



MICRO-CREDENTIAL

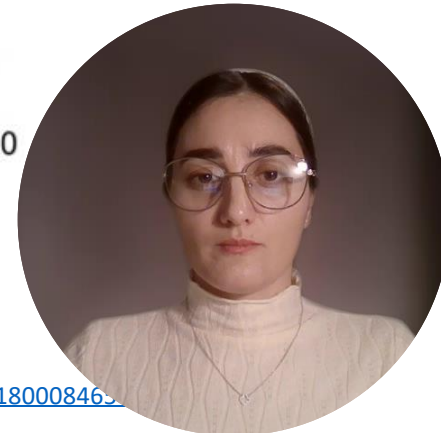
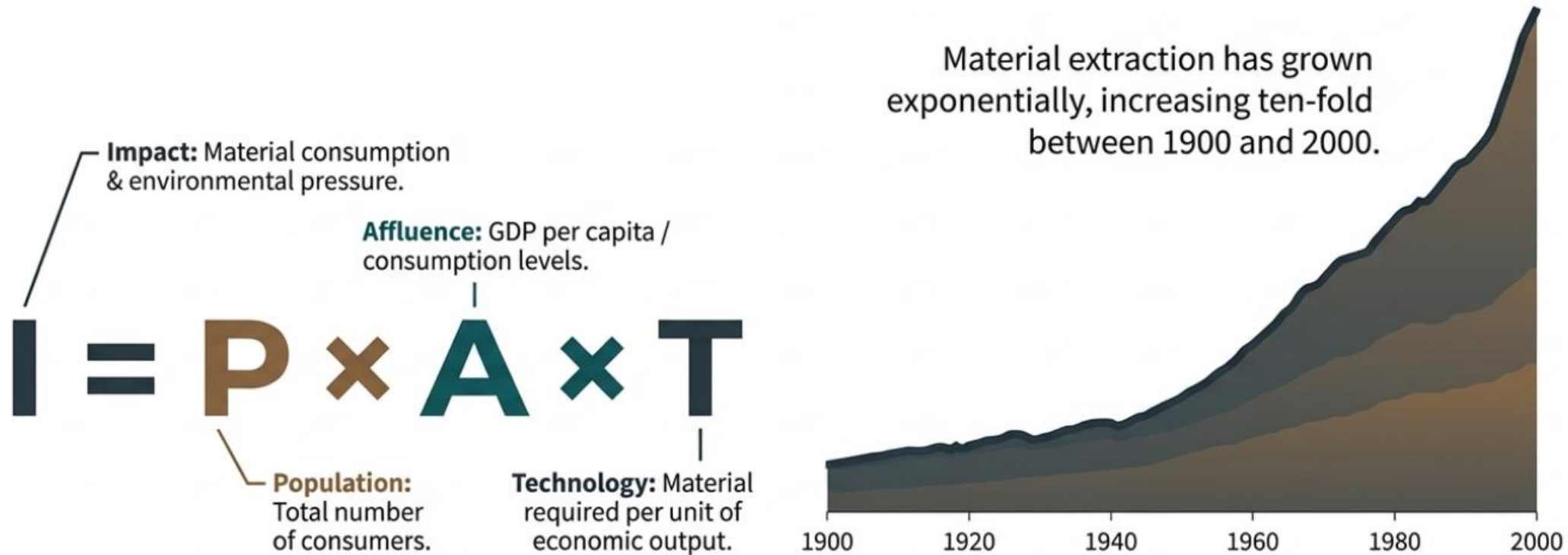
CIRCULAR ECONOMY FOR LAND AND WASTE MANAGEMENT

1.- Introduction to Circular Economy in Land and Waste Systems

Land, Resources, and Waste in Circular Systems

CELWS-W01-V02





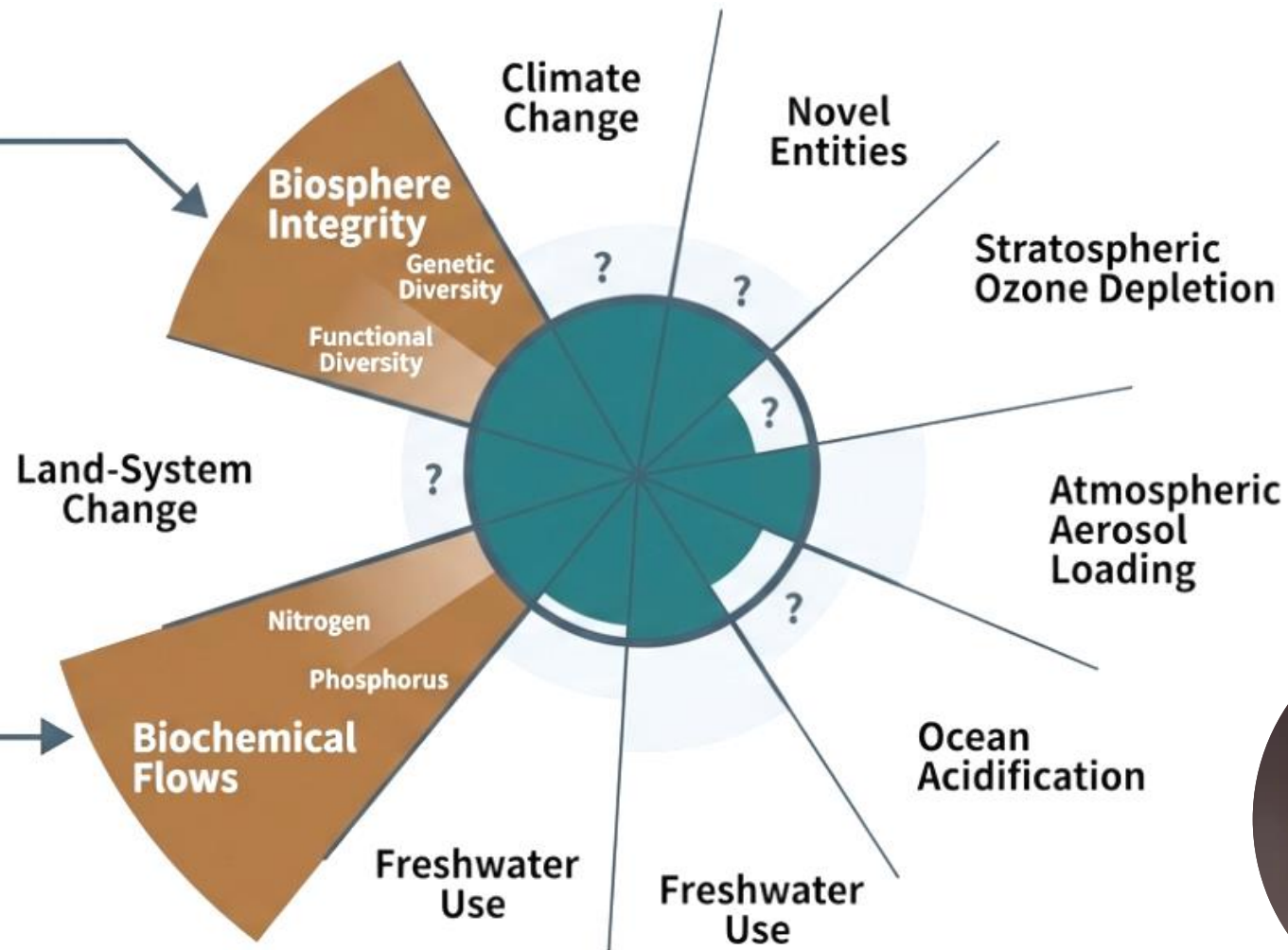
Land as a Critical Resource: Planetary Boundaries

The Framework:

Nine processes regulate the stability of the Earth system. Our land-related boundaries are currently failing.

Boundary Crossing:

Crossing these thresholds increases the risk of irreversible environmental change.



Land as a Critical Resource: Degradation and Soil Health

The Linear Reality

USD 40 Billion / Year

Land degradation costs the global economy approximately USD 40 billion annually.

The Regeneration Gap: Natural topsoil formation takes thousands of years, yet it is being eroded at rates far exceeding regeneration.

The Circular Intervention

The Solution: Circular agricultural practices aim to restore soil fertility by returning organic nutrients directly to the land.



Land as a Critical Resource: Urbanisation and Scarcity

City as Sink



The Urban Squeeze: Major cities are rapidly exhausting landfill capacity; some have only a few years of space remaining.

City as Turntable

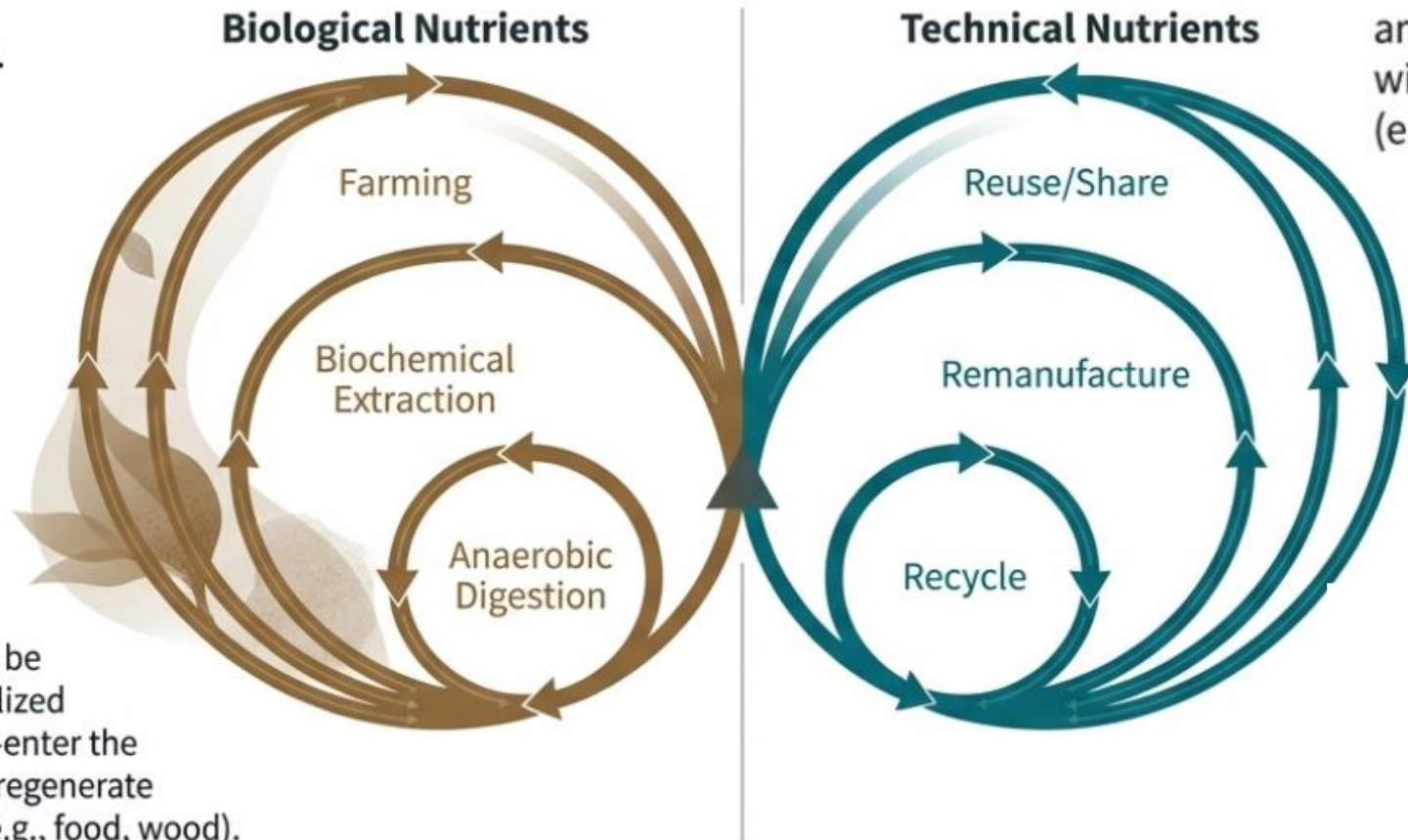


The Shift: Circular cities must transform from "resource sinks" into active "resource turntables".

The Metric: Urban areas house >50% of the global population but generate 50% of global waste.



Circular systems distinguish between biological and technical nutrients.

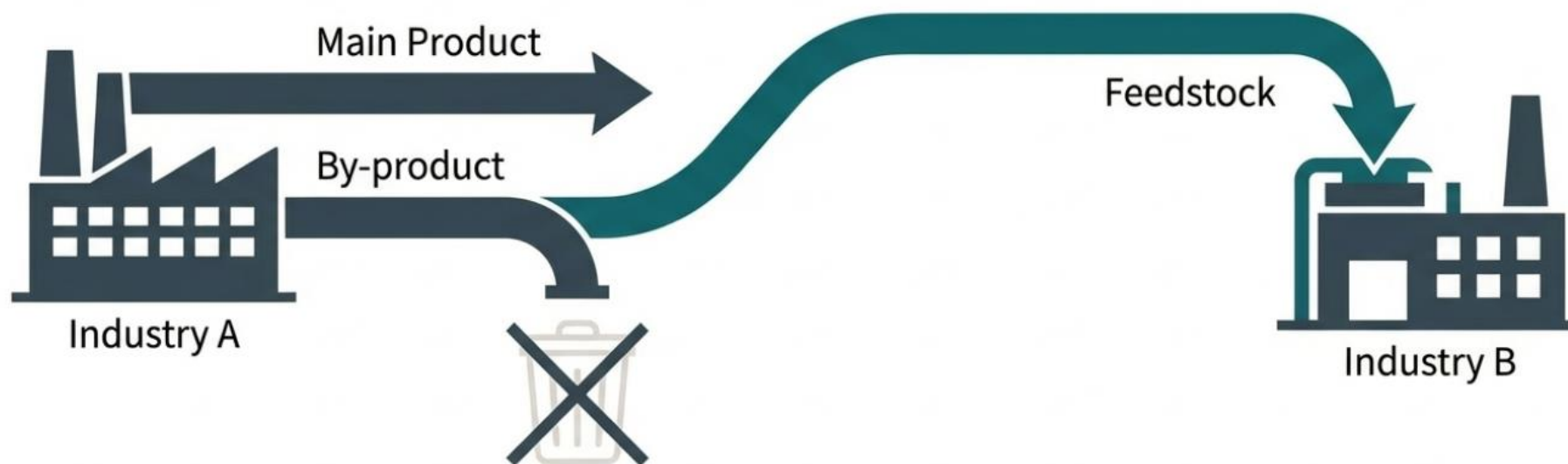


Durable materials designed to circulate in closed loops and retain embedded quality without entering the biosphere (e.g., metals, polymers).

Materials designed to be consumed or metabolized by the economy to re-enter the biosphere safely and regenerate new resource value (e.g., food, wood).



The Philosophy: Waste is defined as “unwanted material,” yet in circularity, “waste equals food”.



Industrial Symbiosis

The process where the by-products of one industry become the essential raw feedstock for another.

The Economic Flip

High-value recovery can turn a negative economic value (disposal cost) into a positive revenue stream.



The Old Standard



The hierarchy prioritises activities from prevention down to disposal.

The Circular Standard

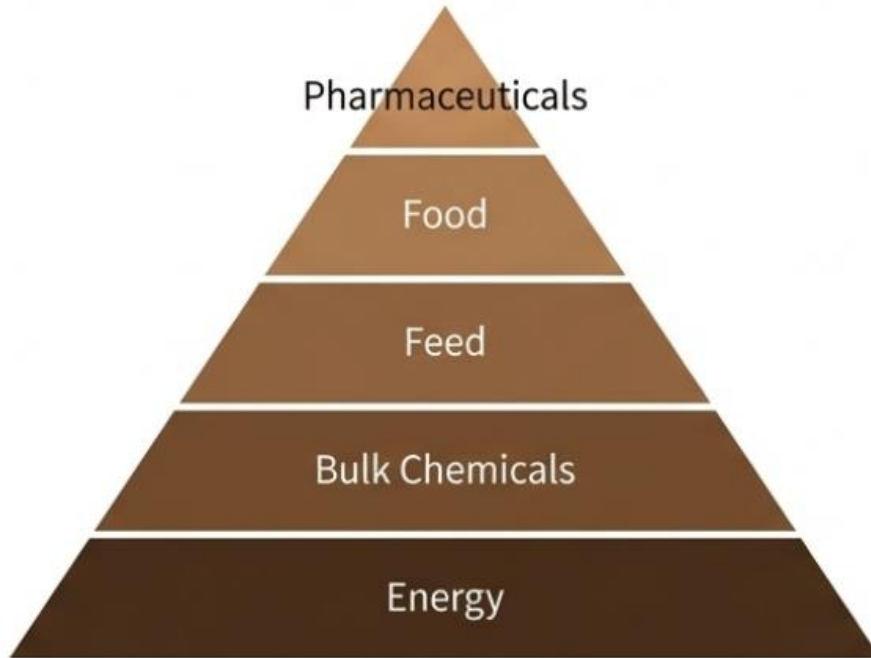


The “10 Rs” expand these strategies, focusing on the core rather than the edge.

The Insight: “Slowing loops” through product-life extension and refusal is fundamentally more effective than “closing loops” through recycling alone.

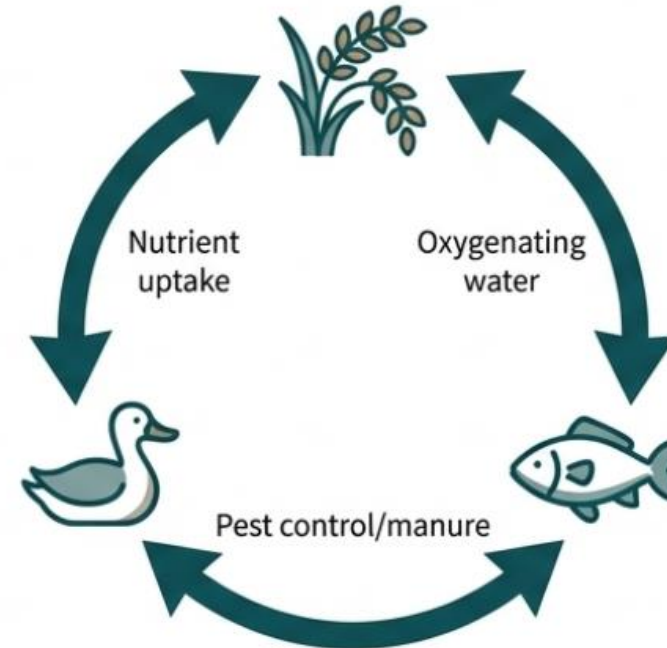


Biomass Value Pyramid



Cascading Value: The pyramid guides the use of biological materials, extracting maximum value from high-value medicine before returning low-value energy to the earth.

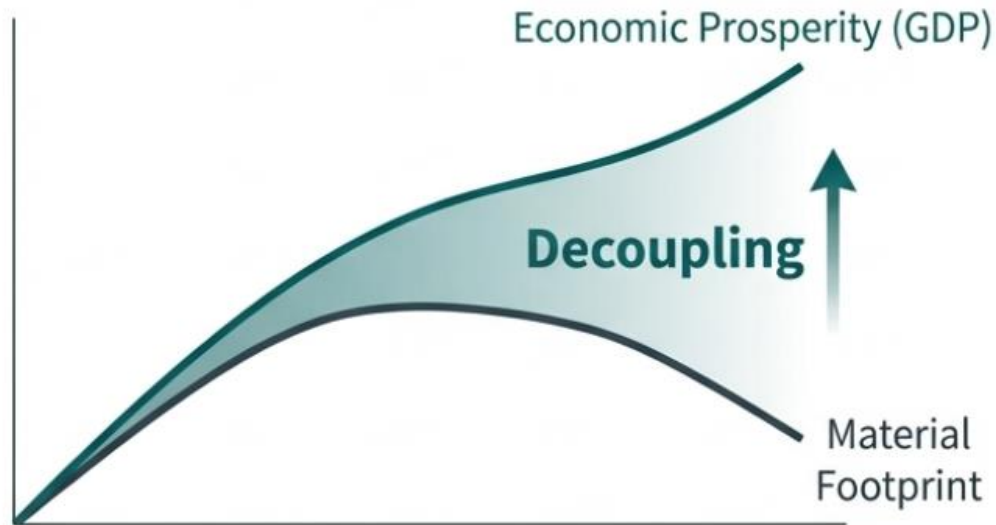
Symbiotic Ecosystem



Regenerative Agriculture: Utilizing polyculture, crop rotation, and zero-tillage to actively rebuild soil health and create symbiotic nutrient cycles without chemical inputs.



Decoupling Chart



The Goal: To fundamentally decouple economic prosperity from finite resource consumption and environmental impact.

2x2 Comparison Matrix

Eco-efficiency (Linear) 	Eco-effectiveness (Circular) 
Minimising damage, doing less bad. Measured by Domestic Material Consumption (DMC).	Positive ecological impact, doing good. Measured by Material Footprint (a more accurate metric as it includes traded goods).



Three-Pillar Dashboard



Climate Change Mitigation

Reducing GHG emissions
by decreasing primary
resource extraction and
eliminating landfill
methane.



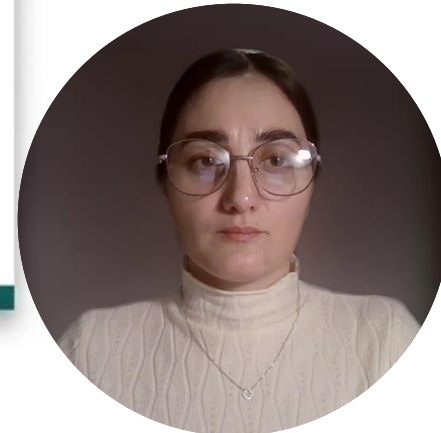
Biodiversity Protection

Preserving critical habitats
by halting the demand for
new, destructive
agricultural land expansion.



Pollution Reduction

Designing out toxic
substances and persistent
microplastics at the product
conception phase.



Kalundborg, Denmark

Model: Industrial Symbiosis

Key Innovation: The world's first and most famous closed-loop network where public and private enterprises exchange steam, gas, water, and gypsum.



VRM Biologik, Thailand/Aus.

Model: Soil Regeneration

Key Innovation: Converting localized food waste into high-content humic soil media, rapidly restoring degraded land.



Taisugar Circular Village, Taiwan

Model: Urban Circularity

Key Innovation: Communitarity
Key Innovation: An integrated living environment featuring shared resources, modular architecture, and urban farming.



Systemic Interactions:

What works for one industry may negatively affect another (e.g., reduction vs. recycling interests).

Contamination:

Mixed or hazardous materials are difficult and energy-intensive to separate back into pure nutrients.

Economic “Lock-in”:

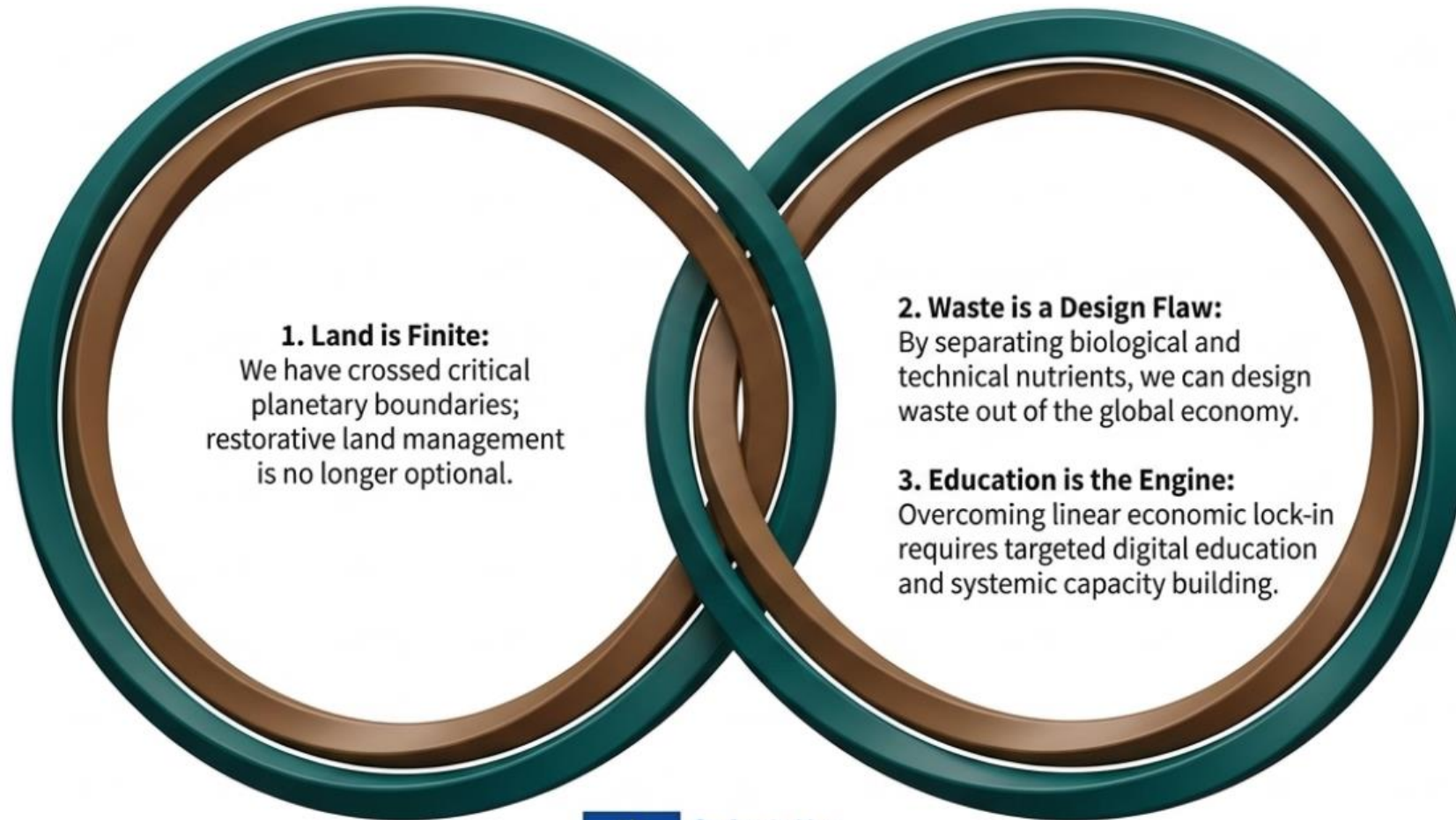
Existing global regulations, fossil subsidies, and entrenched consumer habits heavily favour the linear model.

The Linear Inertia: These barriers **interlock, creating systemic friction against the circular transition.**





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Co-funded by
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