per day

IMPACT

- Plants are processing about 35 metric tons of plastic waste per day, equivalent to removing 52,500 tonnes of carbon dioxide per year.
- Reducing plastic pollution, greenhouse gasses emissions, and burden on landfills.

NOTABLE ACHIEVEMENTS AND AWARDS

- Runner up in 'ClimateLaunchpad 2019' by European Institute of Technology Climate – Knowledge and Innovation Community (EIT Climate – KIC).
- Finalists at 'The IndUS Entrepreneurs (TiE) - Spirit of Manufacturing Awards', Delhi (2019).
- Shared the 'West Zone under Best City in Innovation & Best Practices' award at 'Swachh Survekshan 2020' with the Petlad Nagar Palika plant for providing pyrolysis technology.
- 'Indian Achievers' Award 2021 for Emerging Company' by Indian Achievers' Forum.

Image 47: Plastic pyrolysis plant

Image 48: Plastic pyrolysis plant

TEAM

Manojj Natarrajan *(Director)*

Banibrata Jana *(R&D, & Business Development)*

Nandesh Patel *(Production Manager)*

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5.5.2.b Rudra Environmental Solution India Ltd.

Converting plastic waste to fuel through Thermo Catalytic Depolymerization (TCD)

Incorporation Pune, Maharashtra, July 2009

TECHNOLOGY READINESS LEVEL: 9 (Actual system proven in operational environment)

PRODUCT/SERVICE OFFERING

- Rudra Environmental Solution provides technology to convert waste plastic to polyfuel through Thermo Catalytic Depolymerization to Urban Local Bodies (ULBs), plastic manufacturers and recyclers, and corporates to be funded under corporate social responsibility.
- The polyfuel is the replacement of Light Diesel Oil (LDO), diesel, and kerosene. It can be used in cooking stoves, incinerators, boilers, generators, agriculture pumps, generators, and furnaces.

Image 49: Plant facility

INNOVATION POTENTIAL

- The fuel resulting from the process is sulfur-free.
- The technology reverses the plastic production process and recycles all types of plastics of various thicknesses, including non-recyclable and low-grade plastic.
- Each ton of plastic produces approximately 600 to 650 liters of fuel.
  - 20 to 25% cleaned synthetic gas is used up in the process.
  - 5 to 10% residual char can be used as road filler with bitumen.
- TCD starts breaking molecules at 160 degrees Celsius, which is lower than pyrolysis, making the process safer.
  - Catalyst is used to improve efficiency and reduce risks.
  - An eco-friendly process with carbon-negative footprint.

NOTABLE PROJECTS

- 'Most Promising Company of Year Award' by Maharshi Karve Stree Shikshan Samstha (MKSSS) Smt. Hiraben Nanavati Institute of

- Management and Research for Women, Pune, and Rotary Club of Pune Gandhi Bhavan (2016).
- 'Phoenix Leading Lady Award' to Dr. Medha Tadpatrikar by Phoenix Marketcity, Pune (2017).
- Plastic waste recycling technology was awarded the 'Dynamic Asia Global award' for 'Outstanding Contribution to Recycling Industry' (2019).
- Awarded as 'Excellence in Recycling' at the Economic Times Polymers Awards 2017.
- 'Best Innovation Industry Award' by Nagesh Karajagi Orchid College of Engineering and Technology, Solapur (2017).

IMPACT

- 1 ton of recycled plastic unit saves 144,936 kg carbon dioxide per year, which is equal to planting approximately 45 trees (40-year lifespan) each year or taking away 30 cars from the road.
- In partnership with Keshav Sita Memorial Foundation Trust, Rudra Environmental Solution collects more than 15 - 17 metric tons of plastic per month.
- Collected plastic waste from more than 25,000 households in and around Pune and Pimpri-Chinchwad Municipal Corporation.
- Collected more than 750 metric tons of plastic waste that saved 45 million kg of emission till 1st quarter in 2021.

NOTABLE ACHIEVEMENTS AND AWARDS

- 'Most Promising Company of Year Award' by Maharshi Karve Stree Shikshan Samstha (MKSSS) Smt. Hiraben Nanavati Institute of Management and Research for Women, Pune, and Rotary Club of Pune Gandhi Bhavan (2016).
- 'Phoenix Leading Lady Award' to Dr. Medha Tadpatrikar by Phoenix Marketcity, Pune (2017).
- Plastic waste recycling technology was awarded the 'Dynamic Asia Global award' for 'Outstanding Contribution to Recycling Industry' (2019).
- Awarded as 'Excellence in Recycling' at the Economic Times Polymers Awards 2017.
- 'Best Innovation Industry Award' by Nagesh Karajagi Orchid College of Engineering and Technology, Solapur (2017).
- RECOGNITION:
  - Dr. Medha Tadpatrikar was recognized with the 'Swachhodaya U.P. 2019 Award' for 'Let's Recycle' program.

Image 50: Polyfuel

**Batch is defined as the maximum capacity of plastic which can be loaded into the reactor before the 7-8 hour cycle is started.*

TEAM

Dr. Medha Tadpatrikar *(Director)*

Shirish Phadtare *(Chairman)*

Rishika Mahalley *(Senior Manager - Sales/ Business Development)*

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5.5.3.a KK Plastic Waste Management Ltd.

K K Plastic Waste Management Ltd.

Reuse of plastic waste in asphalting of roads

Incorporation Bengaluru, Karnataka, 2002

TECHNOLOGY READINESS LEVEL: 9 (Actual system proven in operational environment)

PRODUCT/SERVICE OFFERING

- KK Plastic Waste Management offers an end-to-end process for the collection of plastic waste from garbage. It's sorting, cleaning, and shredding is done to manufacture flakes called 'KK Poly Blend'.
- KK Poly Blend is a polymer blend made of plastic carry bags/packing material and is used as a binding agent for bitumen and asphalt used in constructing roads.
  - This blend is mixed in the ratio of 8:100 to the total weight of bitumen in hot mix plant.

Image 51: Asphalting of roads

10. Laying the roads with waste plastic mixed ashplate.

INNOVATION POTENTIAL

- **Addition of 8% KK Poly Blend bituminous concrete mix increases:**
  - Marshall stability, flow value, and comprehensive strength of bitumen.
  - Values of fatigue life and indirect tensile strength by three times as compared with the conventional mix.

  (Certified by the Central Road Research Institute (CRRI), Center for Transportation Engineering, and Department of Civil Engineering, Bangalore University)
- The use of this technology enhances roads' durability, efficiency, and performance compared to that of plastic-free roads.

11. After laying .

Image 52: Asphalting of roads

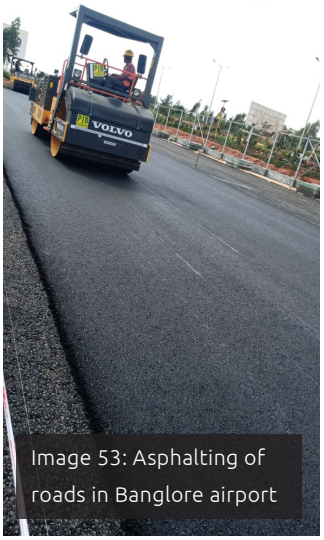

Image 53: Asphalting of roads in Banglore airport

NOTABLE ACHIEVEMENTS AND AWARDS

- Winners under the category of 'Urban Body – Private Sector Partnership' in partnership with Bruhat Bengaluru Mahanagara Palike at the 'Credit Rating Information Services of India Limited (CRISIL) Awards for Excellence in
- Municipal Initiatives 2004-05'.
  'Best Practice Award in uUrban Sector for 'Environment' category' at City Managers' Association, Karnataka in association with
- Urban Development Department, Government of Karnataka (2005-06).
  'Real Heroes Award' in the 'Environment' category by Cable News Network-Indian
- Broadcasting Network (CNN-IBN) in collaboration with Reliance Industries Limited (2008).
  'Manjushree Award' in the 'Governance and
- Innovation' category of 'Plastic Waste Disposal and Recycling' at Manjushree Awards for Innovation and Excellence 2009.
- 'Green Leaf Award' in association with Bruhat Bengaluru Mahanagara Palike at Suzuki Exnora, Hyderabad (2009).
- **RECOGNITION**
  - The plastic waste reuse technology is patented and backed up by research from the Department of Civil Engineering (Bangalore University), is certified by the Centre for Transportation Engineering (CTE) and the Central Road Research Institute (CRRI), New Delhi, and is approved by the Indian Road Congress.

IMPACT

- KK Plastic Waste Management offers up to INR 6 per Kg of non-recyclable plastic carry bags/ packing materials, thereby improving incomes of sanitary workers.
- The project also improves the socio-economic status of the city and town as many employment opportunities are created.

NOTABLE PROJECTS

- **Bengaluru municipal corporation project – Bengaluru, Karnataka (2012 - 2013)**
  - Size/Capacity: 4,500 kilometers of roads using 12,000-13,000 tons of plastic waste.
  - Partners: Bruhat Bengaluru Mahanagara Palike (BBMP)
- **Bengaluru airport project (2019)**
  - Partners: Bangalore International Airport Limited (BIAL)
- **Currently operating plastic reuse/recycling plant - Bengaluru, Karnataka**
  - Size/Capacity: Processing up to 30 metric tons of plastics per day.

TEAM

K. Ahmed Khan *(MD)*

K. Rasool Khan *(Director)*

Asif Haasan Khan *(Director)*

CONTACT

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5.5.3.b PotHoleRaja®

Road construction, repair, and maintenance using recycled plastic waste

Incorporation 2013 as Ground Reality Enterprises Pvt. Ltd. and 2016 as PotHoleRaja®, Bengaluru, Karnataka

TECHNOLOGY READINESS LEVEL: 9 (Actual system proven in operational environment)

PRODUCT/SERVICE OFFERING

- PotHoleRaja® has developed a road construction and maintenance technology with a work order model for one-time repair – the GridMats™ system.
- GridMats™ are made of 100% recycled plastic (Polypropylene (PP)).

Image 54: Concrete flooring of godown at Gayathri Associates

INNOVATION POTENTIAL

- **GridMats™:**
  - Offer crush resistance of empty grids of 300 tonnes/m2.
  - Incorporate an interlocking system, which is ultraviolet stabilized and relocatable road technology.
  - Are durable with a minimum product lifetime of 30 years.
  - Offer multiple filling options: asphalt, concrete, and red soil (landscaping roads).

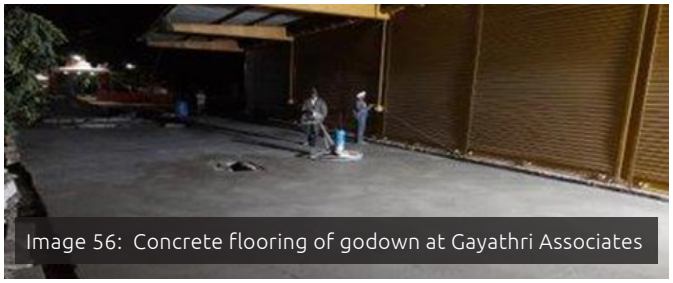

Image 56: Concrete flooring of godown at Gayathri Associates

Image 55: Bitumen Road pilot at Carsmith Motors

NOTABLE PROJECTS

- **Godown concrete flooring – Hennur, Bengaluru (2020)**
  - Size/Capacity: Area: 400 sq. mt. and plastic waste used: 1,600 kg.
  - Partners: Gayathri Associates
- **Bitumen road pilot – Bengaluru (2020)**
  - Size/Capacity: Area: 100 sq. mt. and plastic waste used: 400 kg.
  - Partners: Carsmith Motors
- **PotHoleRaja® GridMats™ speed hump – RMZ Ecoworld, Bengaluru (2020)**
  - Brief: Built the first road hump from plastic waste in India from cold asphalt with an installation time of 2 hours.
  - Size/Capacity: Plastic waste used: 36 kg.
  - Partners: RMZ Group (Now Brookfield)

IMPACT

- A minimum of 20 tonnes of recycled plastic is used per kilometer of road construction using PotHoleRaja® GridMats™ over the last 1 year.
- 3 metric tons of recycled plastic used in the last 1 year by fixing 7,500+ potholes in 6 cities and maintaining 1,000+ kilometers of road.

NOTABLE ACHIEVEMENTS AND AWARDS

- Winners of the 'Urban Liveability Challenge' by Social Alpha (2019).
- One of the top 25 startups in 'WhatsApp Grand Challenge' by Startup India (2019).
- Overall winners of the 'BlueSky Thinking Track' at Electron Vibe 2020 by New Energy Nexus.
- RECOGNITION:
  - Story covered by YourStory and The Logical Indian.
  - Members of 'Brigade Real Estate Accelerator Programme (REAP) - Cohort 6'.

TEAM

Dr. Prathaap B *(Founder & CEO)*

Sourabh Kumar *(Co-founder & COO)*

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5.6

Others

5.6.a Sanshodhan An E-Waste Exchange Pvt. Ltd.

Plastic exchange using blockchain

Incorporation Hyderabad (Ranga Reddy district), Telangana, November 2017

TECHNOLOGY READINESS LEVEL: 6 (Technology demonstrated in relevant environment)

PRODUCT/SERVICE OFFERING

- Sanshodhan has developed a plastic exchange using blockchain. They plan to sell plastic credits to brands, producers, and importers (mandated for Extended Producer Responsibility (EPR) compliance and other sectors like Fast-Moving Consumer Goods (FMCG)/e-commerce, etc. to turn plastic neutral).
- Sanshodhan will develop a tech platform to hyper-locally connect the hotels, dharmshalas, shops, and organizations with authorized plastic pickers and recyclers.

INNOVATION POTENTIAL

- The incentive for each market segment will be defined and showcased on Sanshodhan's tech platform, and each segment will be motivated to leverage the benefits/incentive against their plastic waste. This mechanism will solve the plastic waste menace issue in the selected geography.
- Implementing plastic exchange for plastic credits in India will formalize the process of collecting waste.

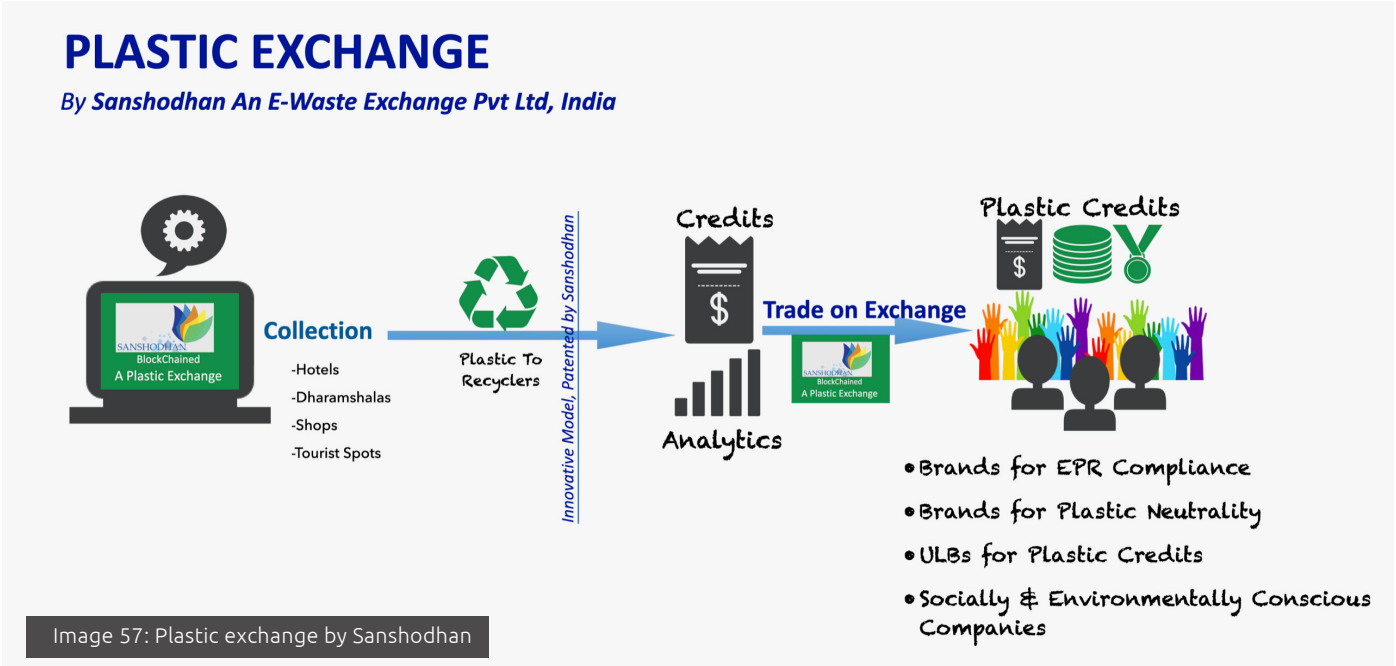

Image 57: Plastic exchange by Sanshodhan

NOTABLE PROJECTS

- **Established an e-waste exchange for online aggregation of e-waste – Hyderabad, and Lucknow (Pilot: June 2018 - December 2019)**
  - Brief: Sanshodhan developed a tech-based system to connect brands and consumers with government-authorized and technologically competent e-waste dismantlers and recyclers for safe recycling. This system enables child-labor-free and environment-friendly recycling. It aims to prevent leakage of e-waste to the informal players, thus preventing e-pollution.
  - Size/Capacity: Being used by more than 15,000 households, 15 Small and Midsize Businesses (SMBs), 12 large-scale businesses, 5 government departments, and several embassies.
  - Partners: Launched by Information Technology, Electronics and Communication Department, and Telangana Industries Department of the Government of Telangana.
- **Re-Circulate™: A circular economy label – Telangana (August 2020)**
  - Brief: It is to certify the circularity of products and business units.
  - Partners: Launched by the State Government of Telangana, Partnered with Global Institute for Circular Economy and Sustainable Development Goals, and consortium of Non-Governmental Organizations from Europe.

IMPACT

- Enabled recycling of 152 tons of plastic through 8 B2B clients within 1 year.
- Enabled recycling of 60 tons of plastic from e-waste in approximately 2 years.

NOTABLE ACHIEVEMENTS AND AWARDS

- 1st prize under the 'Waste' sector at 'Department of Industrial Policy and Promotion (DIPP) Swachch Bharat Grand Challenge', by the Ministry of Commerce and Industry, Government of India (2018).
- Winners of the 'SDG Global Challenge' organized by Responsible Finance and Investment (RFI) Foundation and DDCAP (Dubai International Financial Center (DIFC)) Limited (2019).
- One of the top 10 finalists at the 'Better Together Award – Collaborative Solutions for Local Climate Action 2019' facilitated by Impact Hub, Berlin on behalf of Federal Ministry for the Environment, Nature Conservation and Nuclear Safety of the Federal Republic of Germany.
- Winners of the 'E-Waste Artifacts Design Competition (2020)' by Information Technology Development Agency (ITDA), Government of Uttarakhand.
- RECOGNITION:
  - Recognized by the World Economic Forum for innovating 'Circular Economy for E-waste Management Sector' (2019).

TEAM

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Shivaani Vishwakarma *(Co-founder)*

Bibhay Ranjan *(Tech Advisor)*

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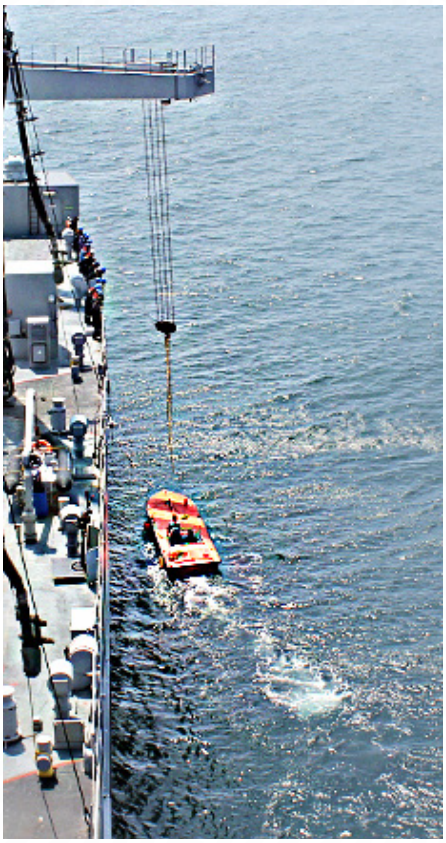
Geocycle India Launches
Plastic Free
AGRA
ACC
Ambuja Cements




Rhino
Rhino


BLUE BARRIERS


REFILLABL


recykal

06: Annexure

6.1 Annexure 1: About the businesses/additional information about the businesses

- Any legal entity in existence for at least 6 months
- The business should have a Technology Readiness Level of 5 and more above as follows:
  - TRL 5 – Technology validated in relevant environment (industrially relevant environment in the case of key enabling technologies)
  - TRL 6 – Technology demonstrated in relevant environment (industrially relevant environment in the case of key enabling technologies)
  - TRL 7 – System prototype demonstration in an operational environment
  - TRL 8 – System complete and qualified
  - TRL 9 – Actual system proven in operational environment (competitive manufacturing in the case of key enabling technologies; or in space)

6.2 Annexure 2: Screening criteria of the applications (Application Phase)

- Completeness of application.
- Existence of the business as a legal entity in existence for at least 6 months.
- Technology component of the proposed solution being a minimum of Technology Readiness Level 5.
- Does the proposed business solution address the thematic problem statements specified?
- Deployment readiness of the solution.
- Can the proposed solution be deployed in the cities of Rishikesh and Haridwar?

6.3 Annexure 3: Scoring criteria of the applications and pitch deck (Application Phase and Pitch Phase)

- Suitability of solution.
- Market potential of the proposed solution.
- Suitability of applicant
- The overall quality of application/pitch

6.4 Annexure 4: Jury composition

- Rishikesh Nagar Nigam
- Nagar Nigam Haridwar
- Alliance to End Plastic Waste
  - Milind Chavan (Sustainability and Advocacy Lead, Dow)
  - Chintan Joshi (Head - Communications, Covestro India Pvt. Ltd.)
  - Ursala Thakkar (New Business Development, TotalEnergies)
  - Fatemah Al Faresi (Senior Marketing Specialist, EQUATE Petrochemical Co.)
- Karo Sambhav
  - Pranshu Singhal (Founder)
- Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
  - Christopher Speier (Technical Lead – Plastic Waste Management, Circular Economy and Marine Litter Prevention)
  - Kamna Swami (Advisor)

Climate Collective Foundation

- Pratap Raju (Founding partner)
- Jui Joshi (Partner)

aviral
Reducing Plastic Waste in the Ganga

Powered by: ALLIANCE TO END PLASTIC WASTE

Implemented by: giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

In co-operation with: CLIMATE COLLECTIVE