



MICRO-CREDENTIAL

CIRCULAR ECONOMY FOR LAND AND WASTE MANAGEMENT

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

From Linear to Circular Economy: Core Concepts

CELWS-W01-V01



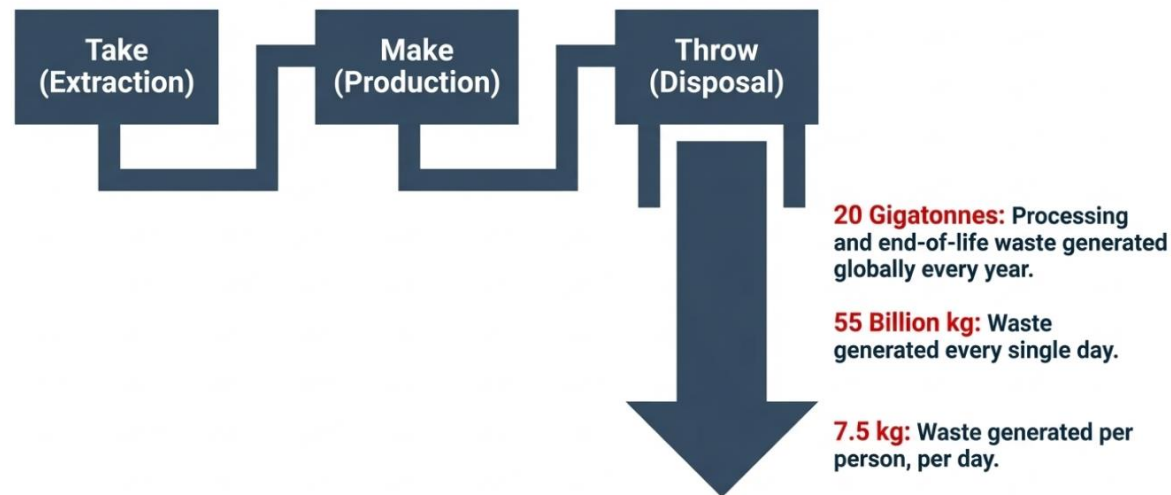
Traditional Model:

Extract raw materials → Manufacture products → Sell/Use → Discard as waste

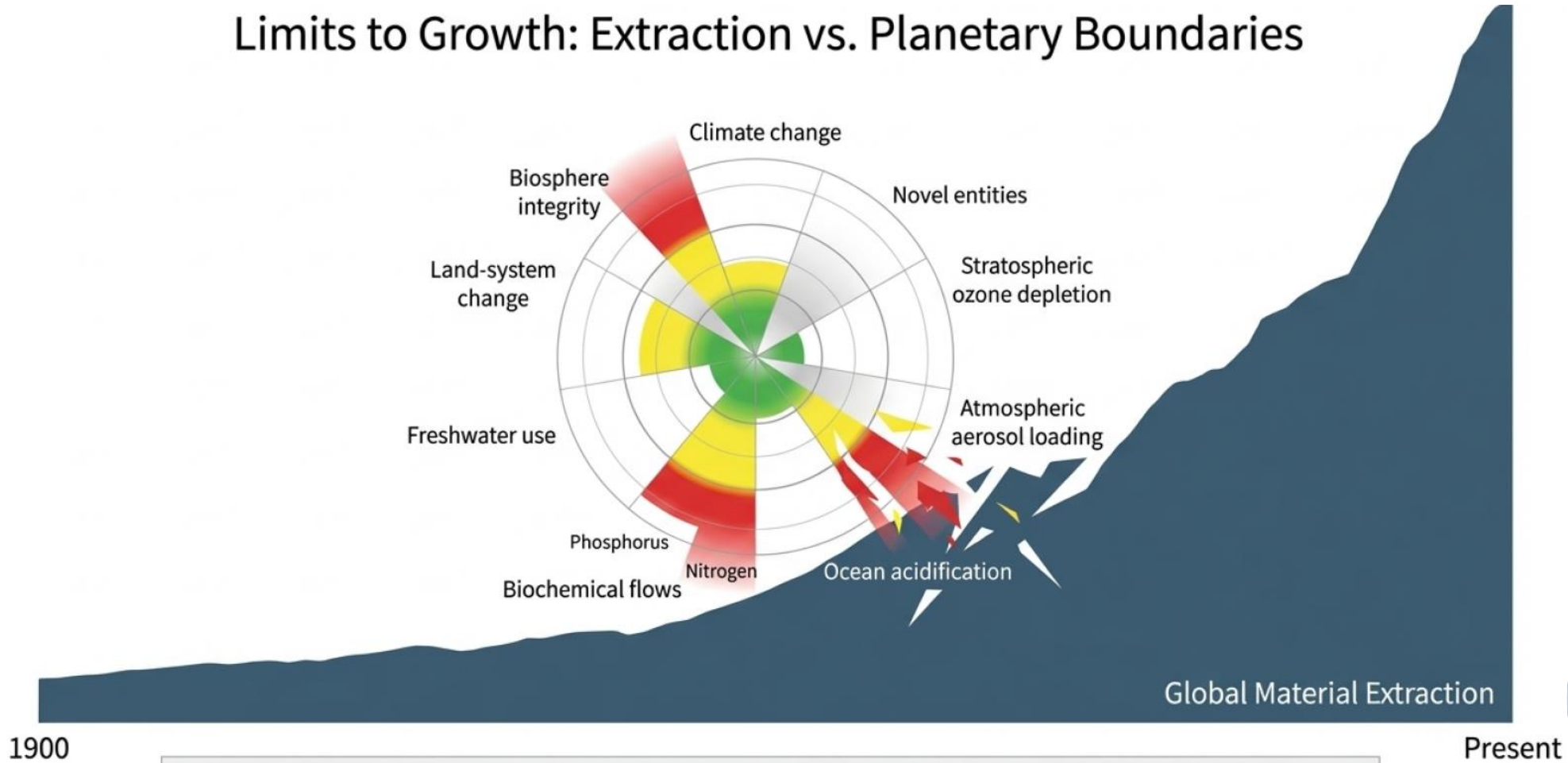
Global Impact: The world produces about **20 gigatonnes of waste annually**.

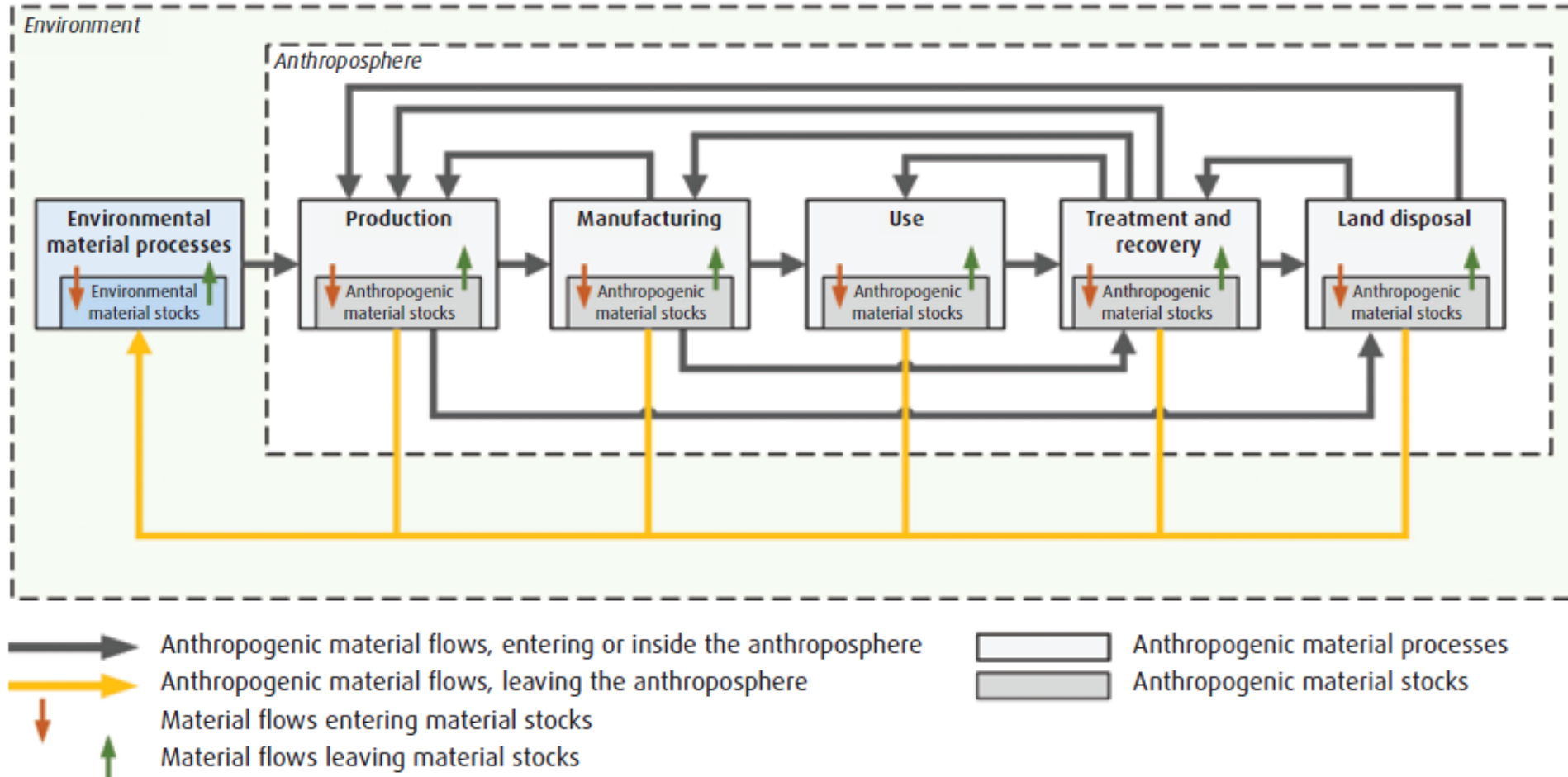
This equates to roughly **7.5 kg per person every day**

The Linear Model: Take-Make-Throw



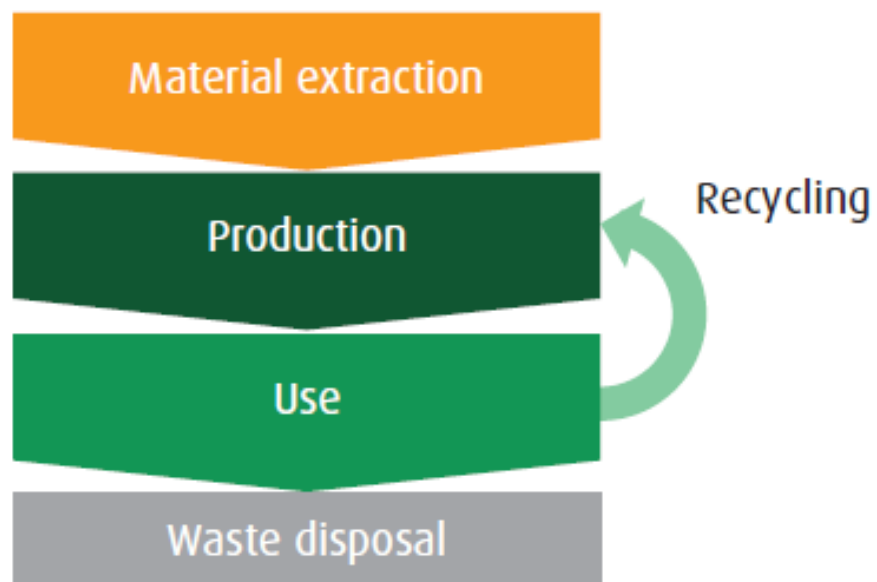
Limits to Growth: Extraction vs. Planetary Boundaries



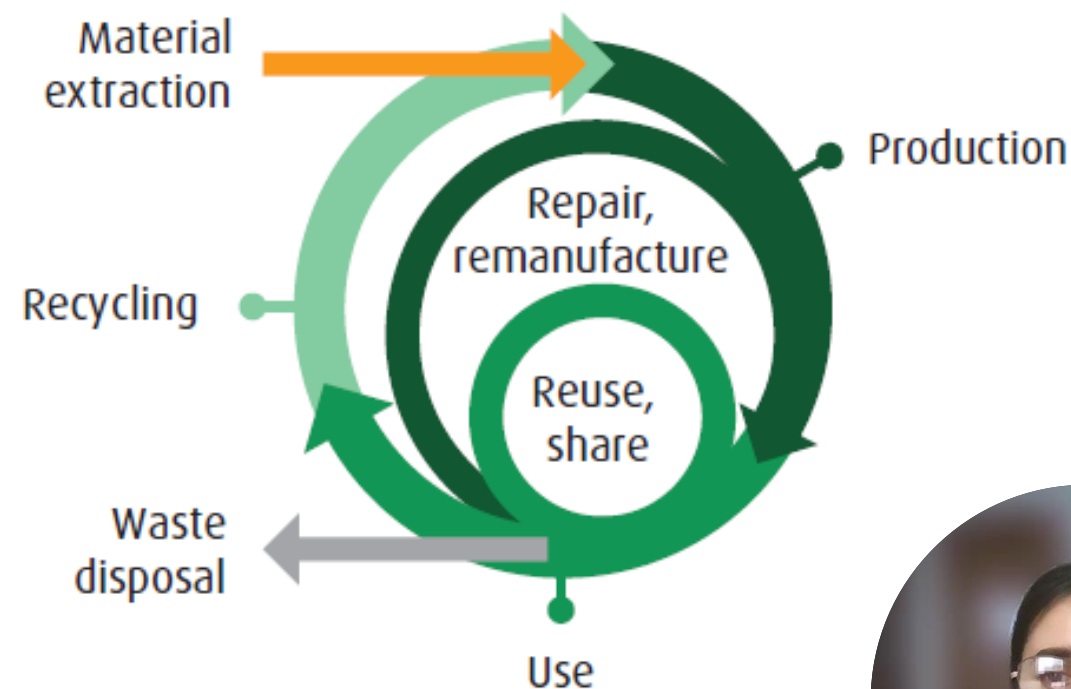


Defining the Circular Economy

Linear economy



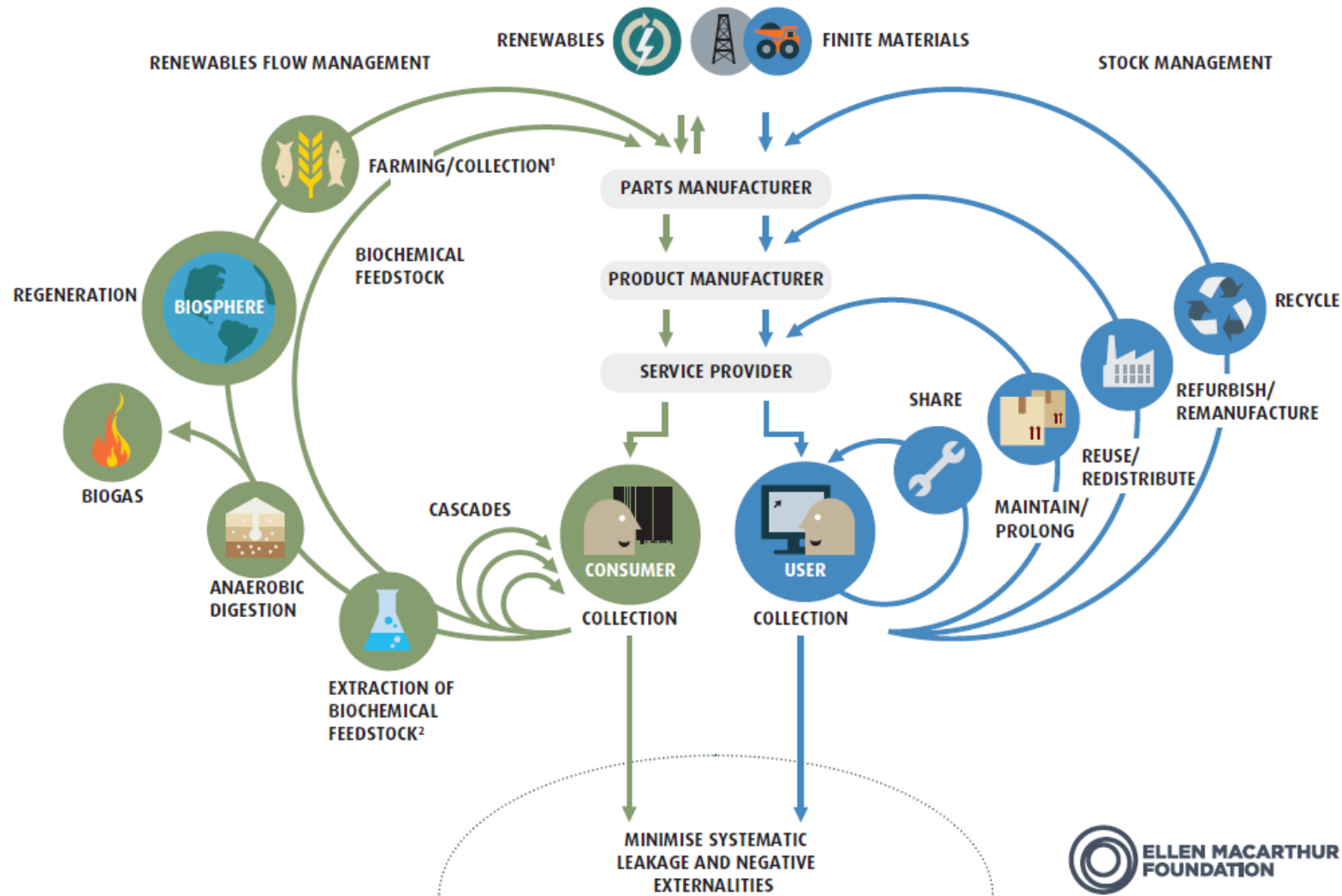
Circular economy

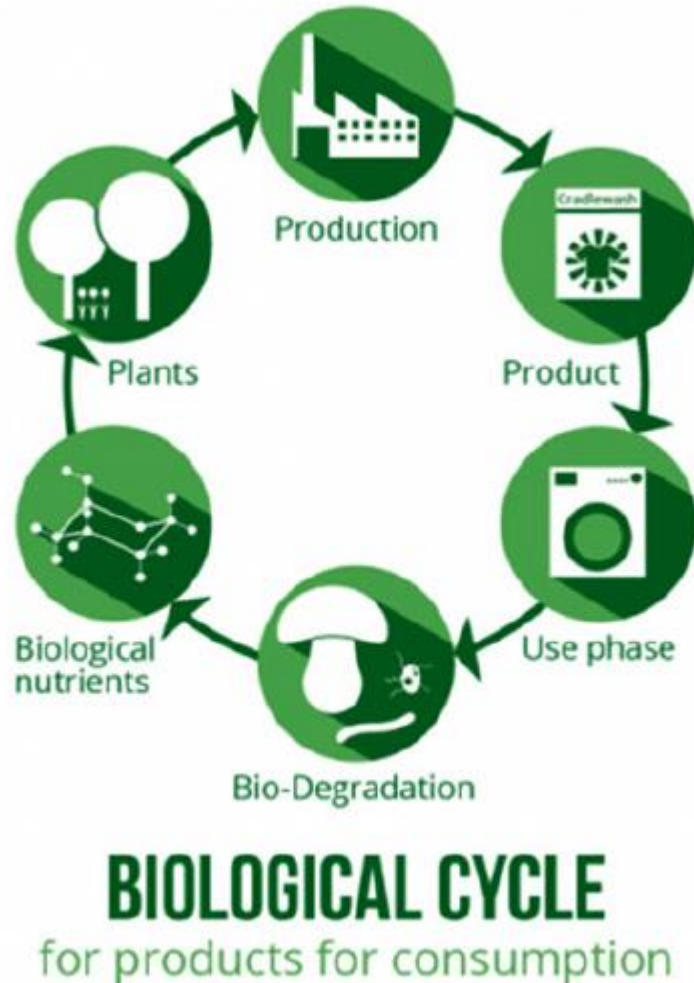


The Three Core Principles



Material Circularity: The Butterfly Diagram





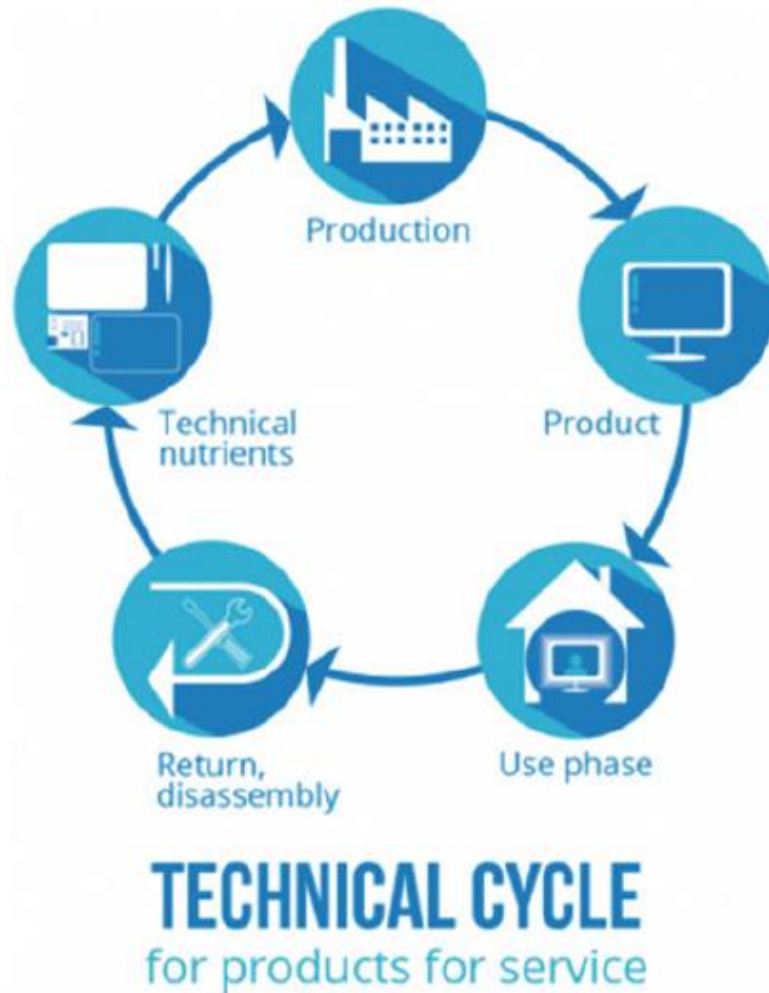
Materials: Food, timber, cotton, and bio-based materials.

Loop Strategy: "Waste equals food".

Circular Processes:

- Anaerobic Digestion & Composting: Returning organic matter to soil.
- Cascading: Using materials for multiple purposes before they return to the biosphere





Materials: Metals, plastics, and minerals.

Loop Strategy: Maintain embedded quality, energy, and value.

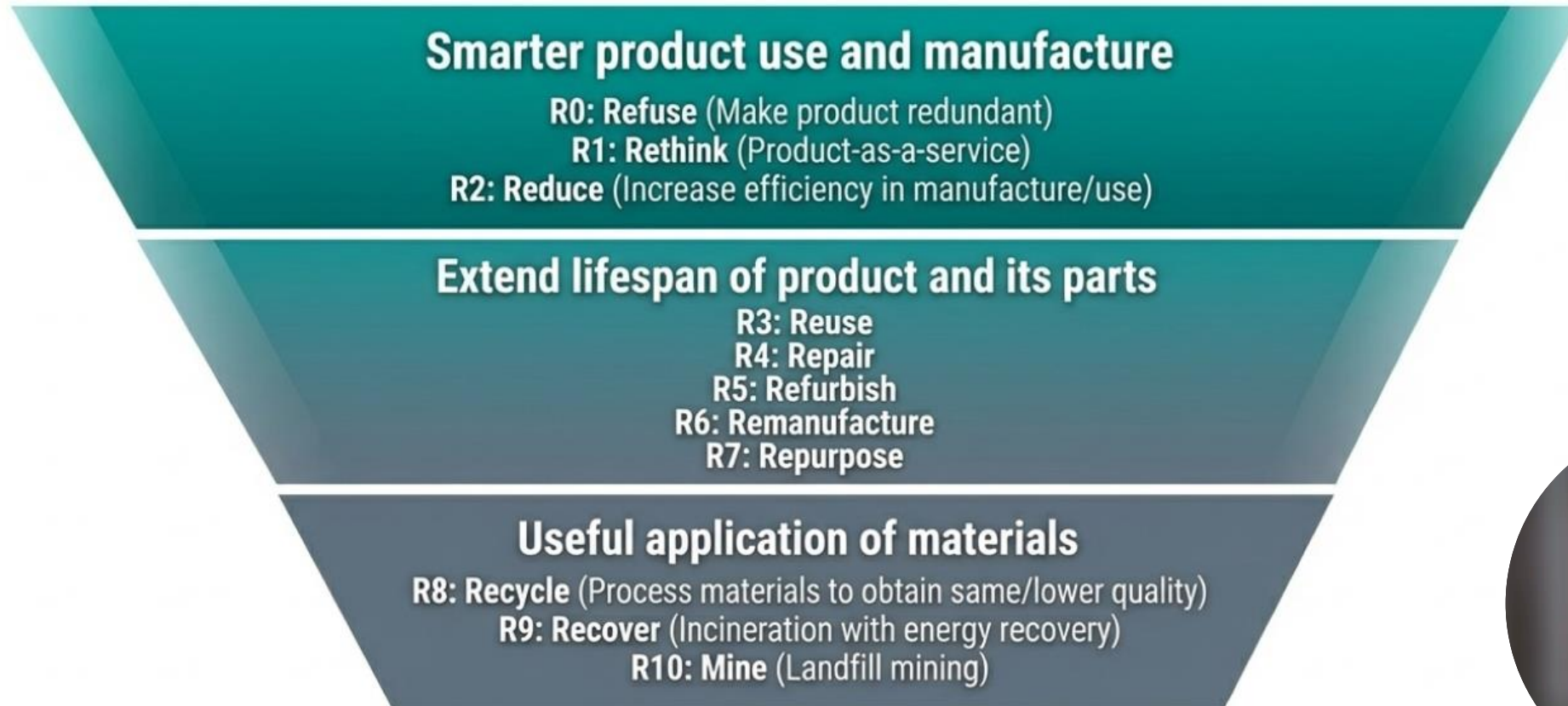
Hierarchy of Action:

Maintain/Repair → Reuse → Remanufacture → Recycle.

Recycling is the last resort.



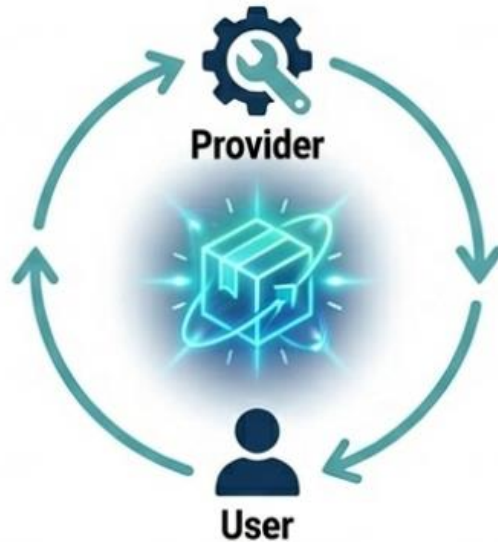
The 10 Rs Hierarchy



	↑ Upcycling	↓ Downcycling
 Material Fate	 Material quality is maintained or enhanced .	 Material quality irreversibly degrades .
 Value Trajectory	 Economic value increases or remains locked in the system.	 Value drops significantly at the end of life; merely delays the landfill.
 Energy Input	 Designed for minimal energy input during transition.	 Often requires high energy (melting, chemical breaking) to transform.
 Example	 Remanufacturing a commercial printer to as-new condition.	 Shredding high-grade plastic bottles into single-use park benches .

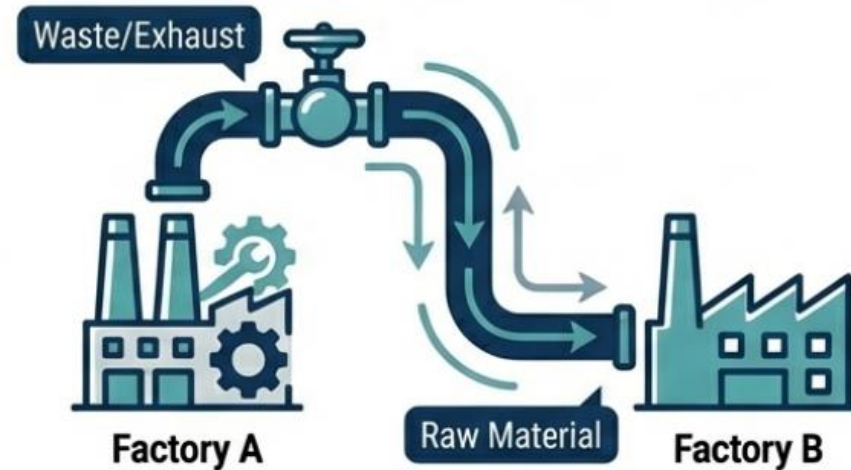


Product-as-a-Service (PaaS)



Ownership remains with the manufacturer. The customer pays for performance or utility (e.g., paying for light, not the lightbulb). Incentivizes the manufacturer to design for extreme durability and reparability.

Industrial Symbiosis



A meso-level strategy where geographically close industries exchange physical resources. One firm's waste (heat, water, byproducts) becomes another firm's critical feedstock.



Definition: Optimising the entire system rather than individual components.

Complexity: Every decision in design or production affects the entire waste stream later.

Feedback Loops: Industrial processes should operate like adaptive living systems.



Assessment Tools: LCA & MFA



Life Cycle Assessment (LCA)

- **Focus:** Measures the **Environmental Impact** (e.g., carbon emissions, water use, toxicity) across all stages of a product's life.
- **Use Case:** Used to ensure that shifting to a circular model doesn't accidentally increase carbon emissions or energy use (avoiding 'burden shifting').



Material Flow Analysis (MFA)

- **Focus:** Measures the **Mass and Volume** of materials entering, stocking within, and leaving a defined geographical or economic system.
- **Use Case:** Used by policymakers and urban planners to track where physical resources are accumulating or leaking out of a city or country.





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