



MICRO-CREDENTIAL

CIRCULAR ECONOMY FOR LAND AND WASTE MANAGEMENT

2.- Principles and Models of Circular Economy

Circular Economy system thinking

CELWS-W02-V03

Circular Economy System Thinking

From Linear Traps to Regenerative Futures



The Linear Trap – Why Business Can't Keep Going As Is



\$80–120 B Lost Annually

In plastic packaging alone — value extracted, used briefly, then permanently destroyed (Goretti Arnaste, 2023).

30% of Global GHG Emissions

Still directly tied to "take-make-dispose" supply chains — a systemic failure baked into our industrial model.

Linear Waste = \$120 B Annual Leak

\$120B

Destroyed Every Year

Value lost in plastic packaging alone — equivalent to the entire GDP of Norway vanishing into landfills and oceans annually.

30%

Global GHG Share

Of greenhouse gas emissions are directly attributable to linear "take-make-dispose" supply chains worldwide.



\$120 B Vanishing into the Void

Every year, the linear economy discards enough value to fund entire national economies — washing it into oceans and landfills, never to return.

The Circular Promise – What What Happens When We Close Close the Loop

48% CO₂e Reduction

Achievable by 2030 if circular practices scale globally — equivalent to removing billions of cars from the road (Arnaste, 2023).

\$1 Trillion in Savings

Annual savings potential for households and industry combined — unlocked by eliminating waste and extending product value.

The 4 R Pillars of System Thinking



Reduce

Design out waste from the very start — fewer inputs, lighter footprints, smarter material choices before production begins.



Reuse

Extend product life through service models — leasing, refurbishment, and take-back schemes that keep materials in circulation longer.



Recycle

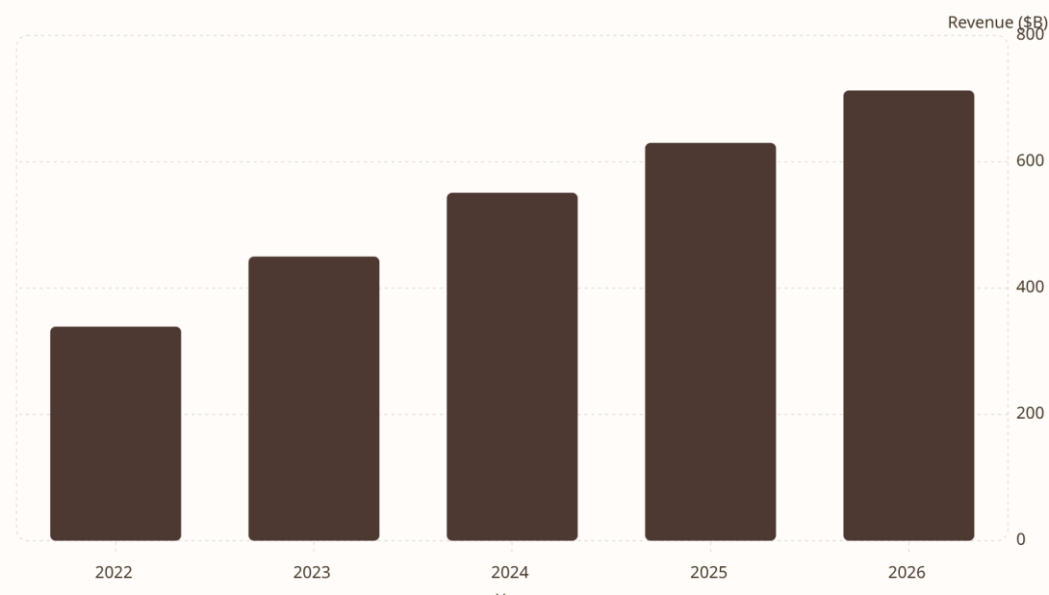
Recover and reprocess materials at end-of-life, preserving embodied energy and reducing the need for virgin resource extraction.



Regenerate

Return biological materials safely to natural systems, restoring soil, water, and biodiversity rather than depleting them.

Global Circular Economy Revenue: A 2× Surge



Doubling in Four Years

From **\$339 B in 2022** to a projected **\$713 B by 2026**, the circular economy is one of the fastest-growing sectors in global business history (Statista, 2024).

This trajectory reflects accelerating consumer demand, tightening regulation, and the compounding economics of resource efficiency.

Where the Money Grows – Sector Breakdown (2022)



Electronics — \$93 B

Driven by smartphone refurbishment programs and modular device design initiatives.



DIY & Hardware — \$73 B

Modular tool kits and community repair hubs enabling extended product lifecycles.



Clothing — \$61 B

Resale platforms like ThredUp driving the second-hand fashion revolution with \$12 B ARR.

20B

Deals in 2022

The baseline of circular-economy transactions worldwide at the start of the measurement period.

32B

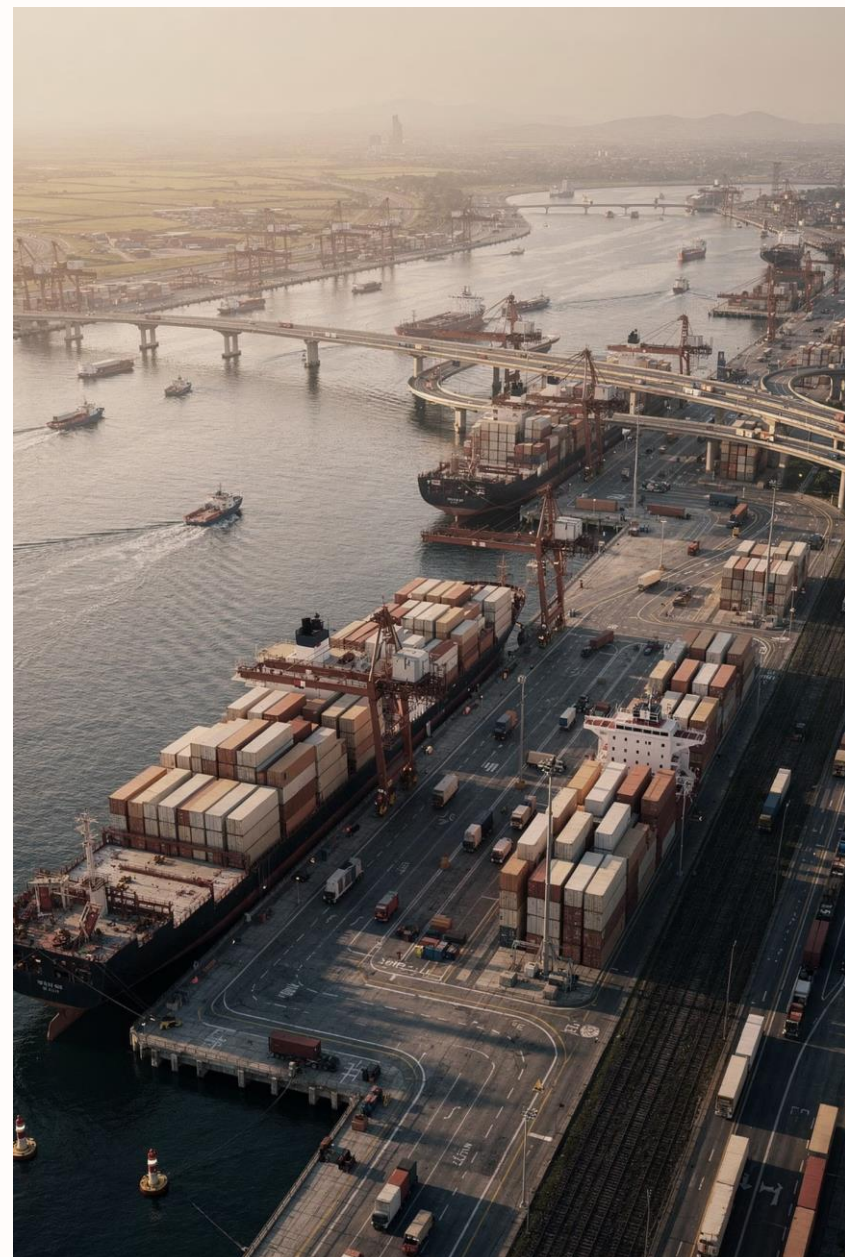
Deals by 2026

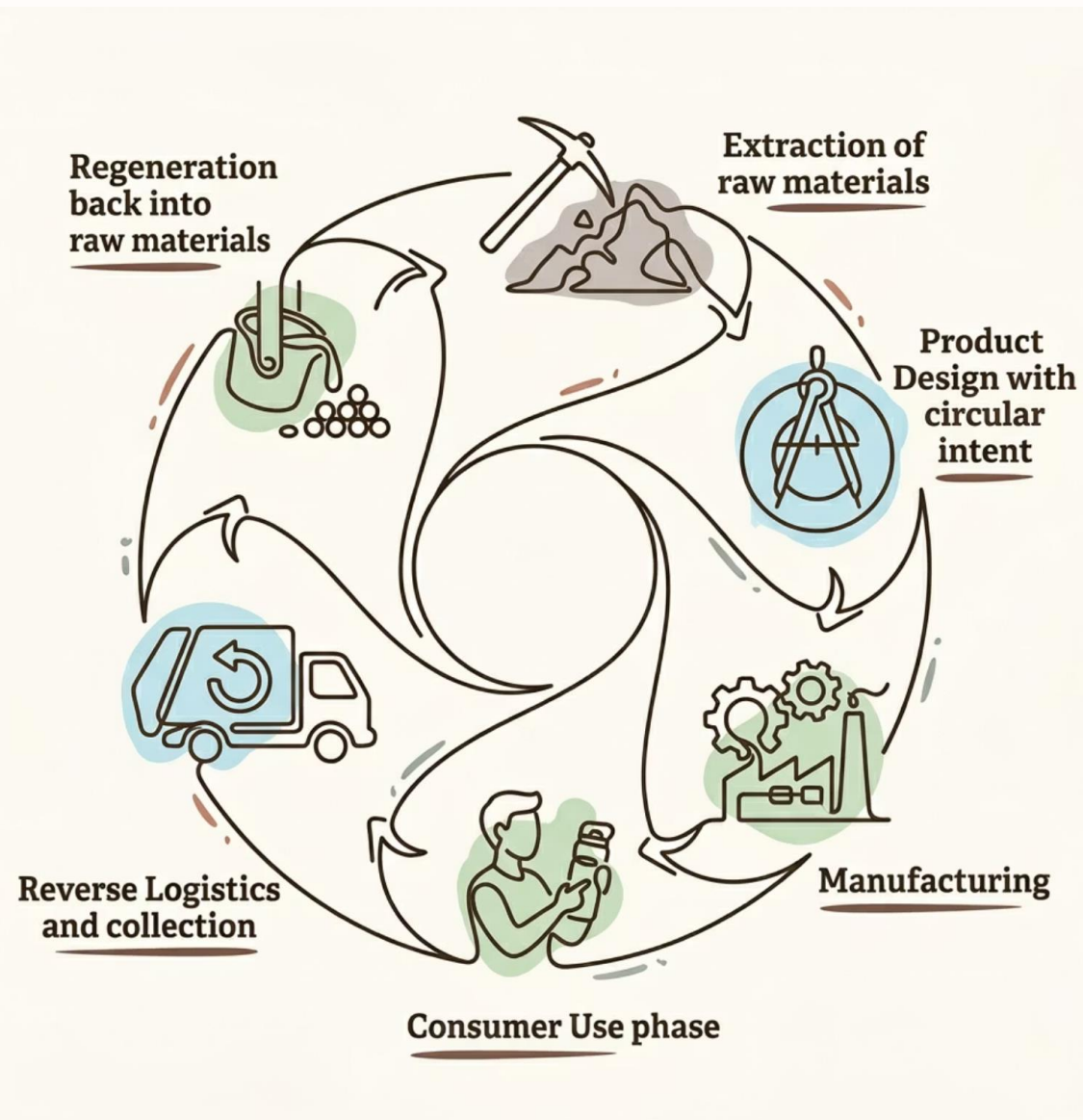
Forecast circular transactions — a 60% increase driven by platform growth and policy mandates (Statista, 2024).

60%

Transaction Growth Growth

The projected surge in circular deal volume, reflecting systemic adoption across industries globally.

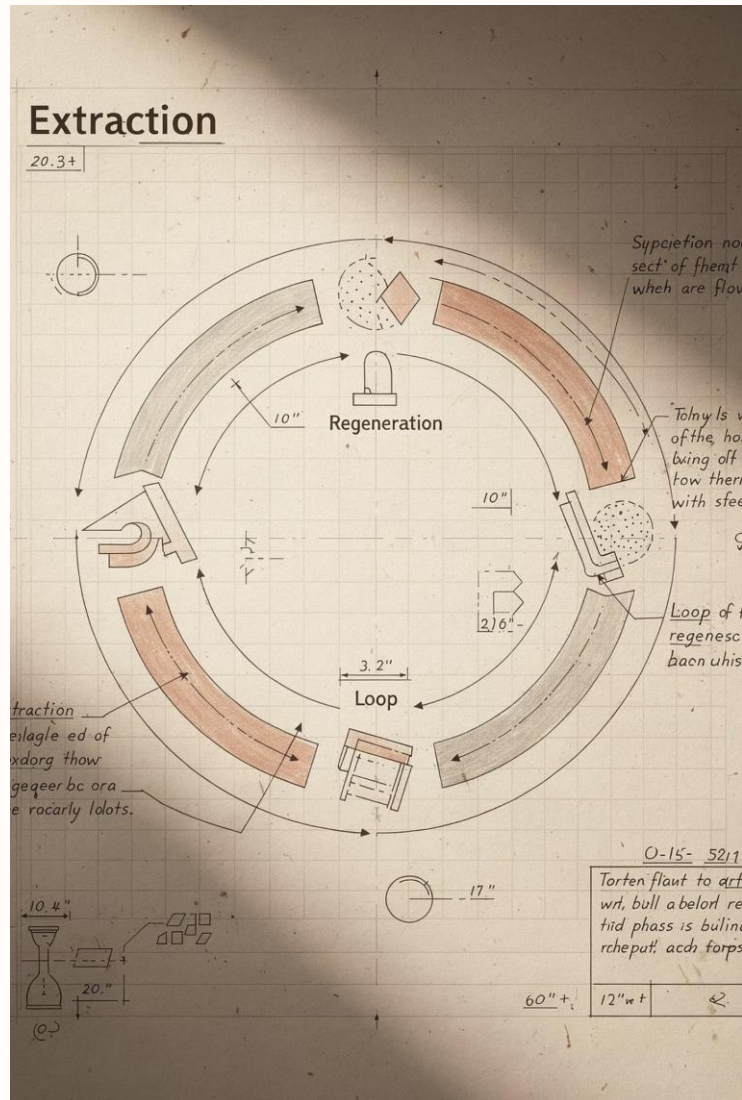




Circular system thinking moves beyond recycling as an afterthought. Every product carries a **material passport** — a traceable record of its composition, origin, and end-of-life pathway.

Visualizing these flows reveals hidden value in waste streams, turning what was once "trash" into a strategic asset and input for the next production cycle.

Every stage — from raw extraction to reverse logistics — is an opportunity to recover value, reduce emissions, and design a smarter system.





3M t CO₂e Avoided

Over 5 years of operation through reuse and upgrade cycles.

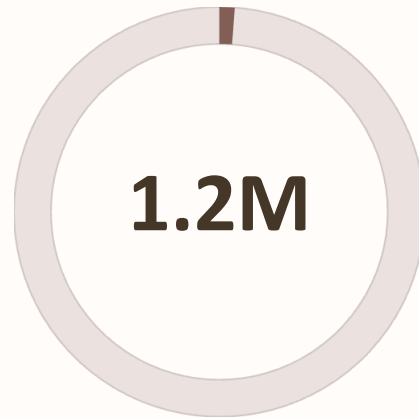
+12% EBITDA

Higher margin vs. traditional product sales (Philips Annual Report 2024).

Case Study 1 – Philips Lighting's "Pay-per-Lux"

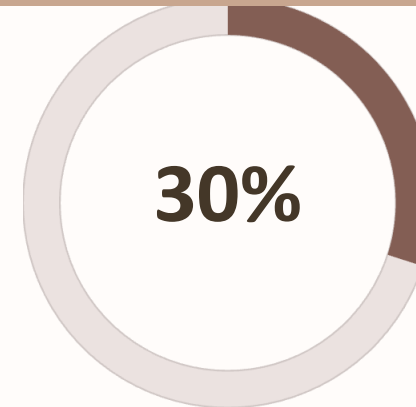
Light-as-a-Service Model

Philips retains ownership of all luminaires, maintaining, upgrading, and reclaiming them — customers simply pay for the light they use.



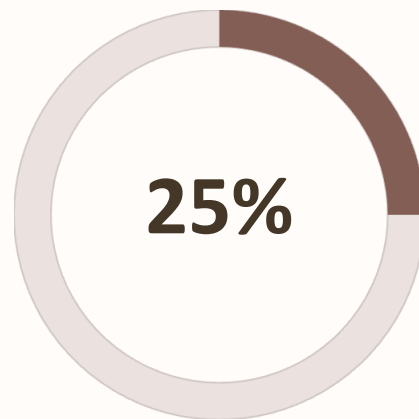
Pieces Returned

In the first 18 months of the leasing pilot program across U.S. markets.



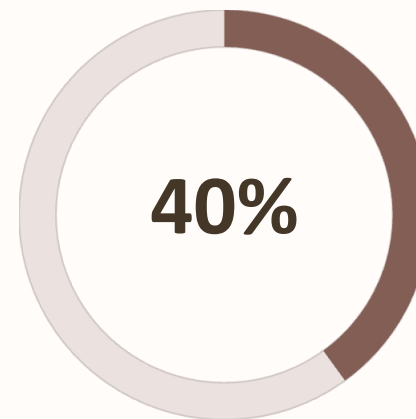
Material Reclaimed

Of returned furniture material recovered and reintroduced into the production cycle.



Lower Upfront Cost

For customers choosing leasing over outright purchase — improving accessibility.



Longer Lifespan

Product longevity extended through professional maintenance built into the lease model.



Strategic Insight: Leasing creates a built-in reverse-logistics loop — IKEA knows exactly where every piece is, enabling recovery at end-of-life by design.

MIXING DESTROYS RECYCLING

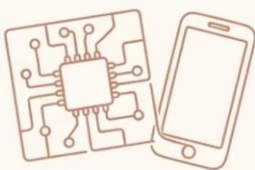


DEDICATED STREAMS ENSURE RECOVERY

PAPER & CARDBOARD



ELECTRONICS & E-WASTE



METALS & MATERIALS



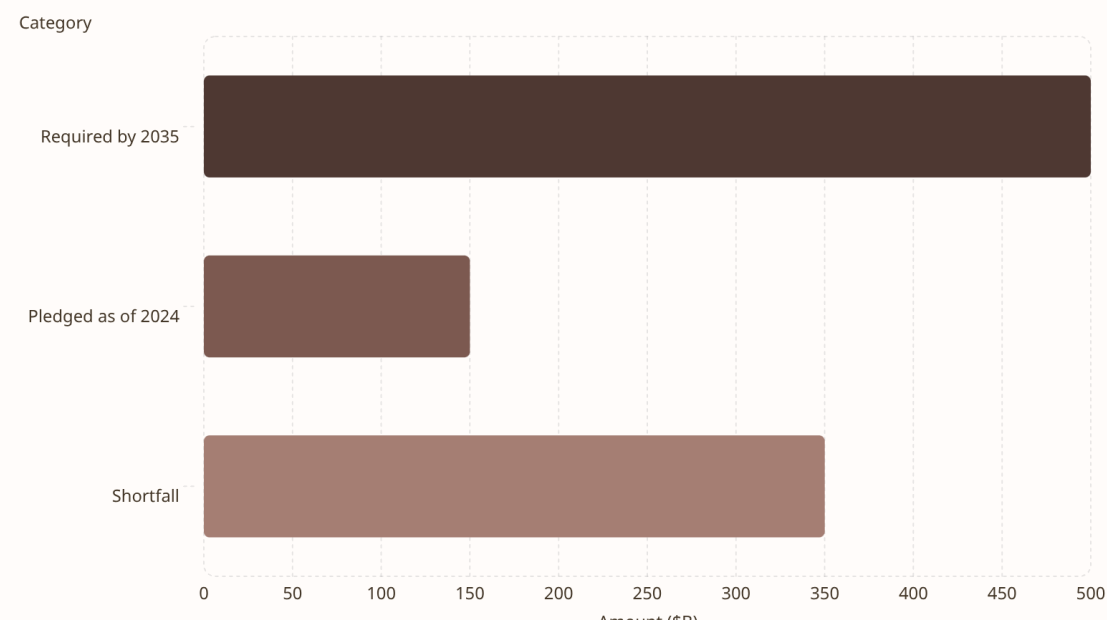
Challenge 1 – Fragmented Recycling Streams

Infrastructure Silos Block Progress

Paper, electronics, and metals each require **dedicated, specialized collection infrastructure** — a fragmented reality that mixed-material products make far worse (Baidas, 2024).

The result: only **45%** of mixed-material waste is currently recyclable in the U.S., leaving more than half of recoverable value permanently lost.

Challenge 2 – The Investment Gap



\$350 B Still Missing

\$500 B is required by 2035 to retrofit global supply chains for circular compatibility (World Economic Forum, 2025).

With only **\$150 B pledged as of 2024**, the gap is not just financial — it represents a structural risk to the entire circular transition timeline.

Policy Landscape – United States Takes the Lead

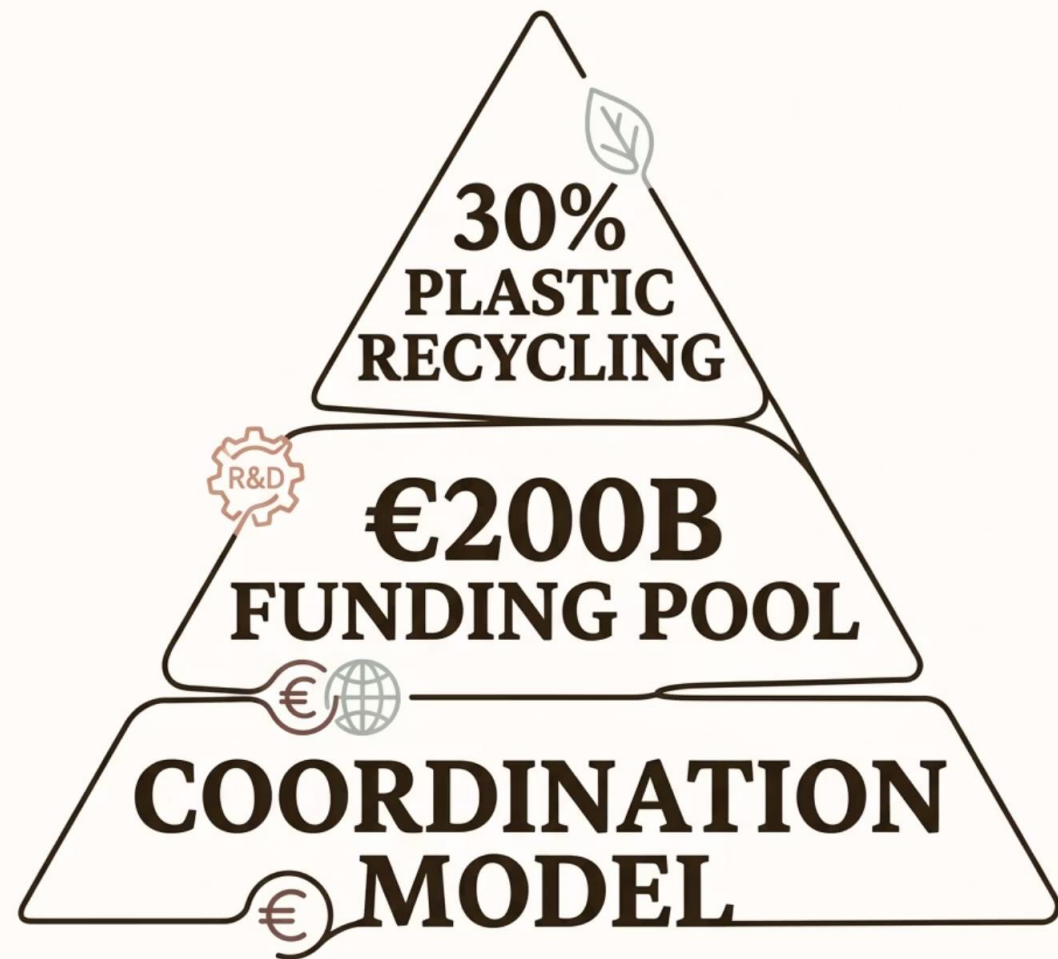
2024 Inflation Reduction Act

\$15 B earmarked for circular-economy grants, incentivizing manufacturers and municipalities to adopt circular infrastructure and reverse-logistics systems (EPA, 2024).

2025 EPA Circularity Rule

Mandatory **product-level material passports** required for over 10,000 high-volume consumer and industrial items — the most ambitious traceability mandate in U.S. history.





International Benchmark – EU Circular Economy Action Plan 2024

Europe's Blueprint

The EU's Action Plan sets a **30% recycling target for plastics by 2030**, backed by a €200 B funding pool spanning R&D, infrastructure, and regulatory enforcement.

Its federal-regional coordination model offers a direct template for U.S. federal-state circular economy policy design — proving that ambition at scale is achievable.

Construction Sector – The Hidden Waste Giant



Massive Scale, Massive Opportunity Opportunity

The UK alone generated **45.85 M tonnes** of construction and demolition waste in 2012 — with **86.5% recovered**, demonstrating what dedicated infrastructure can achieve (CPA, 2016).

Yet despite this recovery rate, **£47 B of material value** still ends up in landfill annually — a signal that recovery alone isn't enough without design-for-disassembly upstream.

Manufacturer's Role – From Producers to Circular Leaders

Design-for-Disassembly

24 major UK manufacturers — including **British Steel** and **BASF UK** — now embed disassembly standards into product engineering from day one.

Reverse-Logistics Networks

Collaborative industry networks for material recovery have cut average material loss by **12%**, proving that cooperation multiplies impact.

Innovation Spotlight – Bio-Based Polymers

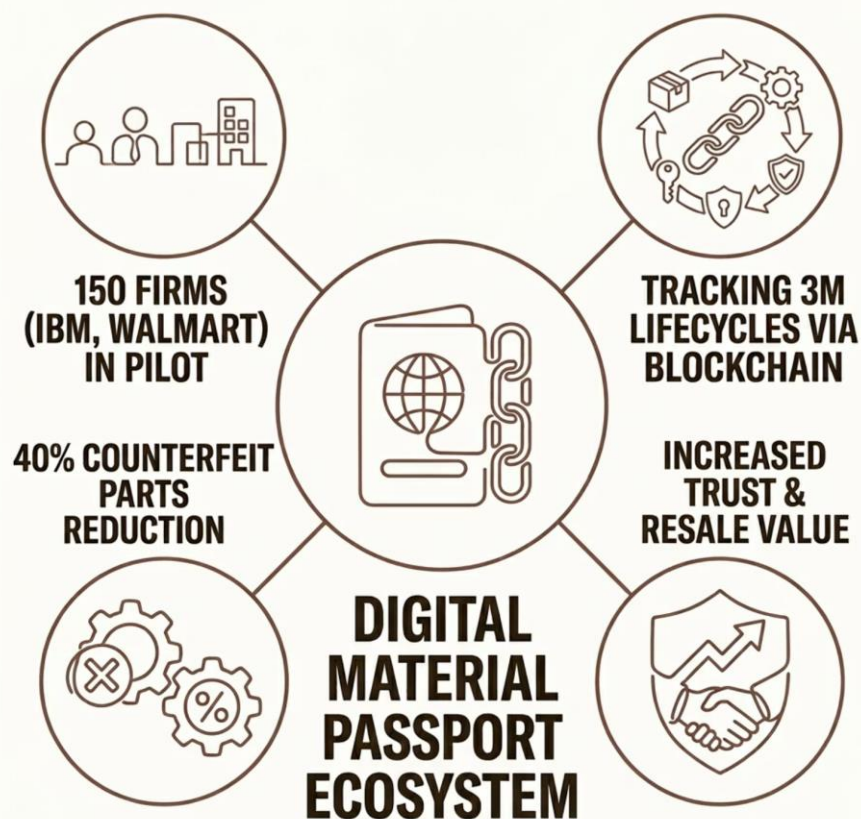


A \$12 B Market Replacing Petro-Plastics

The bio-based polymer market reaches **\$12 B in 2025**, projected to replace **30%** of petroleum-based plastics by 2030 (Baidas, 2024).

NatureWorks' Ingeo™ PLA is already deployed in **1.5 M food containers annually** — proving that bio-based alternatives are no longer a niche experiment but a scalable commercial reality.

Digital Enablers – Material Passports & Blockchain



Traceability at Scale

A 2024 blockchain pilot with **150 firms** — including IBM and Walmart — tracked **3 M product lifecycles**, reducing counterfeit components by **40%**.

Real-time digital traceability does more than prevent fraud: it builds the consumer trust and verifiable provenance that fuels resale markets and circular business models.

Economic Upside – Jobs & Growth

2M

New Jobs by 2030

Circular-economy roles projected globally — spanning repair, remanufacturing, logistics, and digital traceability (World Economic Forum, 2025).

\$68K

Average Salary

For circular economy roles — 15% higher than comparable positions in linear-economy industries, reflecting skills premium.

15%

Salary Premium

Circular jobs pay more because they demand higher-order skills: systems thinking, materials science, and lifecycle design expertise.





SDG 12 — Responsible Consumption

Direct alignment. The circular economy is the operational model for responsible production and consumption patterns at scale.



SDG 7 — Clean Energy

Circular energy systems — including remanufactured batteries and renewable components — accelerate the energy transition.



SDG 13 — Climate Action

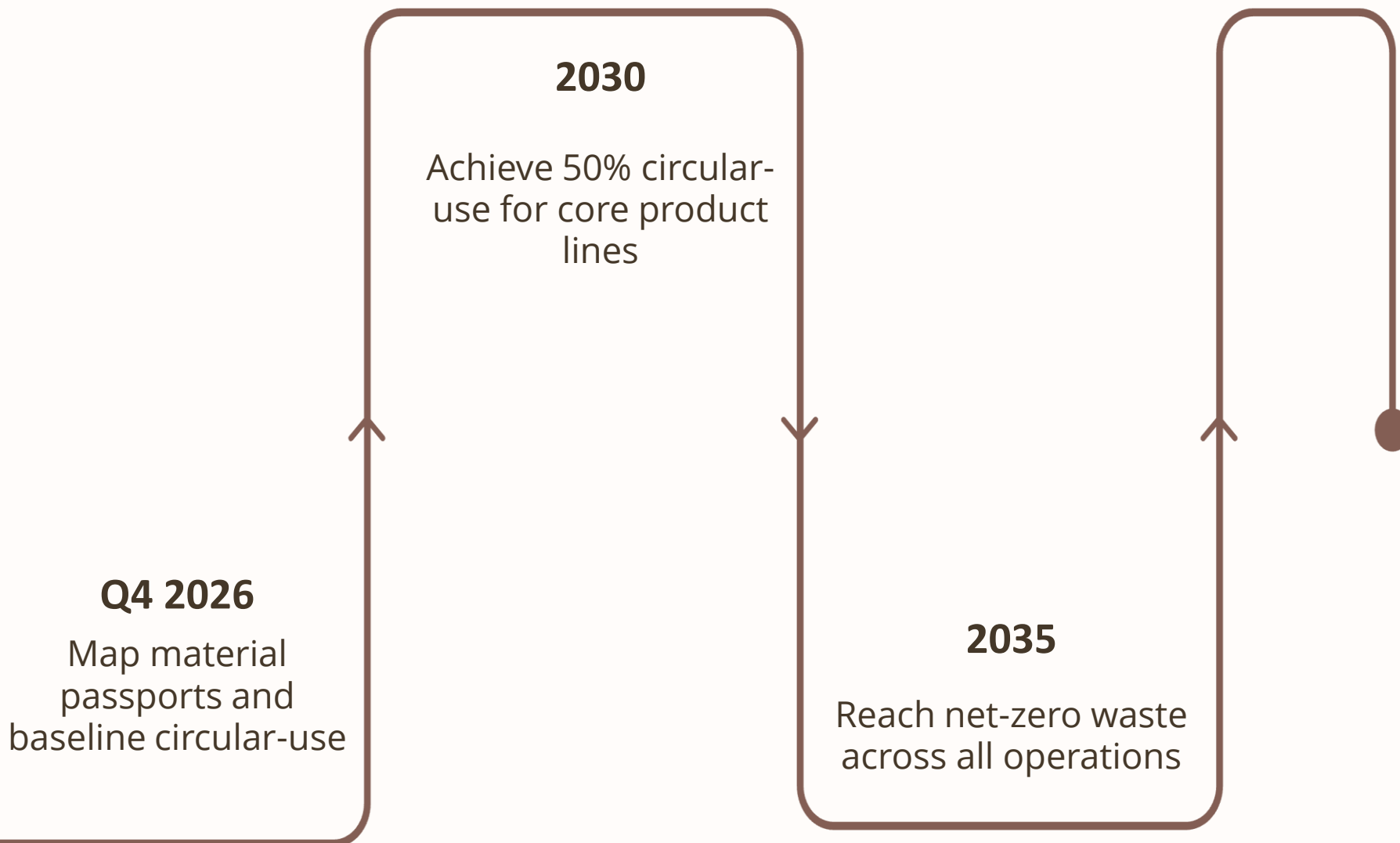
Closing material loops directly reduces industrial emissions, supporting net-zero commitments worldwide.



SDG 15 — Life on Land

Regenerative circular practices restore soil, reduce habitat destruction from mining, and support biodiversity recovery.

Call to Action – Your Organization's 2035 Circular Target



System thinking isn't a future ambition — it's a present business imperative. Organizations that begin mapping material flows today will lead the markets of 2035.

The Future Is Circular

A **zero-waste world** where "trash" becomes **resource**, and every dollar spent **regenerates value**. The linear economy is ending — the regenerative economy is beginning.
Join the loop.

