Digitalization of the Plastic Value Chain in Southeast Asia - Piloting of Digital Solutions for Plastics Circularity

PROMOTING ACTION ON PLASTICS POLLUTION FROM SOURCE TO SEA IN SOUTHEAST ASIA AND PACIFIC
SUBPROJECT 2: PRIORITIZING AND IMPLEMENTING ACTIONS TO REDUCE MARINE PLASTIC POLLUTION

TA-6669 REG

18th of June 2025

In Consortium with

CONSULTING ENGINEERS

Conference
Agenda

01
Screening of digital solutions

02
Piloting digital solutions for Plastics Circularity

03
Leveraging AI & Data Analytics

04
Q & A

Screening of digital solutions
Classification of global and regional digital solutions in the plastic value chain
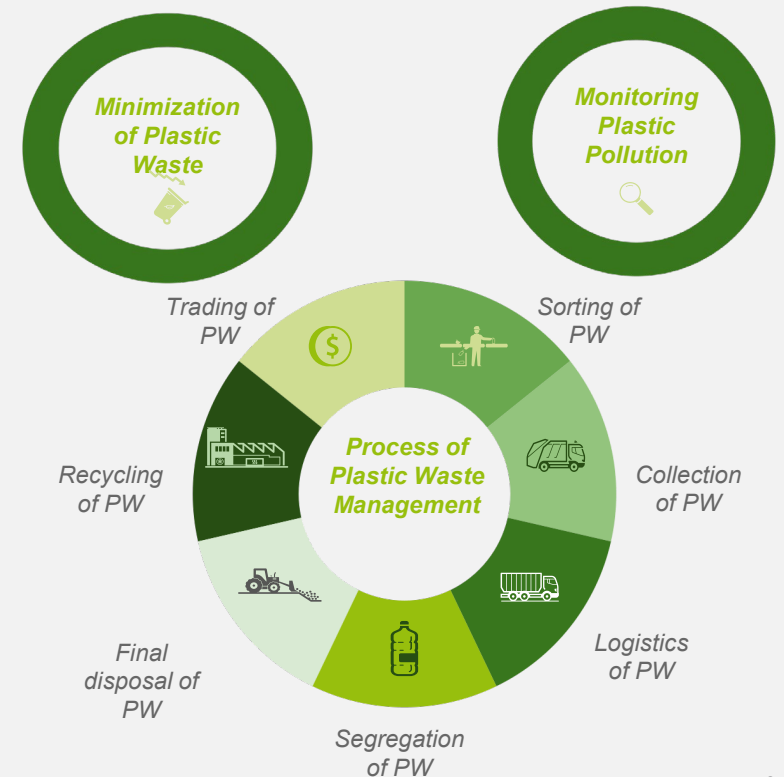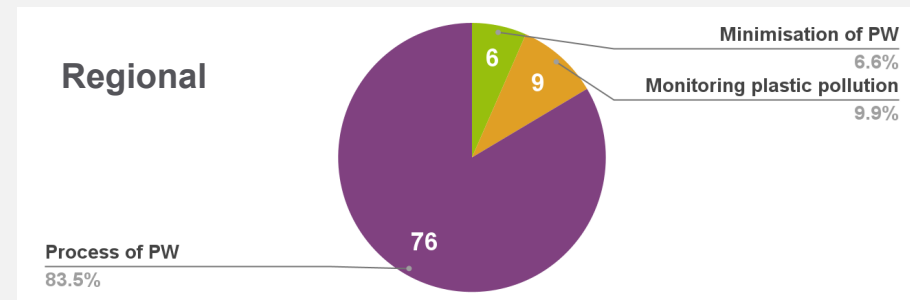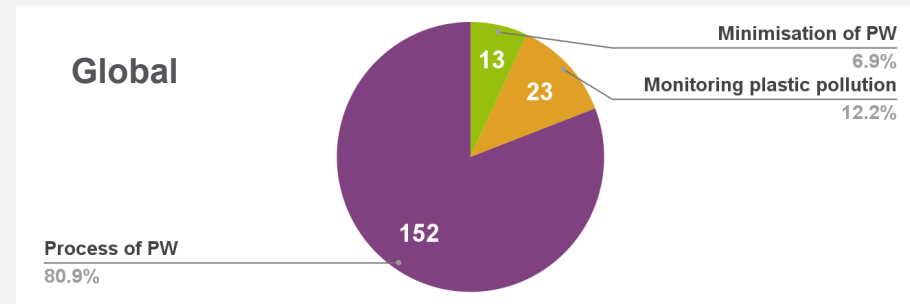
Database
- Creation of extensive **global database** with **> 200 digital solutions** focused on plastics
- Analysis of various parameters including: business model, current status, user base, technology used, segment of application, type, requirements etc.

By sector and segment of application

- **Minimisation of plastic waste;**
- **Monitoring of plastic pollution;**
- **Processing of plastic waste.**

The majority of solutions are focused on the processing of plastic waste.

Global
- Minimisation of PW — 6.9%
- Monitoring plastic pollution — 12.2%
- 13
- 23
- 152
- Process of PW — 80.9%

Regional
- Minimisation of PW — 6.6%
- Monitoring plastic pollution — 9.9%
- 6
- 9
- 76
- Process of PW — 83.5%

Minimization of Plastic Waste

Monitoring Plastic Pollution

Process of Plastic Waste Management
- Sorting of PW
- Collection of PW
- Logistics of PW
- Segregation of PW
- Final disposal of PW
- Recycling of PW
- Trading of PW
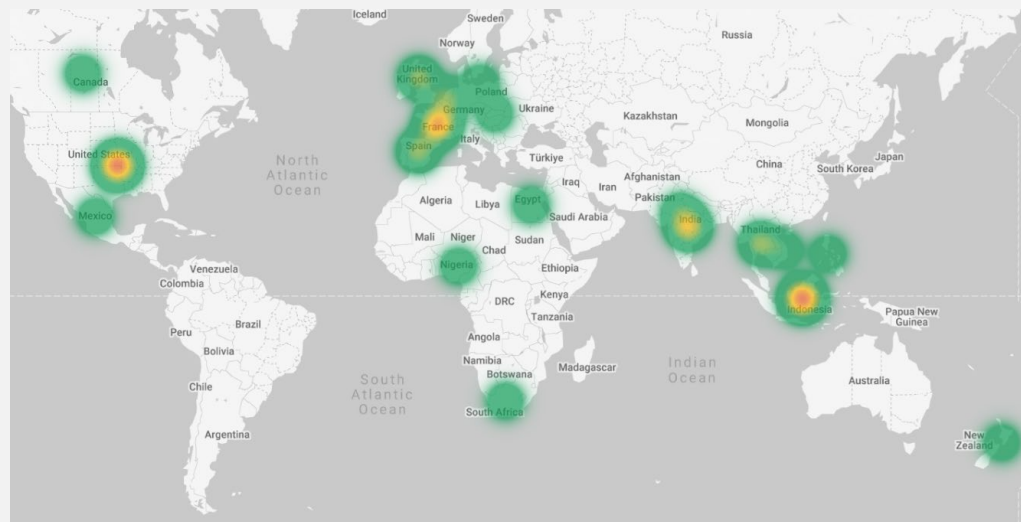
Screening of digital solutions
Global and regional digital solutions by functional utility for users

Solutions by functional utility for users

- **Awareness:** Providing a fresh perspective and aid in understanding environmental issues and poor waste management.

- **Performance:** Aiming to improve different segments of the plastic value chain.

- **Traceability:** Identification of flows, tracking, creation of databases, geolocation etc.

- **Cash Transfer:** All solutions that enable payment for the trade of plastic waste or for services related to plastic waste management.
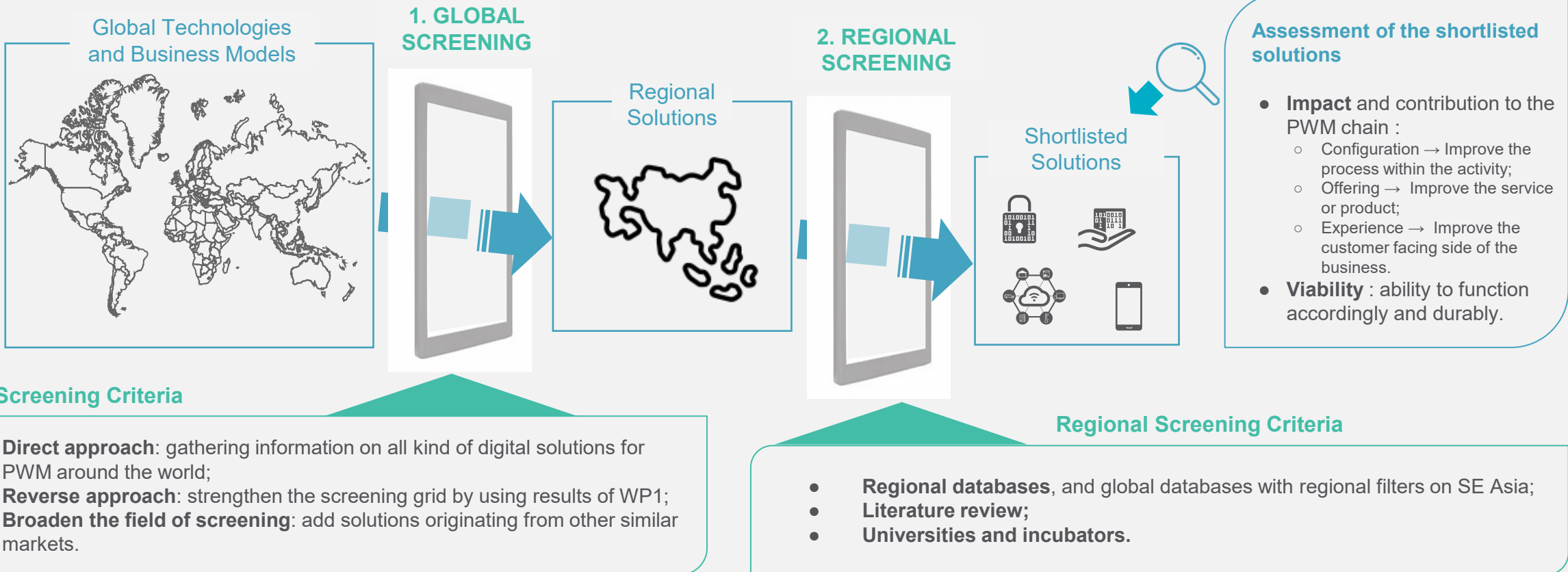
Awareness solutions are mainly deployed in the U.S and in Europe

Solutions concerning payments are mainly deployed in the Southeast Asia region

Screening of Digital Solutions
Understand the global landscape of digital solutions for PWM to select promising apps at the regional level

Global Technologies and Business Models

1. GLOBAL SCREENING

Regional Solutions

2. REGIONAL SCREENING

Shortlisted Solutions

Assessment of the shortlisted solutions

- **Impact** and contribution to the PWM chain :
  - Configuration → Improve the process within the activity;
  - Offering → Improve the service or product;
  - Experience → Improve the customer facing side of the business.
- **Viability** : ability to function accordingly and durably.

Global Screening Criteria

- **Direct approach**: gathering information on all kind of digital solutions for PWM around the world;
- **Reverse approach**: strengthen the screening grid by using results of WP1;
- **Broaden the field of screening**: add solutions originating from other similar markets.

Regional Screening Criteria

- **Regional databases**, and global databases with regional filters on SE Asia;
- **Literature review**;
- **Universities and incubators.**

The review of the digital solutions available was made in light of the challenges identified along the plastic value chain and in the perspective of the plastic treaty

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Piloting digital solutions for Plastics Circularity
Scope and Objectives

Digital Solutions tested in Viet Nam
- **mGreen**
- VECA
- Grac
- **Digital marketing**
- Cybersecurity

Digital Solutions tested in Indonesia
- **Duitin**
- Ekologis
- **pLitter AI**
- Alner
- **Digital Marketing**/ Cybersecurity

Objectives
- Examine the **scalability of digital solutions**, demographic & geographic expansion.
- Evaluate the **effectiveness of already established solutions** (in social inclusion, informal sector conditions, in plastic waste reduction, in increasing recycling rates etc.)
- **Improve technical aspects** of solutions (security, features etc.)
- **Test limited used solutions** (digital marketing for awareness)
- Evaluate the **effectiveness of plastic schemes** (EPR, plastic credits, CSR)

Piloting Results - Duitin
Overview

Materials Recovery Facilities (MRFs)
Facilities in 3 areas for **buying and selling waste**.
- Waste from corporate-funded projects
- From household collections

Market price knowledge through the Tradisi platform.

Household - Collector activities
5,000 active households use app **for waste pickup** (Duitin's internal fleet).
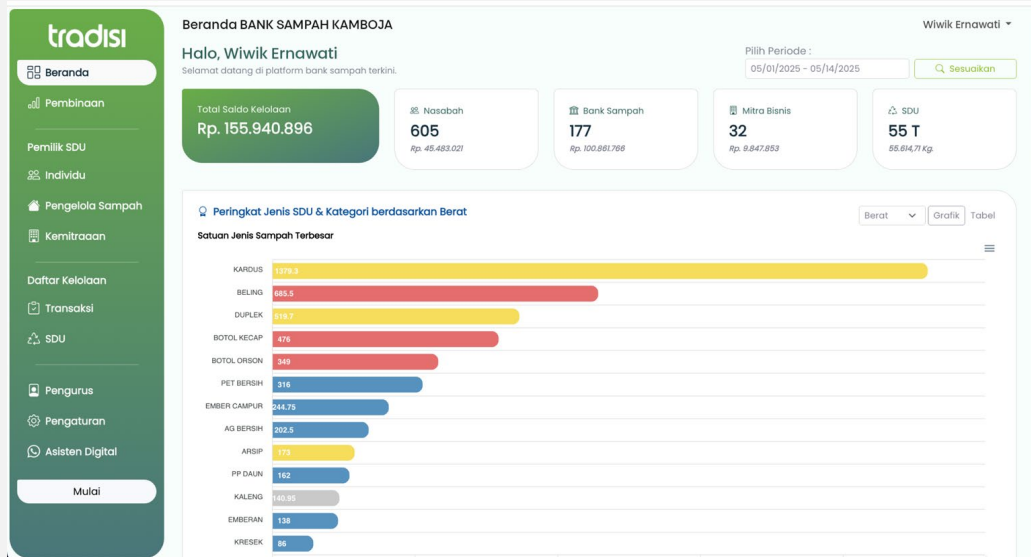
Flow of waste

Waste Banks (Bookkeeping solution)
Tradisi digital platform for waste banks to track transactions, their stock, and view daily prices.

Corporate and Business services
Waste recovery (FMCGs), employee training, funded waste collection, and office waste management.

Piloting Results - Duitin
Digital ecosystem

Waste Bank platform: For bookkeeping, reporting, and enhanced participation in the circular economy.
⇒ waste volumes
⇒ daily waste prices for trading
⇒ National reporting tool (in discussion with government)

Corporate Social Responsibility (CSR) funding & training improving Waste Bank management and revenues
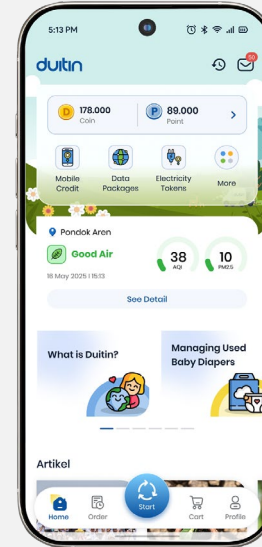
Household App: users can request waste pickups and earn rewards. It promoting household segregation and environmental awareness.
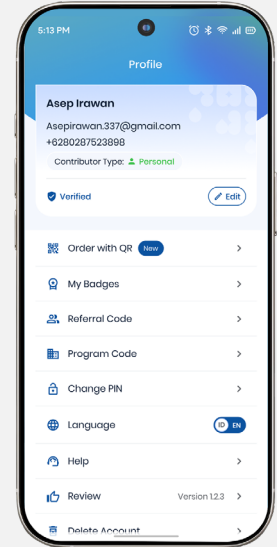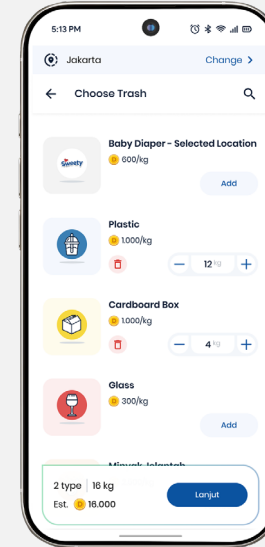
Waste-picker App: Connects waste pickers to pickup requests and facilitates collection.

Used for corporations, businesses and other stakeholder waste collection requests.

Piloting Results - Duitin Waste Bank Platform
Key Findings from Waste Banks Users (2022-today)
Ciamis & Cirebon: March 2025

Participants
- 🗑 2 main waste bank users
- 🗑 14 waste bank unit users

9 existing users; 7 potential users

Waste Banks (Existing User)

- Waste is currently **recorded manually and then entered into Tradisi**, indicating a potential area for streamlining.

- High satisfaction with the Tradisi platform and waste management process.

- Transaction input **via mobile is preferred.**

- 75% of Waste Banks managed by women
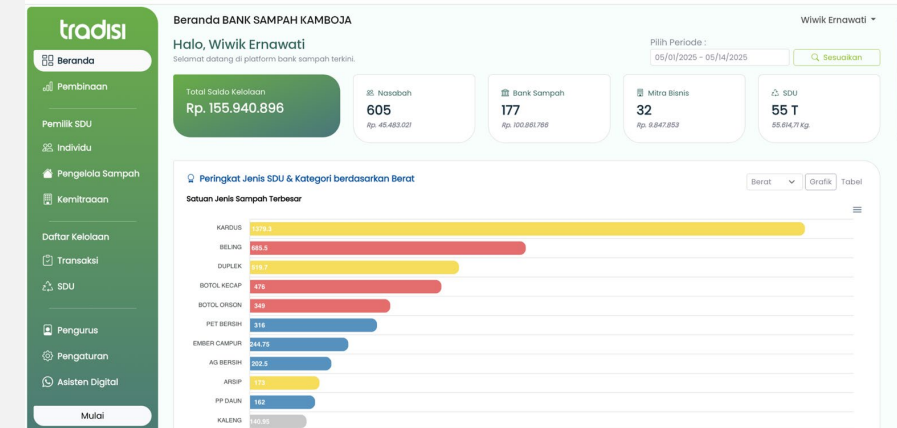
- The *Tradisi* platform considered easy to use ⇒ move to mobile app

- Data analysis features of the *Tradisi* platform are attractive

- Resolves trust and transparency issues between Waste Bank management and employees

- Resource training and governance need to be addressed, involving government, developers and users.

Piloting Results - Duitin
Key Findings

Jakarta & Bandung: April 2025

duitin

Businesses/ Corporations

- Businesses choose Duitin for its data transparency, ease of use, and potential for **waste recycling** and **financial benefits for informal sector**.

Notable clients: IKEA, Kimberly-Clark

Household Users

- Many households **already** segregate waste or are **motivated to do so** They want a sustainable lifestyle & a better environment

Ask to increase types of waste accepted and <u>reduce the **minimum pickup amount**</u> are suggested

Waste Pickers

- Primarily motivated by **income and flexibility**.
- earns 20% of their revenue from Duitin

⇒ Provides support like uniforms and IDs, and should consider distance in **cost calculations** to **improve picker satisfaction** and recognition.

- **Waste Pickers: Income and flexibility are key motivators**
- **Households: challenges in sorting include space constraints and consistency.**
- **Businesses: Data recording and real-time reporting features are valued by businesses.**

Selected piloting App - mGreen
Overview

CSR activities
Corporate partners for CSR purposes or consultancy and communication services.
- Setting up waste management systems
- Setting up collection hubs
- Increasing collection and segregation rates
- Awareness campaigns and training

Household - Collector
Through the mGreen app, residents can schedule pickups of segregated waste, through waste pickers using Collector app.

Households are paid for the recyclable waste through mPoints after a fee is deducted for mGreen.
⇒ **fee not applied yet**

Waste management software (admin system)
For waste management services:
- manage customer base and collectors
- set up information on prices & types of recyclables
- setup collection schedule & manage fees

Selected piloting App - mGreen
Digital ecosystem
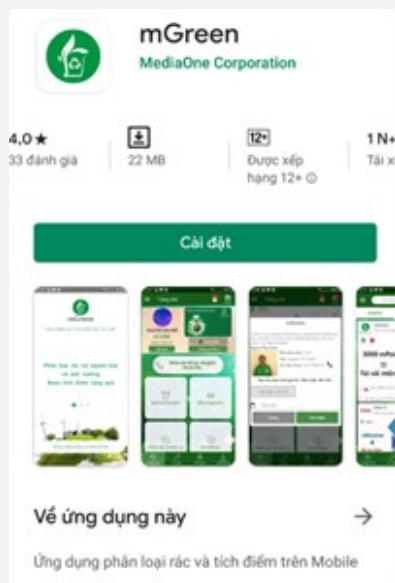
mGreen app for Households
Allows them to schedule the pickup of their waste

mPoint
Reward system for households that used the application based on the amount of waste they segregate
⇒ for future monetization (10% fee)
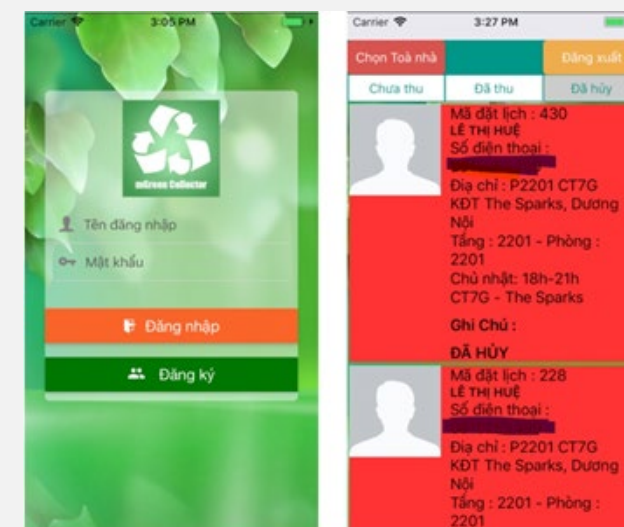
mGreen app for Collectors
Allows them to connect to households/ business that request waste collection

Piloting Results - mGreen App

Key Findings

Nam Tu Liem, Hanoi & Hue City - March 2025 - Potential users

Waste management service

- Used to schedule collection, record data etc.
- Ease of use but **training needed** for implementation

⇒ Increased revenues, collection rates and traceability of volumes and earnings

💡 **Funding and partnerships needed for scalability**

Junkshops

- 25% consider joining mGreen although were **unaware of the app** before
- 100% have smartphone and social media
- 75% face digital apps and digital marketing with apprehension
- 50% **struggle** with digital technology

Businesses

- 80% **already segregate waste**
- 20% **sell their waste**
- 65% are interested in joining mGreen and app fits their process vs 35% say **it's time consuming**

⇒ All would mGreen join for monetary incentives

Households - High awareness

- 92% of households willing to segregate waste **if provided bins**
- 45% interested in using mGreen
- **Regulations, awareness** main reasons for segregation followed by monetary incentives
- Request for quasi-daily collections (**conflict** with high recyclable volume orders needed by collectors)

Piloting Results - mGreen App
Key Findings

Nam Tu Liem, Hanoi & Hue City - March 2025

Participants

🏢 2 businesses

🧳 4   waste pickers

🏛 8 households

Existing Waste Pickers

- Express strong appreciation for mGreen application
- Been using the app for 1-3 years
- **10-15% increase in orders** since adopting the app → 8-10% rise in income
- New orders received quickly, manage orders & earnings effectively

Existing Households & Business

- Been using mGreen app for 1-3 years
- High satisfaction using the app
- Effectively help in segregating recycles
- **Easy to use** and encourage waste management practices

- Foster **more waste management groups**, **healthcare** support including health insurance support and annual check-ups
- Marketing campaigns and local community engagement to encourage plastic waste segregation
- Additional support on working equipment, environmental protection and labor protection

Digitalization of the Plastic Value Chain in Southeast Asia
Business models analysis

Corporate funding:
Funding from companies to support initiatives that align with Extended Producer Responsibility (EPR) policies, Corporate Social Responsibility (CSR) commitments, or plastic credit schemes.

Subscription and transaction-based fees:
Revenue generated through recurring subscription fees or transaction charges for using digital platforms or services.

Donations:
Financial support received from private individuals or organizations to fund operations and initiatives.

Collection fees:
Charges collected from households or businesses for waste collection and management services.

Waste management model:
Integration into the waste management value chain by becoming aggregators, recyclers, or service providers while leveraging digital technologies to optimize operations and connect with clients.

Digital Marketing Campaigns
Duitin & MGreen
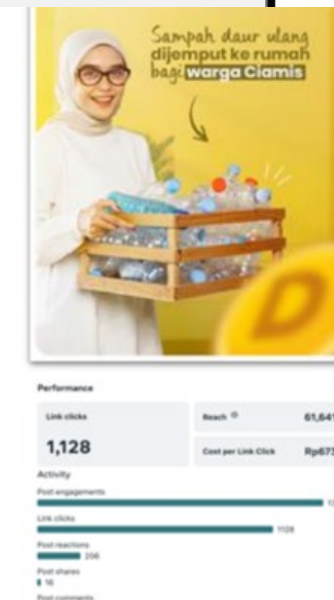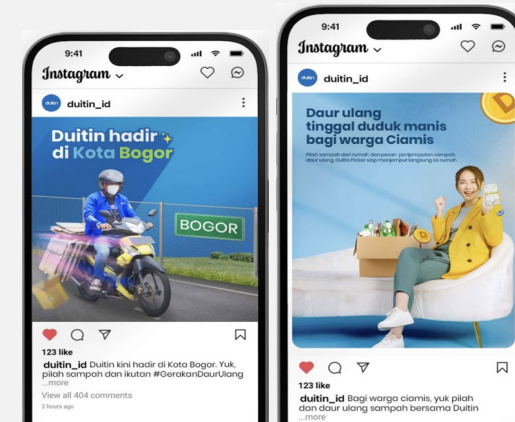
Piloting Results - Digital Marketing Findings Hue City
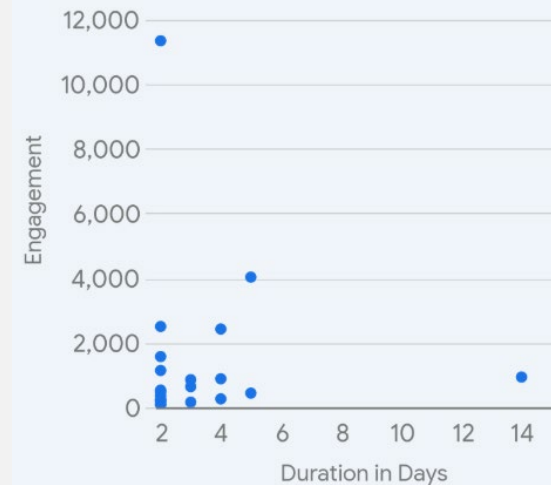## Key Findings

A cost-effective way to reach a large audience and raise awareness.

⇒ Call–to-action posts have higher reach indicating a higher probability of converting new users by using links or QR codes

- Facebook ads can reach 1,000 people for as little as $6.75.
- Cost per reach can be optimized through effective ad design and targeting.

Engagement independent of ad duration

Higher engagement with video (likes, comments etc.)

Piloting Results - Duitin
Digital Marketing Campaign

Ciamis & Bogor: April/May 2025

- **High number of views, but low clicks** – Ads widely seen, engagement was limited. Weak call-to-action messaging.

- **Clicks number low but cost-effective**

Bogor city: 328,500 households with an 80% smartphone penetration
⇒ **$100 to reach 80% of the households in Bogor**, with targeted ads on plastic awareness

- Visuals **close to everyday life** worked best
- Landing page confusion reduced conversions – Having **two calls-to-action** (WhatsApp & App Store) equals hesitation, **lowering action rates**
- **Local influencers** better for user targeting and driving engagement
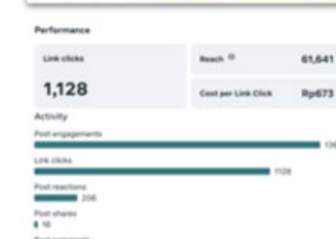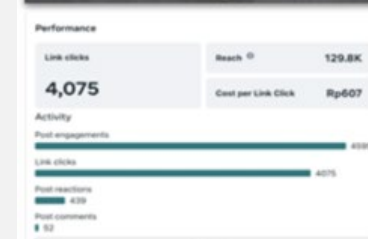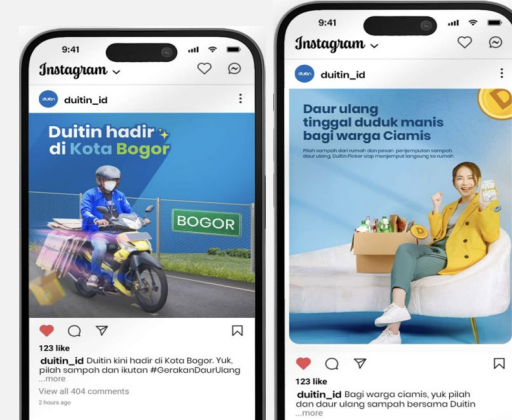
Piloting Results
Digital Marketing Campaign Insights

- Social media marketing offers low-cost awareness. Low cost per click (CPC) in Southeast Asian countries.
  ⇒ **CPC**: $0.08 in SEA vs $0.23 in the EU

- Video content significantly increases user engagement.

- Local influencers drive better user targeting.

- Clear calls to action improve conversion rates.
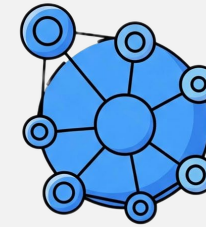
SOCIAL MEDIA   **VIDEO CONTENT**

LOCAL INFLUENCERS   **CALL TO ACTION**

Typical ad: Very high number of views – very low number of downloads

Local influencer ad: lower views, higher engagement, higher number of downloads

Conclusion & Challenges
Key Findings

Conclusion

- Setting up and managing community waste management systems with digital apps – **None benefits from Extended Producer Responsibility (ERP) funds (mostly CSR)**

- **Collaboration** with governments, corporations, NGOs crucial for **scaling the apps**

- Need for more **user-friendly** and to improve lagging issues

- **Regulations** is seen as a **key motivator** for households to segregate and pay collection fees.

- CSR activities higher in Indonesia and support digital initiatives – High competition in Viet Nam with low profitability ⇒ **absence of enabling conditions** makes for less robust business models (absence of market)

Challenges

- **Hesitation due to reliance** on traditional methods

- Challenges in **integrating** informal workers **into formal regulatory** frameworks

- Low awareness – **Lack of behavior change** campaigns toward sustainable practices

- **Funding constraints** for CSR and EPR initiatives and **lack of monitoring of funding (need of frameworks)**
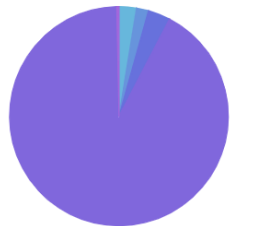
Piloting Results - Waste Identification AI model for floating waste
Key Findings

**Can Tho April 2025 - Live feed from pLitter
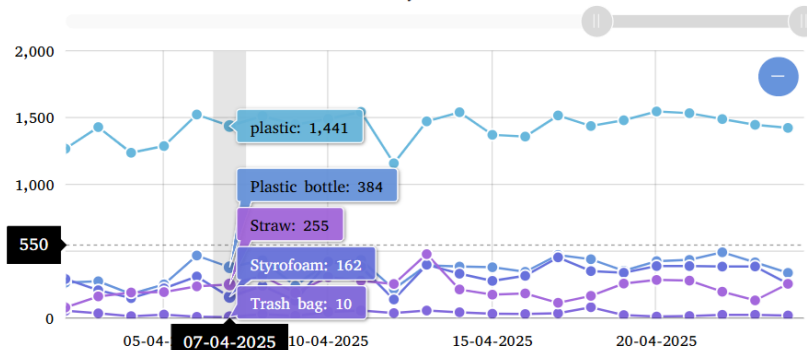UNEP - Asia Institut of Technology**
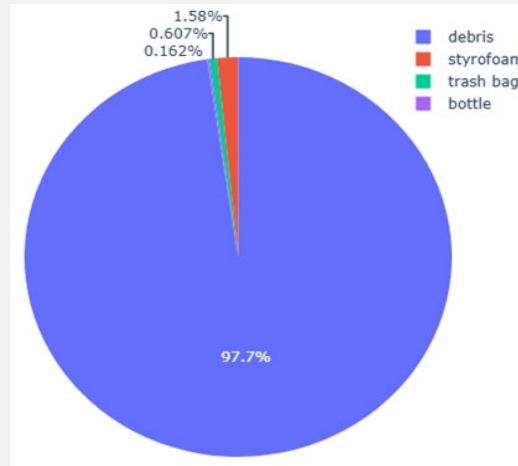
Piloting of the plastic litter identification AI model

debris 0.34

Composition of floated litter detected

Styrofoam	2.6%	Straw	1.8%
Plastic bottle	3.3%	plastic	92.0%
Trash bag	0.3%		

Litters by Date

plastic: 1,441
Plastic bottle: 384
Straw: 255
Styrofoam: 162
Trash bag: 10

550

05-04 07-04-2025 10-04-2025 15-04-2025 20-04-2025

1.58%
0.607%
0.162%

- debris
- styrofoam
- trash bag
- bottle

97.7%

Number of waste detected per image

Numéro de frame
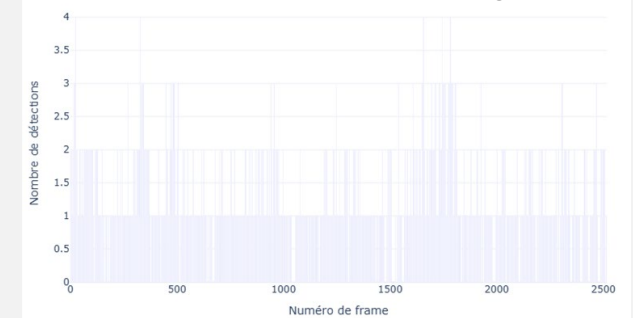
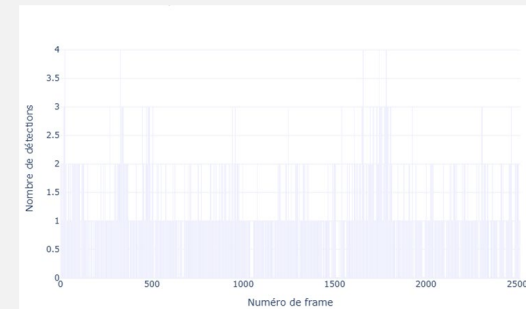# Piloting Results - pLitter Waste Identification
Key Findings

Solution easy to implement:
- No need for particular AI expertise
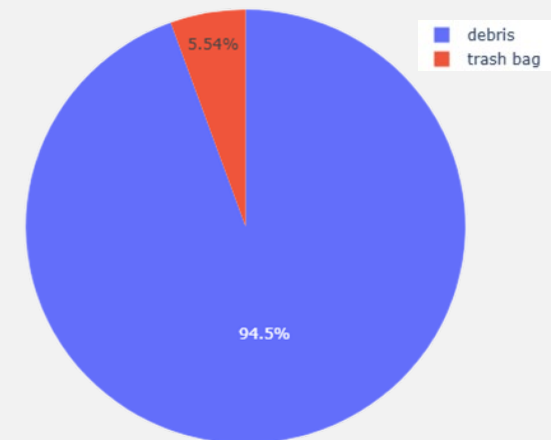- Low equipment costs

Implementation

- CCTV ($100)
- AI module (pe NVIDIA Jetson $100)
- Support equipment ($50)

⇒ **$250 per location**

Local context and water-body conditions affect model's efficiency:

The model need to be retrained with images of the new location every time it's implemented

Conference
Agenda

01
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02
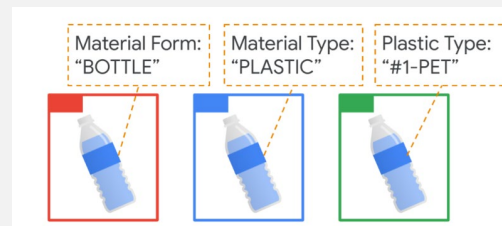Piloting digital solutions for Plastics Circularity

03
Leveraging AI & Data Analytics

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Leveraging AI
## CircularNet (Google) for Materials Recovery Facilities (MRFs)

Material Form: "BOTTLE" | Material Type: "PLASTIC" | Plastic Type: "#1-PET"

CircularNet can help improve MRF operations:
- Quality control
  ⇒ real-time contamination level monitoring
- Data collection and traceability
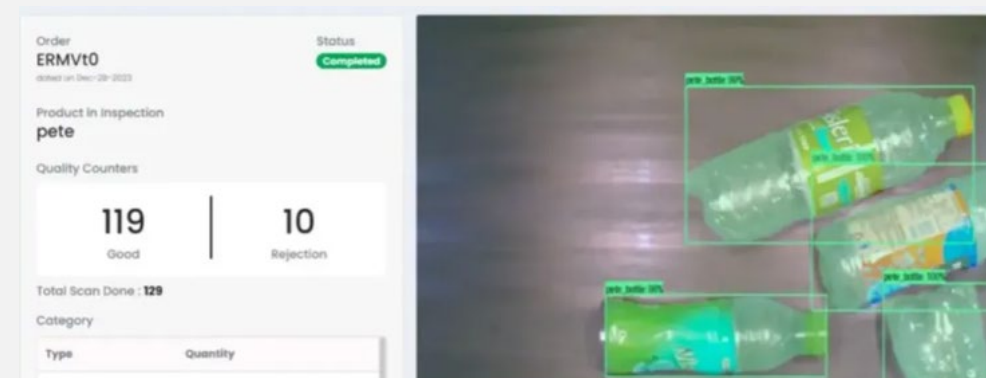- Reporting for decision-making

Implementation

- Camera (e.g GoPro $300)
- AI module (e.g NVIDIA Jetson $100)
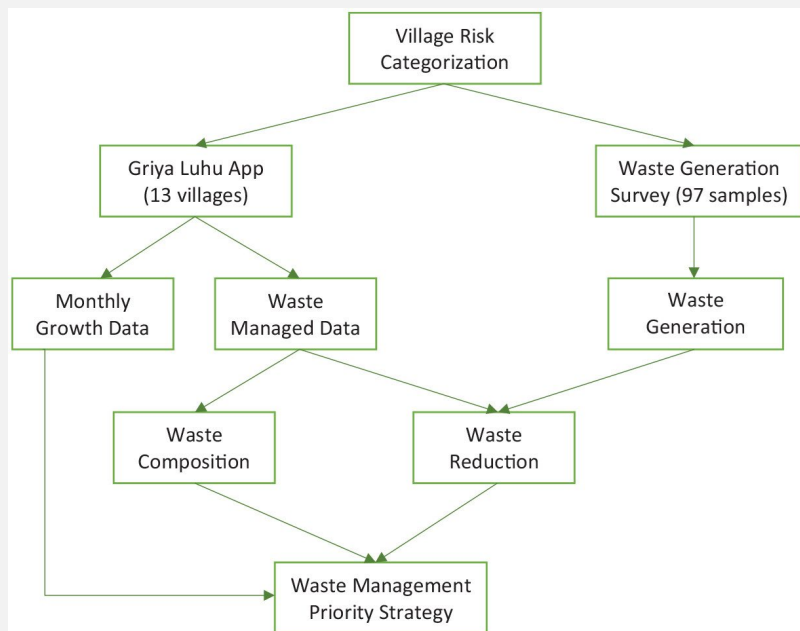- Support equipment ($50)

$450 per location

Example Setups

Global Shutter Machine Vision Camera

Rolling Shutter GoPro
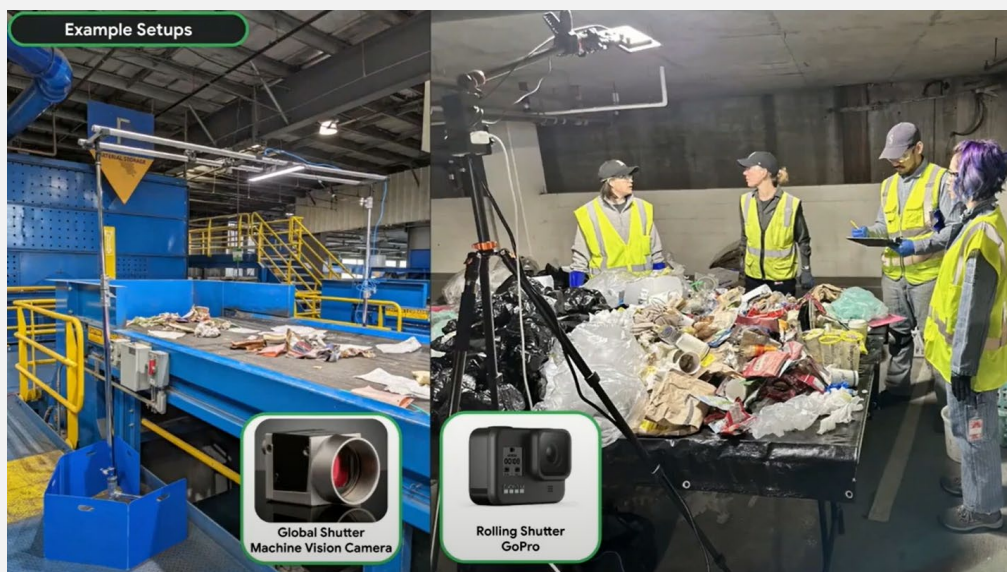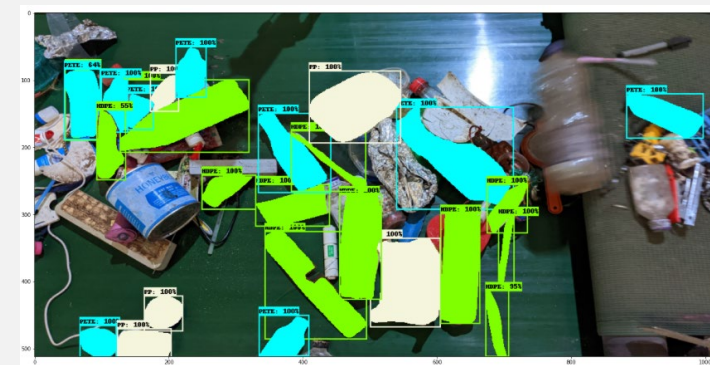
waste-innovation-external@google.com

Quality control - Saahas Zero Waste India
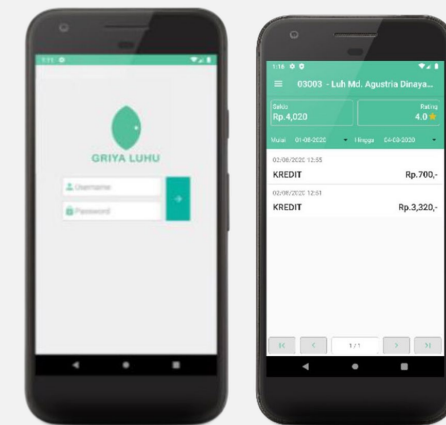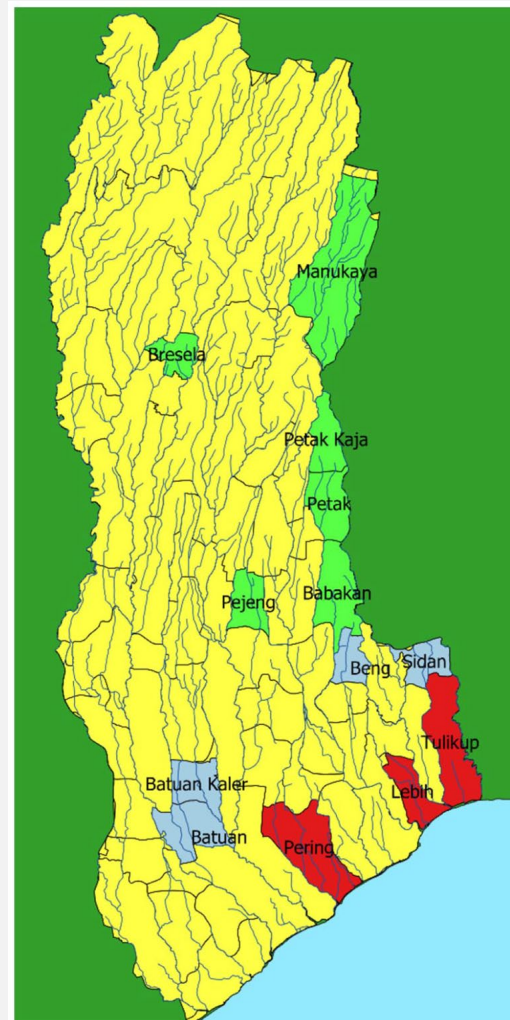
Data Analysis - Prioritization
Identifying risk areas with Griya Luhu app

Data from different sources to assign leakage risk levels to areas in Bali.

- Distance of area from the sea
- Waste management data from Griya Luhu app
- Data from surveys

Can be used to prioritize operations and investments.

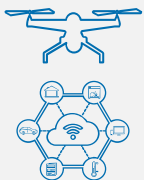| Low-Risk	Medium-Risk	High-Risk
1. Bakbakan	1. Batuan	1. Lebih
2. Benawah	2. Batuan Kaler	2. Tulikup
3. Petak Kaja	3. Beng	3. Perangsada
4. Manukaya	4. Sidan	
5. Bresela		
6. Pejeng		

AI-Powered Waste Management
Data collection to decision making

Comprehensive Assessment Systems for Reporting and Plastic Leakage Risk Classification

Input Sources

Computer Vision Inputs

- Real-time monitoring
- City-wide to site specific

Citizen Science Inputs

- Punctual inputs for specific projects
- Regular inputs in Smart City or Waste Management apps

AI & Data Processing Models

Waste Detection Models

General models:
Yolov5/ FasterR-CNN

Specific models:
APLASTIC-Q/
WasteNet/ CircularNet
PlasticNet/ pLitter

Detection/ Classification
Quantification
Quality control
Automated Sorting

Aquatic or Urban environment
Industry (MRFs)

- Municipal or Industrial application
- Real-time or punctual analysis

Scoring Frameworks

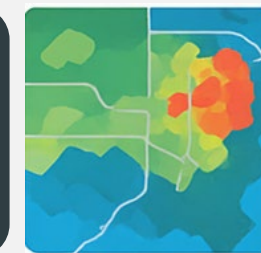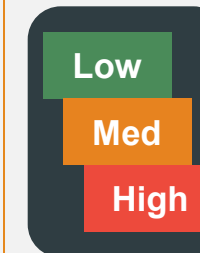**Cleanliness Index (CI):** District-level cleanliness scoring (Spain)

Plastic Hotspot Waterway Mapping: plastic density heatmaps tied to locations

SPOT (Leeds UC): Spatial hotspot maps of an area's plastic pollution

Plastic Hotspot Framework: Potential plastic leakage hotspots risk factors

Output Applications

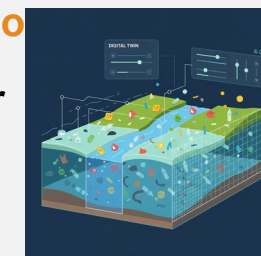### Risk Level Classification

Low
Med
High

Digital Twin Integration

End results for decision-making

- Investment planning
- Monitoring of risk areas
- Reporting of performance metrics

Q&A Session
Piloting of Digital Solutions for Plastics Circularity

Thank you!

Please scan the QR if you want to ask any questions.

OR join at <u>menti.com</u>

Code: 1792 4101