PLASTIC ODYSSEY
FACTORIES.

POSITION PAPER

Impact Assessment & Position Paper.

Plastic Odyssey Factories

ÉDITION

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VERSION

1.0-draft

Contents.

Why clarifying our position?

The world we operate in is linear and carbon-based. That is the starting point, not a problem to wish away. In low- and middle-income countries, plastic burns in open dumps because no alternative infrastructure exists. Waiting for a circular economy to emerge before acting means accepting another decade of the same baseline.

We made a different bet. Solutions adapted to specific contexts, structured around solid business models, industrial discipline, and the right financing instruments can be viable, profitable, and replicable. Not as boutique pilots funded by philanthropy. At industrial scale, across hundreds of factories. That is the only scale that changes how waste is managed in the regions where we operate. [1]

We believe what we propose is, in order of magnitude, far better than how plastic is handled today in those regions. We also make compromises. To work at scale, we engage with industries that are part of the economy as it is, not the economy we wish for. Those compromises must be illuminated, measured, and paired with concrete improvement plans. Never hidden under impact storytelling.

This paper is not a promotion of our factory concept. It is a snapshot at moment T: the choices we make, the trade-offs we accept, the gaps we acknowledge. It projects the company and its partners into a trajectory of scaling up, of amplifying positive impacts, and of managing the negative ones we will necessarily produce. It is also an invitation to dialogue. We need our partners to challenge our trade-offs and shape our governance with us.

Benoît Blancher

CEO, PLASTIC ODYSSEY FACTORIES

[1] Pew-SYSTEMIQ, Breaking the Plastic Wave (2020).

Executive Summary

The thesis

Plastic pollution is not primarily a consumer problem. The priority is to reduce wherever possible, but an infrastructure gap remains. Reduction policies are necessary, but they will not absorb the legacy. Even in ambitious 2040 scenarios, over 400 million tonnes of plastic will still be produced each year (OECD 2022). Mechanical recycling into durable products is not THE solution. It is a damage-control strategy: a bridge between today's reality and tomorrow's destruction technologies. [2]

Where we operate, and what is the baseline?

We focus on low- and middle-income countries, where 80% of ocean plastic originates. In these contexts, the alternative to mechanical recycling is not chemical recycling, enzymatic processes, or pyrolysis. Those technologies do not exist at scale or at cost. The actual baseline is open dumping and open burning: 93% of waste in low-income countries (World Bank 2018). Our impact must be measured against this counterfactual. Secondary cities sit in the "missing middle": projects of EUR 50,000 to EUR 500,000, too small for DFIs, too large for microfinance. [3]

The model in 5 figures

- **Containerized recycling units, franchise model.** Standardized factories, 300 to 1,000 tonnes per year, deployed in 6 to 9 months. 80% of maintenance handled locally.
- **13 factories deployed by end of 2025**, across 10+ countries. Target: 200 factories by 2030 across 3 regional clusters (West Africa; East Africa & Indian Ocean; Southeast Asia & Pacific).
- **10 to 30 formal jobs per factory.** Direct integration of waste pickers. Network target: 10,000 formal jobs by 2030.
- **Three revenue streams** to absorb virgin plastic price volatility: raw materials, finished products, Plastic Certificates. Baseline economics exclude Plastic Certificate revenue.
- **Catalytic finance platform: $50M for 200 factories.** 20% Reimbursable Grants (First Loss), 80% Digital Green Bonds with partial guarantees.

13	200	10-30	10,000
FACTORIES DEPLOYED BY END OF 2025	FACTORIES TARGETED BY 2030	FORMAL JOBS PER FACTORY	FORMAL JOBS TARGETED IN NETWORK BY 2030

[2] OECD, Global Plastics Outlook (2022/2024).
[3] World Bank, What a Waste 2.0 (2018).

What we measure, across the full value chain

Our impact methodology was built with **Impact Labs** as quantitative partner. Each link of the chain is audited. [4]

Upstream

Tonnes diverted, formal jobs, collectors integrated, income uplift, gender ratio.

Operations

Occupational safety (TRIR), heat and noise, dust and VOCs, wastewater, energy and water intensity.

Downstream

Chemical migration, microplastic fragmentation, leachate, substitution effects, end-of-life pathways.

We are structuring our impact assessment around **two pillars:** a blockchain-based traceability app for a measurable and auditable value chain, and a multi-parameter impact model developed by Impact Labs assessing impacts for product ranges and projects. Long-term research projects on microplastics and chemical transfers complement this work.

EDITORIAL NOTE

This document is not a brochure. It is a lucid analysis of an early-stage venture: serious, methodical, and honest about its gaps. We support binding production caps and the Global Plastics Treaty. We also deploy capture infrastructure today, in places where waste burns by default. Both are necessary. The credibility of the second depends on never confusing it with the first.

[4] Impact Labs, POF Impact Strategy (Feb. 2026).

Our Mission.

Build a **sustainable, inclusive, and resilient economic model** capable of addressing major challenges facing humanity and inspiring. A model that can be replicated at global scale and adapted to the century ahead.

Sustainable

Solutions to humanity's major environmental challenges, respecting both people and planetary boundaries.

Inclusive

Access to essential services and opportunities, through a model that redistributes value and knowledge.

Resilient

Economic models and ways of living together that stay adaptable through uncertainty and crises.

Profitable

Profitable at every level so the model can scale and endure, with every extra dollar of revenue generating extra positive impact.

Rethinking the economic model

Current economic models have concentrated and specialized production tools in pursuit of a single parameter: profitability. We are adding three parameters and must therefore question the model.

Decentralize and simplify the production system

- **Simplify factories** — Simple, robust machines designed to be operated and maintained locally. Standardized units, optimized for their context and requiring easily transferable know-how. Substituting certain complex technologies with quality employment that low- and middle-income countries need.
- **Root production in territories** — Manufacture useful products locally from locally produced materials or waste. Rely on local communities to make projects succeed and ensure respect for their immediate environment.
- **Shorten value chains** — Reduce transport and its impact on the environment and supply chain fragility. Increase margins for local entrepreneurs.

Network operations

> *« The resilience, local impact and scalability of a decentralized system, combined with the productivity gains and power of a scaled system. »*

- Open markets at territorial or global scale
- Share knowledge and resources
- Pool R&D effort at global scale
- Digitize the diffusion, translation and sharing of know-how
- Build local hubs capable of pooling resources

Integrate impact into the financial equation

- **Demonstrate impact and give it value** — Trace flows and know the links in the value chain. Demonstrate social and environmental impact and compliance with standards. Then share value equitably, particularly with the most informal and precarious actors.
- **Valorize impact** with international private or public actors through compensation (plastic credits, carbon) or impact dividends.
- **Structure financing** at global or sub-regional scale through a catalytic platform integrating public or philanthropic actors alongside private investors.

Reduce frictions and mobilize energy

Containerization and standardization, adaptation of systems to their contexts, and optimization of size, water, electricity and input consumption are all technical adaptations designed for rapid deployment. Decentralization is in itself a strong lever for replicability since every level of the network is designed to be transmitted and replicated, whether at territorial scale or the local factory. In a world where image matters enormously, media coverage is a key lever for attracting the best talent, opening doors, mobilizing energy and attracting capital.

01

PROBLEM

Understanding the Problem.

Why plastic pollution is a systemic threat, where it comes from, what reduction policies can and cannot achieve, and why the counterfactual in low- and middle-income countries is not chemical recycling but open burning.

Plastic pollution — a global systems failure.

Plastic pollution is not primarily a consumer problem. It is an infrastructure gap. 460 million tonnes are produced annually (OECD 2022). Between 1 and 2 million tonnes enter oceans each year (Meijer et al. 2021). In 2022, the Stockholm Resilience Centre confirmed that we have breached the planetary boundary for novel entities. Without system transformation, ocean plastic could nearly triple by 2040. With comprehensive intervention, an approximately 80% reduction is achievable (Pew-SYSTEMIQ 2020). [1] [2] [3] [4]

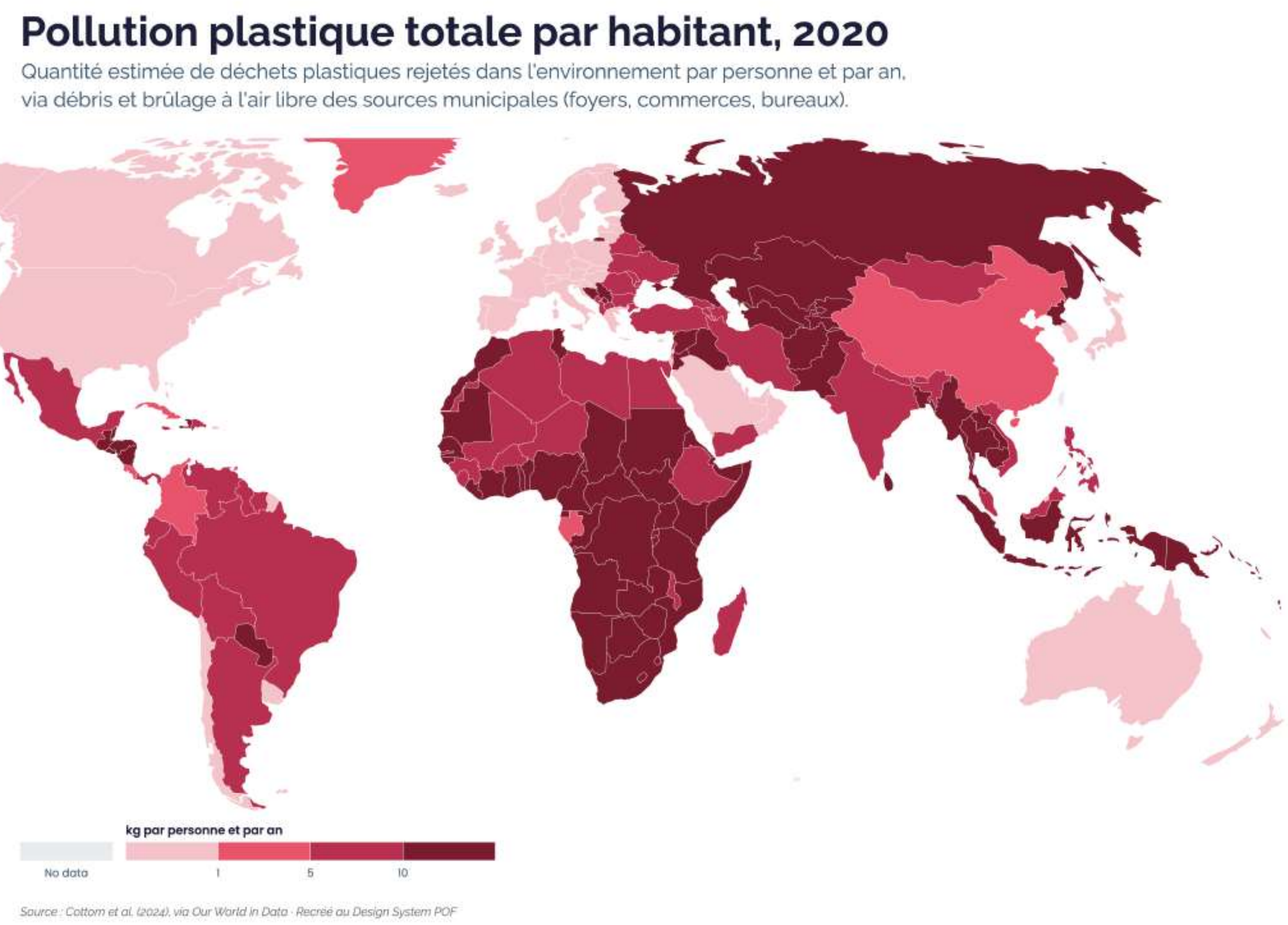

CHART-01 *Total plastic pollution per capita, 2020 (Cottom et al. 2024, Our World in Data).*

[1] OECD, Global Plastics Outlook (2022/2024).
[2] Pew-SYSTEMIQ, Breaking the Plastic Wave (2020).
[3] Stockholm Resilience Centre, Outside the Safe Operating Space of the Planetary Boundary for Novel Entities (2022).
[4] Meijer et al., More than 1000 rivers account for 80% of global riverine plastic emissions (Science Advances, 2021).

460

Mt

PLASTIC PRODUCED ANNUALLY WORLDWIDE (OECD 2022)

1-2

Mt

Plastic entering oceans each year (Meijer et al. 2021)

93%

Waste openly dumped or burned in low-income countries (World Bank 2018)

~80%

Ocean plastic reduction achievable with system intervention (Pew-SYSTEMIQ 2020)

Why plastic pollution is a problem

Plastic pollution is not an aesthetic problem. It is a systemic threat to ecosystems, economies, and human health.

Human health. Microplastics have been found in 93% of bottled water samples (Mason et al. 2018) and in human blood. In LMICs, open burning of waste releases dioxins and furans, causing an estimated 11,000-19,000 premature deaths annually in Africa from PM2.5 exposure (Kodros et al. 2016; McDuffie et al. 2021). Residents within 1 km of open dumpsites show 1.5-3x higher odds of respiratory disease. Waste workers directly exposed to burning face 6-25x higher risk of respiratory symptoms (Morsi et al. 2017). [5] [6] [7] [8]

Biodiversity. Marine plastic pollution is responsible for the death of an estimated 100,000 marine mammals and 1 million seabirds every year (UNEP 2021). Coral reefs exposed to plastic debris experience disease risk rising from 4.4% to 89.1%, a nearly twentyfold increase (Lamb et al. 2018, *Science*). On land, plastic pollution is estimated to kill nearly one-third of grazing animals in Senegal. [9] [10]

[5] Kodros et al., Open burning emissions in sub-Saharan Africa (2016).
[6] McDuffie et al., Global air pollution attributable mortality (2021).
[7] Mason et al., Synthetic polymer contamination in bottled water (2018).
[8] Morsi et al., Respiratory effects of waste burning exposure (2017).
[9] UNEP, Global Assessment of Marine Litter and Plastic Pollution (2021).
[10] Lamb et al., Plastic waste associated with disease on coral reefs (Science, 2018).

FIG-01 *Beach polluted by plastic waste, Senegal (Photo Marine Reveilhac, Feb. 2026).*

Economic cost. UNEP estimates plastic pollution costs approximately $100 billion annually in environmental damage, cleanup, and lost tourism revenue (UNEP 2023).

Where pollution originates and why

80% of ocean plastic originates from land-based sources (GESAMP 2015). Over 80% comes from low- and middle-income countries (Jambeck et al. 2015). The top 10 contributing nations are all developing economies, five in Southeast Asia. The issue is not consumption. It is what happens after use. The mechanism is straightforward: uncollected waste, then open dumps, then rivers, then ocean. [11] [12]

[11] Jambeck et al., Plastic waste inputs from land into the ocean (Science, 2015).
[12] GESAMP, Sources, fate and effects of microplastics in the marine environment (2015).

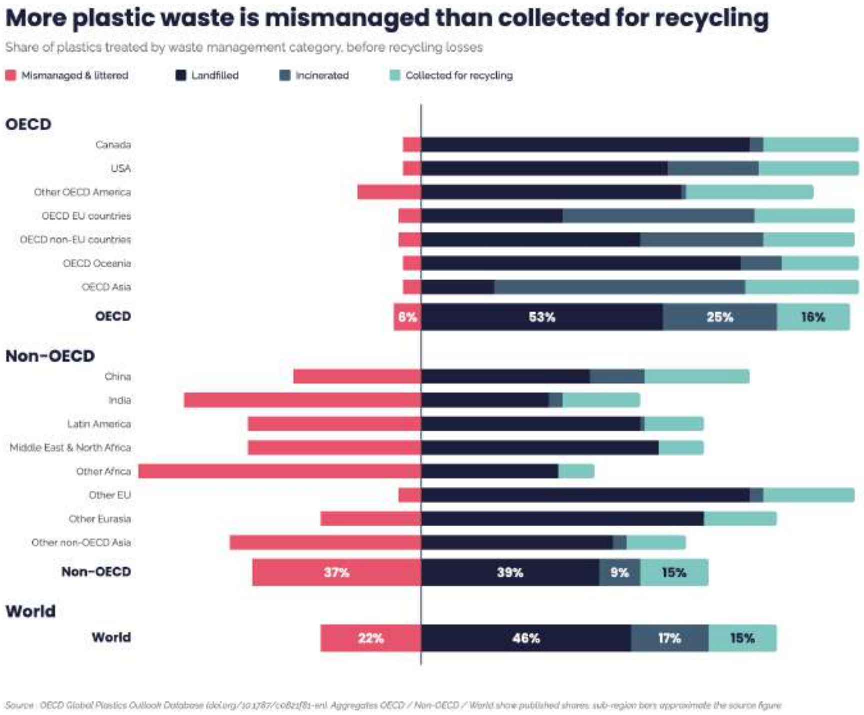

CHART-02 *Plastic waste by management category — more is mismanaged than recycled, especially outside the OECD (OECD Global Plastics Outlook).*

A shifting landscape. Until 2018, wealthy countries exported their plastic problem. China's "National Sword" policy ended that: Chinese imports dropped 99%. The Basel Convention (2021) and EU export ban (2026) are closing remaining routes. China's National Sword policy alone is projected to displace an estimated 111 million tonnes through 2030 (Brooks, Wang & Jambeck 2018, *Science Advances*). [13]

[13] Brooks, Wang & Jambeck, The Chinese import ban and its impact on global plastic waste trade (Science Advances, 2018).

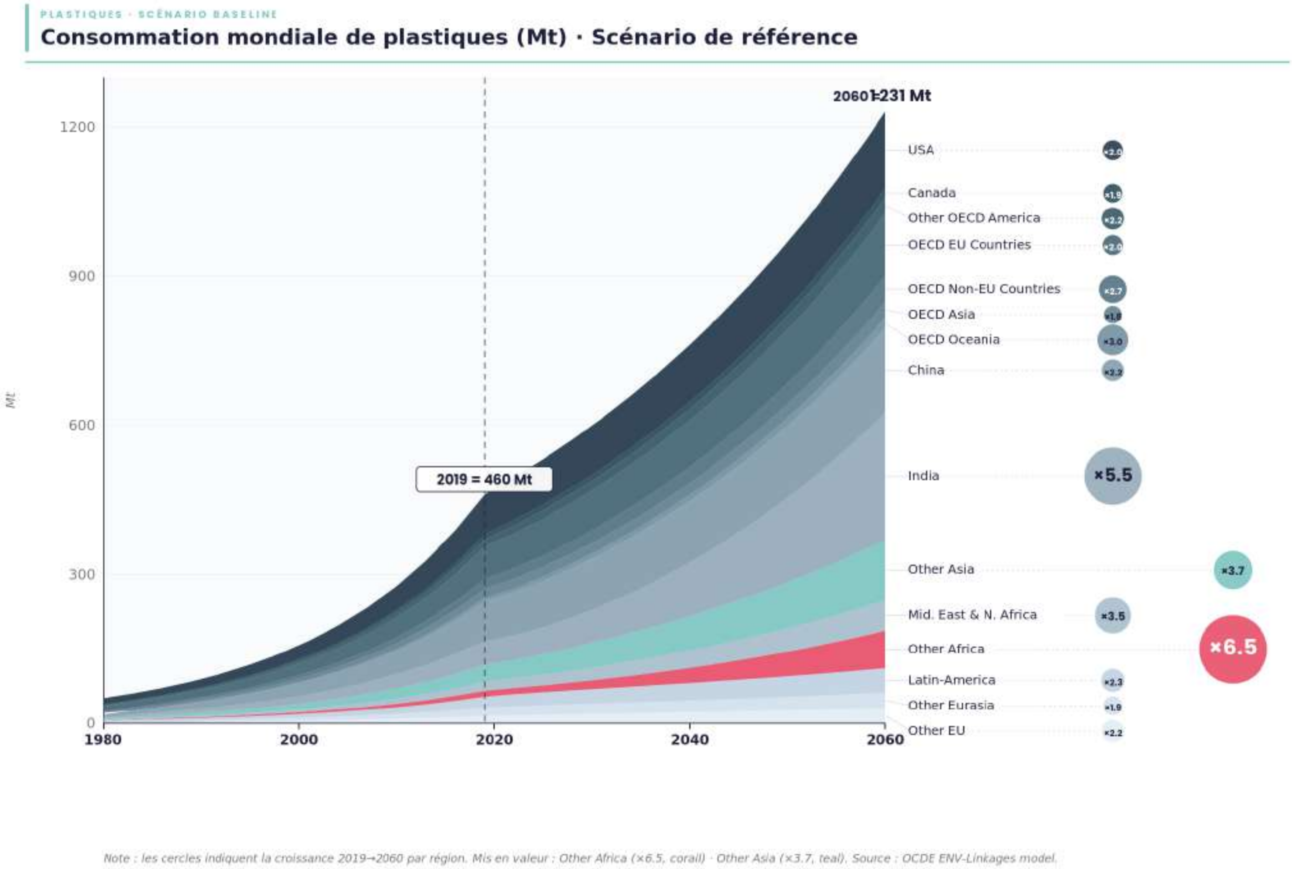

CHART-03 *North-South plastic waste export flows after China's National Sword (Brooks, Wang & Jambeck 2018).*

Reduction first. What it can and cannot achieve.

We support aggressive reduction policies, binding production caps, and the Global Plastics Treaty. **Reduction alone will not solve the crisis.** Even the most ambitious reduction scenarios project over 400 million tonnes of plastic still produced annually by 2040 (OECD 2022; Pew-SYSTEMIQ 2020). Eight to eleven million tonnes leak into oceans each year. Even if production halved tomorrow, decades of accumulated waste with nowhere to go would remain. Between 150 and 250 million tonnes of plastic already saturate oceans and landfills in the Global South.

The counterfactual — what happens without intervention.

Any credible impact assessment must answer one question: compared to what?

In the regions where we operate, the real alternative to mechanical recycling is not chemical recycling, enzymatic processes, or advanced waste-to-energy. These technologies do not exist at scale or at cost in LMICs today. The actual alternative is the status quo: open dumping and open burning. 93%

of municipal solid waste ends up in open dumps or is burned without controls (World Bank 2018). Communities near dumpsites show respiratory disease rates 5x above average. 90% of informal waste workers report chronic respiratory symptoms.

FIG-02 *Unmanaged dumpsite, Guinea.*

This is the baseline against which our impact should be measured. Every tonne of plastic we divert into a durable product is a tonne that does not burn in an open dump, does not leach into groundwater, does not fragment into microplastics in a river delta.

The limits of chemical and enzymatic alternatives.

Enzymatic recycling is limited to PET. Enzymes (PETase, FAST-PETase, TurboPETase) target ester bonds specific to PET. Degradation of polyolefins (PE, PP) remains at the academic research stage (ACS Catalysis 2022; PMC 2024). These are precisely the polymers that dominate the Global South waste stream. [14]

Chemical depolymerization faces the same barrier. Solvolysis, glycolysis, and methanolysis work on condensation polymers like PET, not on PE, PP, or PVC. Depolymerizing polyolefins requires breaking stable carbon-carbon bonds, a process at pilot stage with no industrial deployment.

Pyrolysis produces fuels, not monomers. Pyrolysis cracks PE and PP into hydrocarbons (diesel, naphtha), not into the original monomers needed to close the loop. In the US, 11 chemical recycling facilities processed less than 1.3% of national plastic waste in 2023; several have since closed (Beyond Plastics / IPEN 2023). Pyrolysis also fails to solve the toxic additives problem. [15] [16]

[14] ACS Catalysis (2022) on enzymatic PET depolymerization.
[15] Beyond Plastics / IPEN, Chemical Recycling: A Dangerous Deception (2023).
[16] Baker Institute, Pyrolysis and the limits of plastics-to-fuel (2025).

The case for Waste-to-Product as intermediate storage. Transforming PE and PP into massive, long-lived products is the only available option that reduces immediate impact while remaining compatible with future treatment. Three advantages: no fragmentation into microplastics for decades, far more accessible to future depolymerization technologies than sachets in a river delta, and substitution of virgin materials.

What legislation can achieve, and what it cannot.

CHART-05 *Legislation landscape — outcomes and gaps from the Rwanda, Kenya and Bangladesh bans.*

EXAMPLES OF NATIONAL PLASTIC BANS

Country	Policy	Result	Limitation
Rwanda	Complete polyethylene ban (2008)	Imports: 1,092T → 18T. Cleanest African capital (UN Habitat)	Cross-border smuggling persists
Kenya	Strictest penalties globally ($40k fines)	80% first-year compliance, 6.2B bags eliminated	Alternatives cost 6x more; 60,000 jobs at risk
Bangladesh	First global ban (2002)	Initial success: polythene disappeared	Per capita consumption tripled by 2015; 700+ illegal factories

Lobbying delays or weakens laws. Laws exist but go unenforced. Without local infrastructure, bans displace rather than solve. Bangladesh was the first country globally to ban plastic bags (2002), yet per capita consumption tripled since. Senegal's 2020 anti-plastic law remains largely unenforced, with water sachets exempted due to socio-economic pressure. Kenya's Dandora dumpsite was court-ordered closed in 2021; it still receives 2,000+ tonnes daily. **Infrastructure must precede or accompany regulation. Otherwise, laws become empty promises.**

Frictions to proper infrastructures.

Political complexity

Waste management is intensely political. Projects require municipal coordination, land rights, informal sector buy-in, and sustained political will across 3-5 year electoral cycles. In Lagos, a 2007 ban on informal collectors was reversed within months after waste piled up citywide. In Indonesia, 42% of decentralized recycling units failed within 2 years, primarily due to governance, not technology.

Municipal budget constraints

Public funding alone will not close the infrastructure gap, especially in secondary cities. Low-income countries already allocate nearly 20% of municipal budgets to waste management (versus 4% in high-income countries), yet achieve far worse outcomes (World Bank). Within these strained budgets, 80-95% goes to collection and transportation, leaving almost nothing for treatment or recycling infrastructure. A critical "missing middle" blocks appropriate-scale investments: microfinance stops below $20,000, while DFI thresholds start at $5 million+. The facilities secondary cities actually need ($50,000 to $500,000) fall into a financing desert.

Feedstock, technology and operational risks

Recycling facilities need what LMIC contexts rarely provide: sorted, clean, and consistent feedstock. Sub-Saharan Africa's average collection rate is approximately 44%. Large-scale facilities designed for developed-country conditions frequently fail when deployed in different contexts. And currency mismatch creates structural vulnerability: 74% of LMIC infrastructure investment is denominated in foreign currencies while revenues flow in local currency. Corruption inflates costs, and contract renegotiation affects 68% of PPPs in developing countries.

02

APPROACH

Our Approach.

Mechanical recycling as transition technology, waste pickers as partners, a restricted set of applications, and a containerized operational model designed to bypass the structural barriers that have killed larger facilities.

Reduce before recycling.

Our position on reduction and recycling. We support aggressive reduction policies, binding production caps, and the Global Plastics Treaty. But once societies have done everything possible to reduce, once bans are enacted, alternatives deployed, and consumption patterns shifted, there remains a pragmatic question: *what happens to the plastic that still exists?* Recycling is not a solution to plastic pollution. It is a damage-control strategy for the plastic that reduction cannot eliminate, and a transition solution until destruction and depolymerization technologies become available at the scale and cost of the Global South.

Mechanical recycling as transition technology. Mechanical recycling into durable products is not a second-best option. It is the only technology that works today, at the cost point and skill level available in the communities where plastic pollution is most acute. Waste-to-Product is the bridge between today's reality and tomorrow's destruction technologies.

Waste pickers as partners. We do not see waste pickers as a problem to solve. We see them as partners to integrate. The informal sector collects 58% of recyclable plastic in developing countries. Any model that bypasses these networks is building on sand. Any model that claims to help them must measure whether it actually does. We are building the measurement infrastructure to answer that question honestly. Measurement architecture uses IRIS+ indicators (Waste Reduced OI7920, PI5926), SDG alignment (8.5 Decent Work, 11.6 Waste Management, 12.5 Recycling), and IFC Joint Impact Indicators for gender and jobs. [1] [2]

OUR APPROACH

We produce massive objects (pavers, boards, furniture) that immobilize material for decades, instead of films that fragment in months. We chose the least harmful application pathway. Construction products avoid the primary risk routes: food contact, ingestion, children's exposure. But "least harmful" is not "safe."

[1] Systemiq & Fair Circularity Initiative, Towards Decent Livelihoods for Waste Pickers (2024).
[2] ILO Recommendation No. 204 — Transition from the informal to the formal economy (2015).

Applications — what we do and do not do.

FIG-03 *Recycled plastic pavers, close-up.*

Validated

Industrial pallets, formwork boards, pavers, urban furniture, agricultural posts (non-food). Massive objects that immobilize material for decades.

Controlled

School desks, storage containers (non-food). Selected feedstock plus a virgin layer as external protection via coextrusion.

Avoided

Food contact and children's toys. No authorization pathway exists; post-consumer plastics systematically fail EN 71 / ASTM F963 migration tests.

Why these restrictions?

Food contact: EU regulation 2022/1616 currently only authorizes recycled PET via EFSA-approved processes. For other resins, no established authorization pathway exists.

Children's products: EN 71 (EU) and ASTM F963 (US) standards require migration testing for 19 elements. Post-consumer plastics contain legacy compounds at levels that systematically fail these tests. [3] [4]

Additional measures

- We exclude WEEE-origin plastics from feedstock.

[3] EU Regulation 2022/1616 on recycled plastics in food contact applications.
[4] EN 71 (EU) and ASTM F963 (US) toy safety standards.

- We sort mono-resin streams (HDPE, PP) to avoid contamination.
- Systematic UV stabilizers in outdoor formulations.
- Pigmentation (carbon black blocks UV). High-quality plastics (HDPE, PP) as matrix to ensure cohesion.
- For controlled applications (school desks): a virgin layer as external protection via coextrusion.
- Multilayers directed toward long-term immobilization products (pavers, heavy boards).

The operational model.

Our containerized, standardized model is designed to bypass many of the structural barriers identified above. Modular capacity (300-1,000 T/year) fits secondary cities and remote islands without requiring mega-project governance. Total financing need (EUR 200-350k per factory) falls precisely in the "missing middle" segment that centralized infrastructure cannot reach. Franchise operators work within local political cycles, not against them. And 80% of maintenance can be performed by a local mechanic, eliminating the imported spare parts dependency that has killed larger facilities. These are design choices, not afterthoughts.

But we are clear-eyed: political risks and currency mismatch remain real. Our mitigation: regional clusters that pool operational knowledge, and revenue denominated primarily in local currency.

FIG-04 *Unloading a containerized POF unit at the dock of Manila, Philippines.*

PLASTIC ODYSSEY FACTORIES.

03

IMPACT

Impact across the value chain.

What we measure upstream (collection and integration), in operations (factory QHSE) and downstream (product quality, lifecycle, end-of-life). The targets, the gaps, and the methodology.

Upstream — collection and end of life.


FIG-05 — Polluted beach, Hann Bay, Senegal.


FIG-06 — Operator sorting collected plastic waste — first quality-control step at factory inlet.

The infrastructure gap in numbers

Collection rates tell the story: Europe achieves 90%+, Sub-Saharan Africa 44-46%, ASEAN low-income countries under 50%. In low-income countries, 93% of waste is openly dumped or burned, versus 2% in high-income nations. [1]

End-of-life scenarios and their impacts

END-OF-LIFE PATHWAYS IN LMICS

Scenario	Prevalence (LMICs)	Environmental impact	Economic value
Open dumping	50-70%	Ocean leakage, soil contamination, leachate	Zero
Open burning	20-30%	Toxic emissions, 600,000 annual deaths (Africa)	Zero
Controlled landfill	10-20%	Contained but no recovery	Negative (operating costs)
Waste-to-energy	<5%	Emissions if uncontrolled; high CAPEX	Requires $680-1,026/ton capacity
Mechanical recycling	5-15%	Lowest impact if properly managed	Positive — but only for select resins

[1] World Bank, What a Waste 2.0 (2018).

The problem with open dumps. Rain filters through waste, carrying heavy metals into groundwater (lead levels reach 3-21x WHO limits; contamination spreads over 2 km; 90% of dumps have no collection system). Decomposing organic waste releases methane (80x more potent than CO2). Spontaneous combustion and burning release dioxins and fine particles. Wind and rain carry uncollected waste into rivers and oceans (38 of the 50 largest dumpsites sit near water bodies, Waste Atlas 2014). 2.7 billion people lack access to waste collection services (UNEP/ISWA 2024).

Not all plastics are equal

FIG-07 — Shredded recycled plastic flakes, close-up.

FIG-08 — Handful of shredded LDPE film flakes, Dakar collection.

RECYCLED RESIN VIABILITY

Resin	Recycled value	Global recycling rate	Viability
PET	$260-400/ton	15-29%	**Economically viable**
HDPE	$580-1,650/ton	10-30%	**Economically viable**
PP	$180-400/ton	3%	Recycled costs 80% more than virgin
LDPE films	$140-400/ton	2-5%	Challenging without scale
PS/EPS	~$20/ton	<1%	Non-viable without sequestration

Informal sector and social impact

In developing countries, the informal sector IS the recycling system. An estimated 19-24 million people derive their livelihoods from waste collection and recycling globally (Systemiq/FCI 2024; ILO). They recover approximately 58% of all plastic collected for recycling worldwide. In Indonesia alone, 3.7-4.2 million waste pickers collect approximately 1 million tonnes of plastic annually, representing

83% of Java's plastic recycling. Yet 80% operate informally: no written contracts, no social security, no occupational safety protections. Typical earnings range from $1-3/day, below the poverty threshold.[2] [3]

Income and gender. Documented formalization outcomes show income uplift of 1.5-3x above informal baseline earnings. In São Paulo, waste picker cooperatives helped workers earn 1.5-2x minimum wage. Plastic Bank reports a 30% income increase for Brazilian recyclers. Women comprise 22.7% of the global waste management workforce (ILOSTAT 2024); Africa shows the highest regional figure at 29.5%. UNEP warns that "when waste management formalizes, women are often marginalized and replaced by men." For our operations, a target of 30-40% women in factory employment is aspirational but grounded in achievable precedent. [4] [5]

What we track upstream

10-30
Formal jobs per factory (validated across operational sites)

40+
Collectors integrated per factory (validated, BGS Recyplast Guinea)

30-40%
Women in factory employment (target; sector benchmark 22.7%)

<5.0
TRIR
Initial safety target, declining to <3.0 within 3-5 years

[2] Systemiq & Fair Circularity Initiative, Towards Decent Livelihoods for Waste Pickers (2024).
[3] ILOSTAT, Labour statistics on the waste sector (2024).
[4] Plastic Bank, Sustainability Report (2024).
[5] Kristanto et al., Gender wage gap in the Indonesian recycling sector (2022).

Case study — Mbeubeuss, Senegal

FIG-09 *Mbeubeuss landfill, Greater Dakar — 114 hectares, 1,300-2,000 tonnes daily.*

Mbeubeuss is Africa's largest informal disposal site: 114 hectares serving Greater Dakar, receiving 1,300-2,000 tonnes daily. Over 2,000 waste pickers work there (more recent estimates suggest up to 5,800), organized under the "Bokk Diom" cooperative. Weekly earnings range from 15,000-21,000 CFA ($25-35), with 89% depending on this as their primary income. For context, Senegal's poverty line sits at approximately 1,017 CFA/day ($1.70). Our project in progress:

- Installation of a paving-blocks production unit operated by the cooperative.
- A POF sorting and shredding unit on-site to provide sustained support, training, and technical assistance.
- Direct purchasing from informal collectors at incentive pricing (market rate: 45-100 FCFA/kg).
- Collaboration with Bokk Diom on equipment, training, and access to insurance.

Where we are on the evidence ladder

The Nesta Standards of Evidence framework defines five levels. At 13 factories, we position ourselves between Level 1 (articulated Theory of Change with supporting data) and Level 2 (pre/post data showing positive change among beneficiaries). We have a documented Theory of Change, baseline data collection systems operational across sites, and leading indicators tracked monthly. We do not yet have rigorous pre/post income impact data, validated gender outcome measurements, or long-term health monitoring results. Methodology is under development with Impact Labs. First validated results are expected in 2026-2027. [6]

Operations — recycling and QHSE.

FIG-10 *Basic PPE required for every POF factory: hearing, respiratory, eye, hand protection.*

Understanding the risks

Mechanical plastic recycling involves real occupational and environmental hazards. We acknowledge them openly.

Heat exposure is the primary concern in tropical climates. Extrusion equipment operates at 200-300°C. A Thailand study found 95% of heat measurements near extruders exceeded ILO safe thresholds for heavy workloads (25°C WBGT limit). [7]

Noise from shredding operations routinely reaches 100 dB, well above the 85 dBA limit recommended by NIOSH for 8-hour exposure. Among Brazilian recycling workers, 18% report hearing difficulty and 37% experience noise discomfort.

Dust and microplastic exposure remains an emerging concern. NIOSH confirms no specific occupational limits exist yet for microplastics, though recycling workers face concentrations orders of magnitude higher than general populations. Current guidance applies general particulate limits: 15 mg/m^3 total dust, 5 mg/m^3 respirable fraction. [8]

[6] Nesta, Standards of Evidence framework.
[7] Cavalcante et al., Heat stress in tropical recycling facilities (2025).
[8] NIOSH, Microplastics and occupational exposure (2020-2021).

Chemical residues vary by feedstock. VOC concentrations in PP recycling average 1,625 µg/m^3, primarily during extrusion. PVC contamination above 50 ppm causes polymer degradation and releases hazardous hydrogen chloride when heated, making incoming material control critical.

Wastewater from washing contains suspended solids, oils, detergents, and microplastics. IFC standards require BOD below 30 mg/L and TSS below 50 mg/L before discharge. Without treatment, wash water becomes an environmental liability.

FIG-11 *Night-shift operator at the shredder, wearing respiratory PPE — baseline equipment in every POF factory.*

The gap analysis

The reality gap between informal recycling practices and international standards is significant, but bridgeable with appropriate investment and training.

RISK AREAS — CURRENT PRACTICE VS. POF TARGET

Risk area	Current practice (informal)	International standard	POF achievable target
Heat management	No controls	WBGT monitoring, engineering controls, work-rest cycles	Ventilation systems, protections
Noise protection	No PPE, no awareness	Hearing conservation program, <85 dBA exposure	Hearing protection, equipment enclosure, training
Respiratory protection	Rare or no masks	N95 minimum, OV/P100 for VOC exposure	N95 masks, extraction at extrusion points, carbon and water low-tech filters
Wastewater treatment	Direct discharge or ground infiltration	Full treatment to IFC limits, closed-loop systems	Sedimentation + filtration, water recycling, controlled discharge
Contamination control	Mixed feedstock, no testing	<50 ppm PVC, full traceability per EN 15343	UV sorting for PVC, incoming inspection, batch tracking
Worker formalization	Informal, no protection	Full social protection, living wage	Formal contracts, PPE provided, health monitoring
Incident tracking	No records	TRIR <2.0, full incident reporting	Incident log, monthly review, corrective actions

Every factory deployment includes PPE provision for all workers (hearing, respiratory, eye, hand protection), basic wastewater treatment capacity, incoming material inspection protocols, and formal employment contracts with social protection. These are non-negotiable baseline requirements. [9] [10] [11]

> **OUR APPROACH**
>
> Achieving European-level standards immediately in remote areas of Senegal or the Philippines is neither realistic nor always appropriate. We do not claim perfection. We claim systematic management of the highest-risk areas, progressive improvement, and operational viability.

Mitigation measures

Five priorities prevent the most serious harms.

- Heat stress protocols near extrusion.

[9] ILO Guidelines on Decent Work in Recycling (2025).
[10] IFC Performance Standard 2 — Labor and Working Conditions.
[11] IFC, Environmental, Health, and Safety Guidelines.

- Hearing protection at shredders.
- Wastewater treatment for wash operations.
- PVC detection at intake.
- Formal employment for all workers.

> **OUR COMMITMENT**
>
> Our roadmap toward full QHSE certification includes ISO 45001 (occupational health and safety) and ISO 14001 (environmental management) within 2 years of operation, with QHSE standards certification targeted for 2026. Standardization, impact monetization through audits, and continuous technical assistance can raise the achievable standards over time.

Downstream — quality, lifecycle and product integration.

Chemical migration — toxicity

Mechanical recycling presents real risks. Our approach: identify the least harmful scenario, avoid critical applications, and take systematic precautions to minimize risks.

> *« Each recycling cycle reduces polymer molecular weight. The plastic becomes more porous. This porosity allows additives, stabilizers, colorants, flame retardants, and contaminants absorbed during the product's first life to migrate into the environment or products in contact. Over 16,000 chemical substances have been identified in plastics, of which 4,200 are classified as hazardous (Geneva Environment Network 2024).[^src-43] »*

⚠ Source 1 — Inherited from virgin plastic. Over 16,000 chemicals carry over into recyclate: flame retardants, UV stabilizers, plasticizers, persistent phytosanitary substances.

⚠ Source 2 — Acquired during use. IPEN (Brosche et al. 2021) found 100% of 24 recycled HDPE samples from 23 countries contaminated; DecaBDE, banned since 2017, was present in 22 of 24 samples.

⚠ Source 3 — Newly formed during recycling. Mayrhofer et al. (2023) tested 119 samples: 51 showed DNA-reactive mutagenic activity. rPET was the notable exception, showing none.

General chemical migration data. The Zimmermann study (2021) found that all migrates induced baseline toxicity in 24 plastic products tested; only 8% of detected compounds could be identified. Vera et al. (2023) identified 53 volatile compounds in migrations from recycled HDPE bottles to milk and plant-based beverages, including 5 exceeding regulatory thresholds. [12] [13]

[12] Zimmermann et al., Chemicals in recycled plastics (ES&T, 2021).
[13] Vera et al., Migration from recycled food-contact plastics (Food Packaging and Shelf Life, 2023).

The antimony case in rPET. Antimony trioxide (Sb_2O_3), used as a polymerization catalyst in PET manufacturing, remains trapped in the polymer. The EU has set a specific migration limit of 40 µg/kg. For rPET recycled multiple times, recycling can concentrate residual antimony, and repeated contact cycles increase migration. This reinforces our rule: never recycled plastic in food contact, even for rPET. [14]

Microplastics — surface is everything

> *« All plastic will eventually fragment into microplastics. The question is not "if" but "when" and "where." »*

The rate at which fragmentation happens varies by orders of magnitude depending on three factors: exposed surface area, environmental exposure conditions, and polymer type.

Why surface area is the dominant parameter. Degradation is a surface-driven process. UV penetrates only 25-50 µm into a polymer. Everything beyond that outer shell remains chemically unaltered. A 5g plastic bag represents approximately 1,900 cm^2 of surface; the same weight as a thick board exposes a fraction of that.

FRAGMENTATION TIMELINE BY PRODUCT TYPE

Product type	Time to fragmentation	UV/oxidation sensitivity
Films/bags	Months to years	Very high (large surface/volume ratio)
Light packaging	Years to decades	High
Thick furniture	Decades to centuries	Moderate (UV stabilizers recommended)
Construction materials	Centuries+ (protected)	Low if pigmented + stabilized

The Specific Surface Degradation Rate measures the depth of plastic lost perpendicular to the surface per year (µm/year). Key finding: HDPE buried in soil loses approximately 1 µm per year. At that rate, a 25 mm thick board would take 12,500 years to degrade completely (theoretical, constant conditions). Even in the marine environment with UV exposure, the median SSDR for HDPE is only 4.3 µm/year (Chamas et al. 2020). [15]

Quantified reduction. From waste to dense products, the reduction factor ranges from x4.6 (least favorable) to x394 (most favorable). Realistic scenario (waste exposed to UV/sea, board used in shade): x22 to x73 for HDPE, x185 to x271 for LDPE.

[14] Carmona et al., Antimony migration from rPET (Data in Brief, 2023).
[15] Chamas et al., Degradation rates of plastics in the environment (ACS Sustainable Chem. Eng., 2020).

First quantitative benchmark — Kuka et al. (2026). The first laboratory quantification of microplastic release from thick recycled products: recycled PP released up to 0.3 g/m^2, while wood-plastic composite released 9.4 g/m^2. A 30-fold difference. [16]

Tropical exposure: uncharted territory. Tropical regions receive 2-3x the annual UV dose of temperate zones. Diurnal thermal cycling (20-40°C range) accelerates embrittlement. No study has measured these compounding effects on thick recycled products in tropical field conditions. This gap is central to our 2026-2027 testing plan.

How product design drives environmental impact

Five characteristics determine the net environmental footprint of a recycled plastic product: mass, surface-to-weight ratio, composition, lifespan, and what material it replaces.

- **Mass.** 15-24 million waste pickers form the backbone of plastic collection in LMICs, recovering 58% of all plastic collected for recycling globally. Their collection decisions follow a single logic: weight × price per kilogram versus transport effort. PET bottles in India command approximately $170/tonne at collector level. Multi-layer sachets have effectively zero market value. Producing heavy, bulky products creates an economic incentive for collection and immobilizes material in a form unlikely to reach waterways.
- **Surface-to-weight ratio.** A thin LDPE film (~20 µm) presents ~10,900 cm^2 of surface per gram. A 50 mm recycled board: ~42 cm^2/g. A 260-fold reduction in exposed surface per unit mass. Over 99% of thick product mass remains chemically unaltered after decades-equivalent UV exposure.
- **Composition.** A recycled product that cannot itself be recycled at end of life just delays the problem. The rule: mono-material, no inserts, no fasteners. As little as 2-5% PVC contamination in a PE stream degrades recyclate below commercial viability (Ragaert et al. 2017).[^src-58]
- **Lifespan.** Recycled plastic lumber achieves warranted lifespans of 20-25 years outdoors, with expected service life exceeding 50 years. Mechanical recycling of polyolefins avoids 1,009 to 2,714 kgCO2eq per tonne versus virgin production + incineration (JRC 2020).[^src-34]
- **Baseline.** Substituting virgin plastic avoids 3,500-5,000 kgCO2eq per tonne. Replacing cement avoids approximately 8% of global CO2 emissions. Replacing wood through energy-intensive injection may have *negative* climate performance. Our Impact Labs LCA (2026, Dakar) confirmed this hierarchy: recycled flakes versus virgin plastic = -103% CO2; paving versus concrete = -76%; chair versus wood = -99.5%; injected pallet versus wood pallet = +165%. The process matters as much as the material.[^src-35]

At our Dakar factory: 85% of feedstock comes from landfill or unmanaged collection points, 15% from industrial sources. We track this distinction through our Inclusiv blockchain traceability.

[16] Kuka et al., Microplastic shedding from recycled construction products (2024 & 2026).

End of life

Recycled plastic construction products are a terminal recycling step. Accumulated contaminants, degraded polymer chains, and mixed compositions make reprocessing infeasible. After a 20-50 year service life, two end-of-life pathways remain: controlled incineration or managed landfill. Neither pathway is circular.

We chose controlled immobilization over uncontrolled dispersion. In our operating contexts, the alternative for this plastic is not a European recycling plant. It is open burning, ocean leakage, or unmanaged landfill. Locking contaminants in a dense, stable form for 25-50 years is a pragmatic choice. Not an ideal one. We acknowledge this trade-off explicitly. The regulatory vacuum compounds this challenge: no international standard addresses the chemical safety of construction products made from recycled plastic. Kenya is the only country globally with dedicated standards (KS 2913:2020, KS 2928:2021), but without chemical testing requirements. The UNEP/GEF "Circular and POPs-free Plastics in Africa" project (launched December 2024, US$90M) targets this exact gap. [17]

What this section does not claim

This section does not claim our products are chemically inert. It claims they represent the least harmful application pathway for post-consumer plastic that would otherwise be burned or dumped. It does not claim we have measured microplastic shedding from our products: our fragmentation timeline framework is modeled (Chamas et al. 2020), not empirically validated on our products. It does not claim chemical migration is solved by thick product design: the contaminants documented by Carmona et al., Mayrhofer et al., and IPEN are present in our feedstock; we manage exposure pathways, we do not eliminate the substances. It does not claim end-of-life circularity: our products delay the problem by decades. They do not solve it permanently.

A NOTE ON TERMINOLOGY

This report uses "long-term immobilization" rather than "sequestration." The term "sequestration" implies permanent storage. Our products do not store plastic permanently. They slow fragmentation: a thick recycled board exposes ~260x less surface per gram than a thin film (Chamas et al. 2020), extending material integrity from months to decades or centuries. But slowing is not stopping.

[17] UNEP/GEF, Circular and POPs-free Plastics in Africa (2024).

Economic co-benefits.

The sector's profitability problem

Plastic recycling in low- and middle-income countries faces a structural economic challenge. Most operations are not profitable. Mr Green Africa in Kenya (3,000-4,000 tonnes/year, B Corp certified) was not yet profitable as of 2022 and was targeting breakeven by 2025. Plastic Bank, operating across six countries with an estimated $60M revenue in 2023, has not disclosed profitability. Among World Bank municipal waste projects that targeted cost recovery, only 56% achieved it (IEG 2022). [1]

The margin range for plastic recycling globally sits between 5 and 20%, driven by resin type, feedstock quality, energy costs, and local market conditions (Sigma Earth 2024). A structural risk: virgin plastic price volatility. When oil prices fall, virgin material becomes cheaper, squeezing recycled material competitiveness. Recycled PET flakes in Asia currently trade at a $74-128/MT premium over virgin PET pellets (S&P Global Platts, July 2025). This premium can compress rapidly. [2] [3]

Why most recycling infrastructures fail in frontier markets

Transport economics destroy viability. In LMICs, collection and transport consume 75-95% of waste management budgets (World Bank). For low-value plastics (LDPE films, mixed streams), the viable collection radius rarely exceeds 30-50 km.

Machines without business models produce white elephants. A recurring pattern: funding goes to equipment, not to building the value chain around it. Ethiopia's $95-120M Reppie waste-to-energy plant operates at 28-46% of design capacity (GAIA 2024). In Indonesia, 42% of decentralized recycling units failed within 2 years. Of 54 Brazilian recycling facilities studied, 18 failed. A machine is not a business. [4]

SME survival rates are brutal. In Africa, 70-80% of businesses fail within five years (SEDA 2020). [5]

The "missing middle" blocks investment. Microfinance stops below $20,000. DFI thresholds start at $5 million+. The facilities secondary cities actually need ($50,000 to $500,000) fall into a financing desert.

Decentralized processing — the economic logic

The economics are counterintuitive. Smaller, distributed facilities cost more per tonne to operate, but the overall system is cheaper. By processing locally, you eliminate the cost structure that makes recycling unviable in remote areas. Job intensity is structural: recycling creates 115 jobs per 10,000 tonnes processed versus 2 for landfill or incineration (GAIA 2021). The informal sector already collects 58-60% of recyclable plastic in our target regions (UNEP 2023). Integrating these networks rather than

[1] World Bank Independent Evaluation Group, Municipal solid waste portfolio review (2022).
[2] Sigma Earth, Recycling sector margin analysis (2024).
[3] S&P Global Platts, Virgin and recycled resin pricing (July 2025).
[4] GAIA, Ethiopia plastic management assessment (2024).
[5] SEDA, SME survival in South Africa (2020).

building parallel systems reduces infrastructure dependency and startup risk. The franchise model addresses the white elephant problem directly. What works: equipment + training + feedstock supply chain + structured off-take + working capital + ongoing technical assistance. [6]

Resilience.

Where we stand

7-10%
EBITDA
Target without Plastic Certificate revenue (CDF 7% / PTF 10%)

3-5
yrs
PAYBACK PERIOD (CDF 3-4 YRS / PTF 4-5 YRS)

>80%
Survival rate target at 2 years (African SME baseline: 20-30% at 5 yrs)

<20%
Subsidy dependency target by Year 3, declining annually

RESILIENCE INDICATORS — POF TARGETS AND SECTOR BENCHMARKS

Resilience indicator	Target	Status	Sector benchmark
EBITDA (without Plastic Certificates)	CDF: 7% / PTF: 10%	First operational data Q3 2025	Sector range: 5-20%. Comparable ventures mostly unprofitable
Payback period	CDF: 3-4 years / PTF: 4-5 years	Tracking from commissioning	DFI infrastructure in emerging markets: 3-7 years
Survival rate (2 and 5 years)	>80% at 2 years	13 factories deployed	African SMEs: 20-30% survive 5 years. No sector-specific data exists
Subsidy dependency	Declining annually; target <20% by Year 3	Early-stage: catalytic funding dominant	DFI Working Group on Blended Finance (2023): trajectory matters
Revenue concentration	No single client >20%; no sector >40%	Contractual caps in agreements	Standard: <10% per client is healthy
Feedstock utilization	>63% of installed capacity	Variable across sites	Critical viability threshold (Nature, 2024)

[6] GAIA, Zero Waste Jobs Report (2021).

Three revenue streams per factory (raw materials, finished products, Plastic Certificates) insulate from virgin plastic price volatility, historically the primary cause of recycling business failures. Our baseline economics exclude Plastic Certificate revenue. No venture in this space has published comprehensive economic resilience data combining EBITDA, payback, and survival metrics. We are building this measurement infrastructure alongside the factories.

OUR COMMITMENT

We track survival rates, subsidy dependency, and revenue concentration at factory level. Target: commercial sustainability without continuous subsidies. We publish these metrics because resilience is only credible when measured, not claimed.

PLASTIC ODYSSEY
FACTORIES.

04

LIMITS

Limits & Risks.

Knowledge gaps where industry-wide data does not exist, and the safeguards we put in place to ensure our recycling work does not become an alibi for delaying upstream reduction.

Knowledge gaps and precautionary measures

Three questions we cannot answer yet (no data exists, industry-wide).

1. Soil leaching. When a paver cracks after 10 years, what happens to contaminants? Lixiviation into groundwater? At what concentration? No TCLP data exists for recycled plastic pavers or boards, from any manufacturer globally.

2. Indoor air quality. A recycled furniture piece in a classroom at 35°C in Senegal. What VOCs does it release? Sheridan et al. (2023, *Science of the Total Environment*) showed HDPE doubles benzene emissions between 18°C and 28°C, and that was virgin material. Over 400 VOC species were detected. Recycled products contain more volatile contaminants. No chamber test data exists for recycled plastic furniture during use.

3. End-of-life toxicity. Mayrhofer et al. (2023) showed extrusion generates new mutagenic substances. Rubin & Zucker (2022) found recycled microplastics make organic pollutants an order of magnitude more toxic than virgin. Do our products concentrate contaminants beyond the toxicity of their original waste input? We do not know. [1] [2]

Not being an alibi.

Recycling and source reduction — compatibility and position

The critique is documented and legitimate. Industry lobbying groups have used recycling programs to oppose plastic reduction policies. Internal documents show major producers promoted recycling while knowing it could not scale, and simultaneously lobbied against bans. Today, 13 U.S. states have preemption laws blocking local plastic restrictions, largely through industry efforts framing recycling as the alternative to reduction.

Reduction comes first. But reduction alone will not be enough. The waste hierarchy is clear: prevent, then recycle. We fully support binding production caps. Yet even with aggressive reduction, billions of tonnes of legacy plastic already saturate environments worldwide. In LMICs where we operate, this waste leaks into oceans daily. Waiting for upstream policies to take effect means accepting continued pollution. We need both: reduce future production AND capture existing waste.

How we finance recycling without becoming an industry alibi

The companies with resources to invest (petrochemicals, plastics, packaging) are often those driving the problem. We engage them, but on our terms.

[1] Mayrhofer et al., Thermal degradation in recycled polyolefins (Recycling, 2023).
[2] Rubin & Zucker, Nanoplastic detection and fate (Chemosphere, 2022).

Partner selection based on trajectory. We assess corporate partners on demonstrated reduction commitments: public targets, year-on-year packaging reduction data, investment in reuse systems. Companies using recycling to offset growing plastic footprints are not eligible.

Editorial independence. Partners fund infrastructure. They do not review, approve, or influence our public communications. Our support for production reduction policies, including binding caps in the Global Plastics Treaty, is non-negotiable.

Verified impact only. Our blockchain traceability (Inclusiv) records every kilogram with geolocated proof. Partners report only verified volumes, no estimates, no projections. Third-party audit rights are standard in all Plastic Certificate agreements.

Governance safeguards. Our Mission & Ethics Committee, independent from operations, reviews major partnerships against these criteria. Rejection decisions are documented and final.

Open methodology. Our impact measurement framework, developed with Impact Labs, is published. Competitors can use it. Scrutiny strengthens credibility.

> **OUR APPROACH**
>
> We work with industry because systemic change requires their capital, logistics networks, and market access. But the relationship is transactional, not promotional. The question we ask before any partnership: *does this accelerate the transition to less plastic, or help delay it?*

Mitigation measures

- No single corporate partner exceeds 20% of annual revenue
- No single industry sector exceeds 40% of annual revenue
- Partners fund infrastructure but never review or influence our public communications
- Our Mission & Ethics Committee reviews major partnerships independently
- Third-party audit rights are standard in all Plastic Certificate agreements
- Blockchain traceability (Inclusiv) records every kilogram with geolocated proof

PLASTIC ODYSSEY FACTORIES.

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