



MICRO-CREDENTIAL

CIRCULAR ECONOMY FOR LAND AND WASTE MANAGEMENT

5.- Waste Prevention and Eco-Design

Design for durability and repair

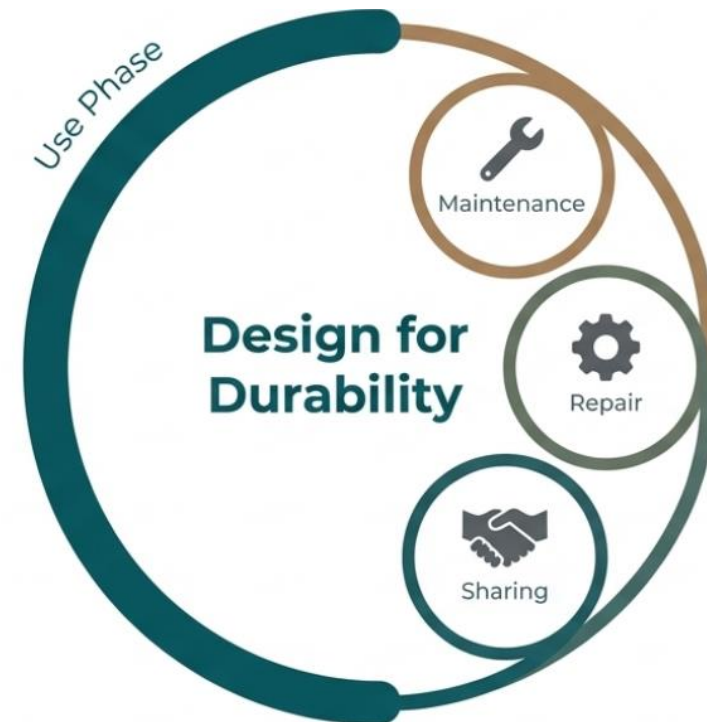
CELWS-W05-V02



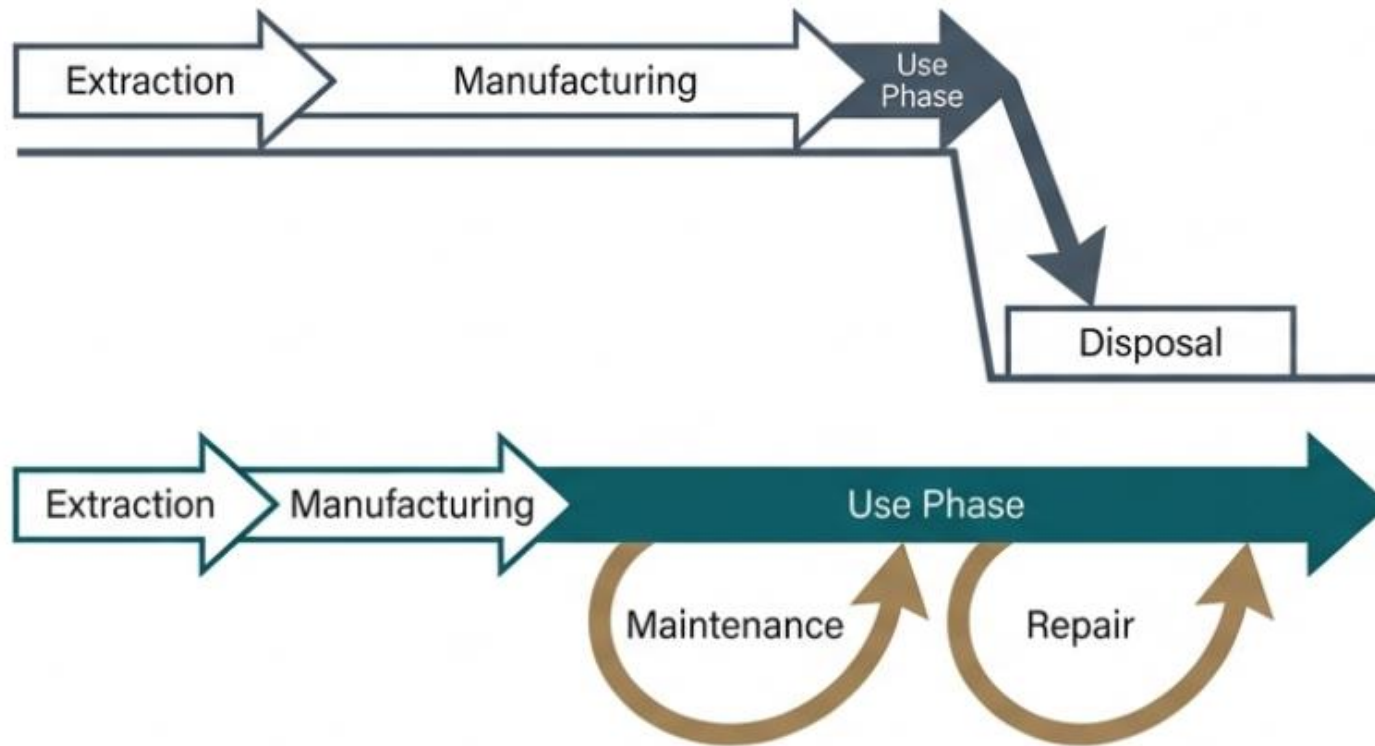
Co-funded by
the European Union



- A systemic shift away from the linear take-make-throw model.
- Extending product lifespans retains maximum economic and environmental value.
- Focus on micro-level product design, business models, and material flow hierarchies.



Product Lifetime as a Circular Strategy



- Product longevity represents the lifespan from purchase to discard.
- Postponing the end-of-life stage reduces aggregate waste generation.
- Extending the use phase actively disrupts massive linear throughput.
- Interventions stretch the timeline before any drop-off occurs.

- Products possess multiple competing lifespans.
- Technical: How long the product physically functions.
- Economic/Social: How long it is fashionable or viable to maintain.
- The shortest lifespan—not the longest—dictates when a product becomes waste.

Technical Lifespan

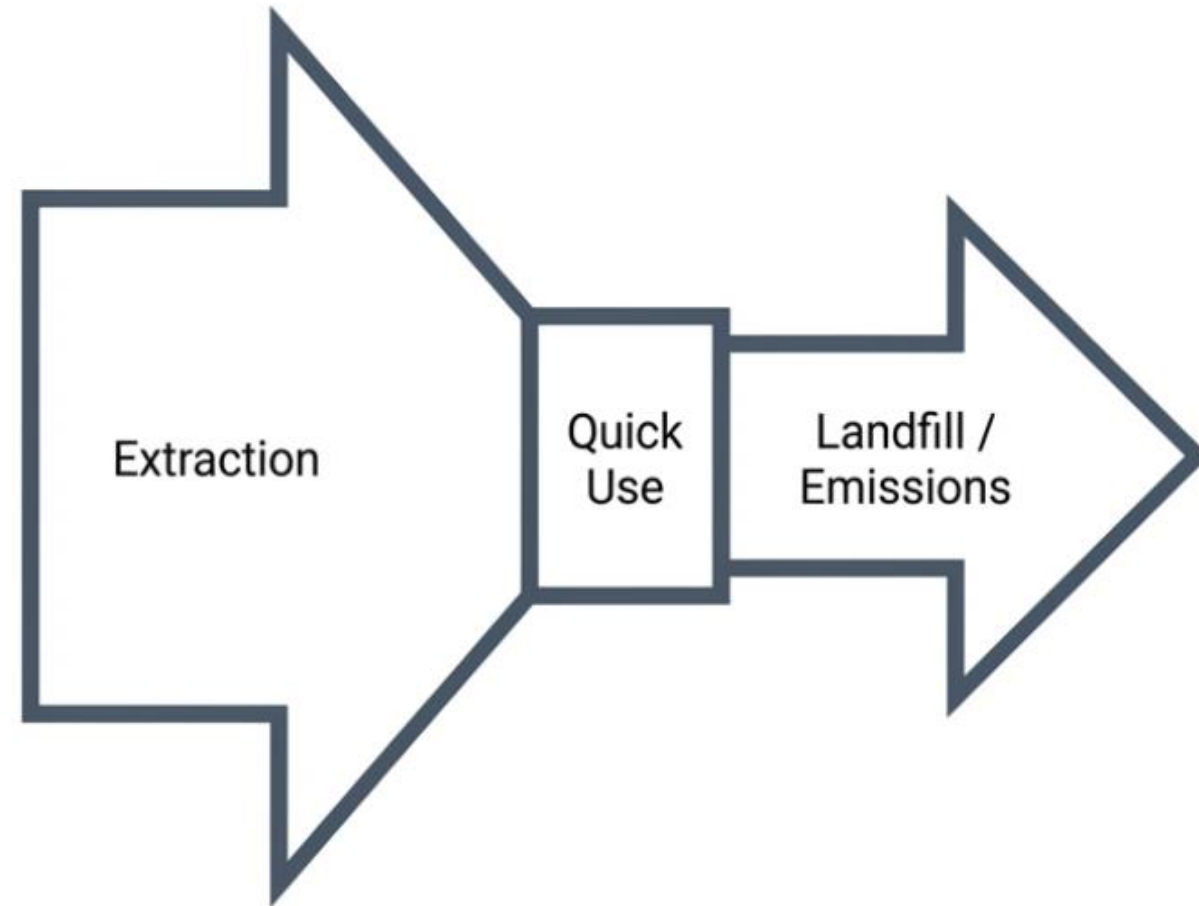


Economic / Social
Lifespan

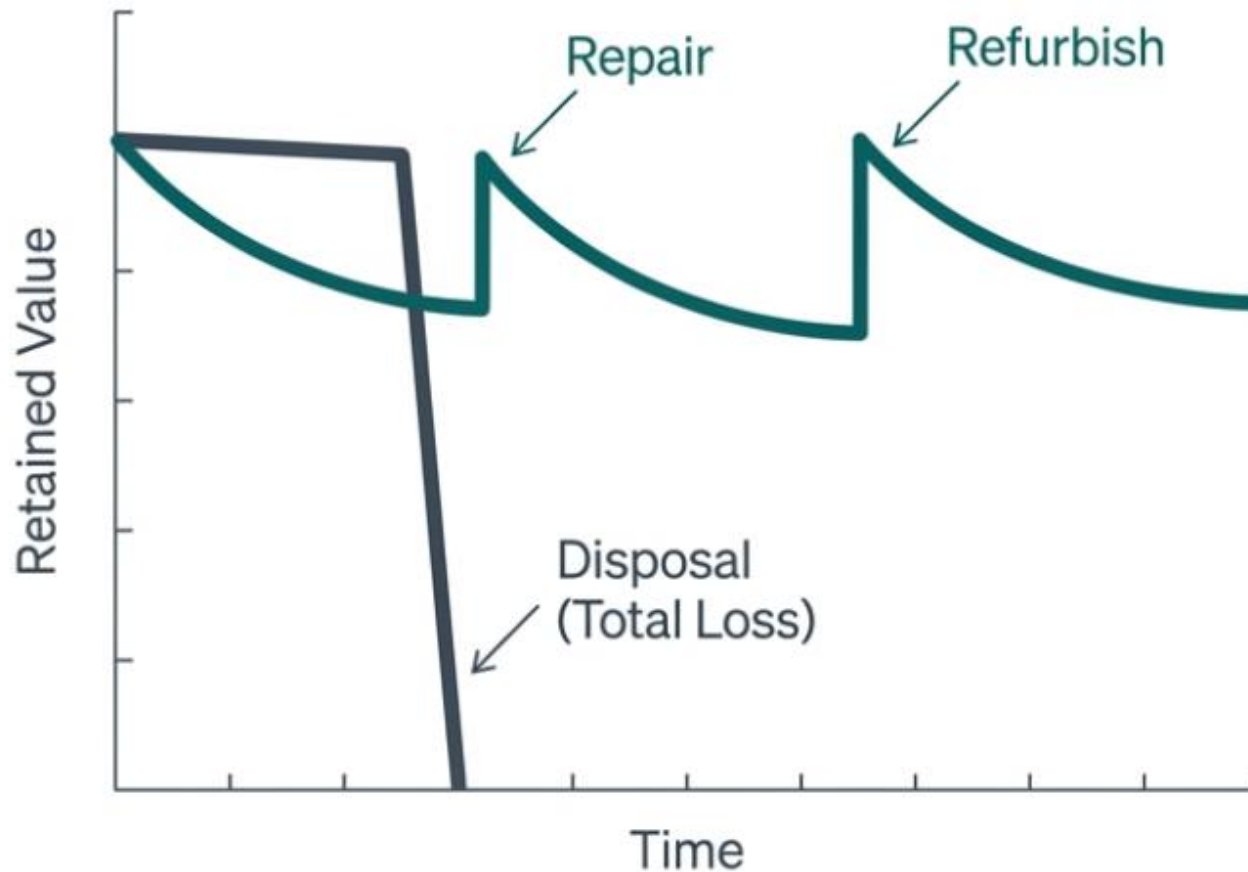


Environmental Implications of Short Lifespans

- Post-war acceleration relies on extracting massive quantities of accessible resources.
- **Linear economies** translate natural capital directly into pollution and emissions.
- Accelerated material throughput generates roughly 20 gigatonnes of global waste.
- **Short-lived goods** create disproportionate environmental destruction.

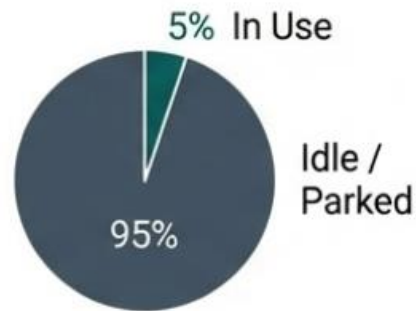


System Inefficiency and Embedded Value

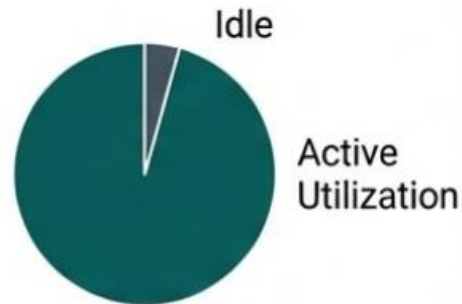


- Manufactured goods contain embedded energy, labor, and structural complexity.
- Linear disposal completely destroys this complexity.
- The circular economy redefines value creation by capturing embedded value.
- Inner loops (repair) are economically superior to producing new goods.

Scenario A: Private Ownership



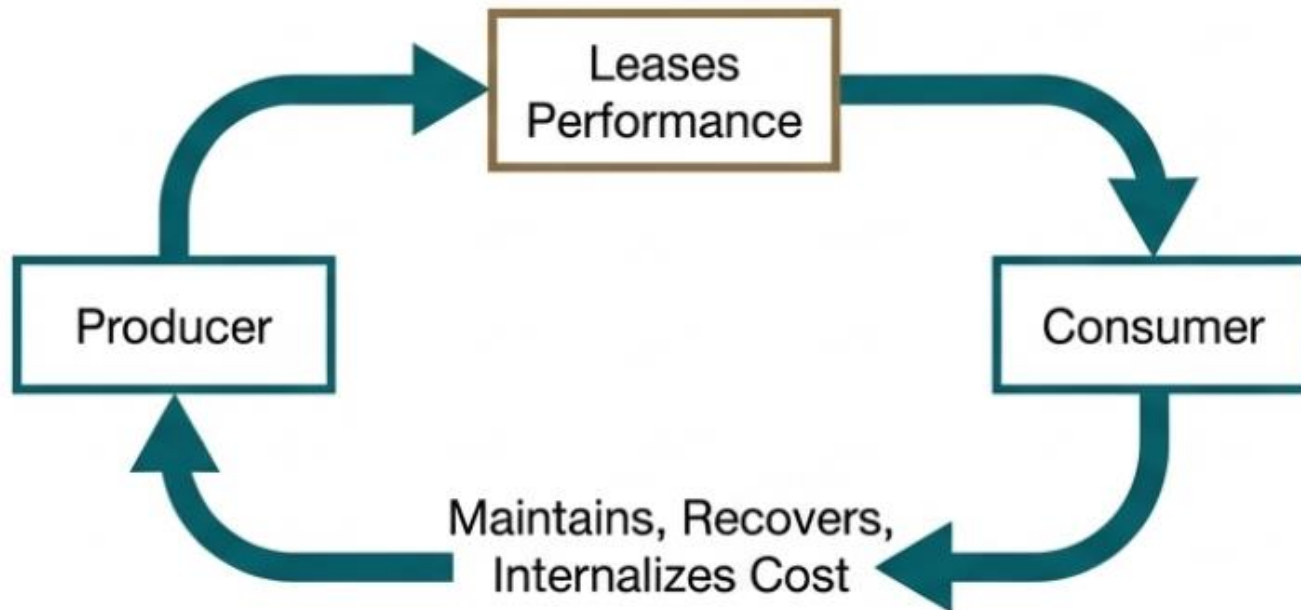
Scenario B: Shared Circulation



- Designing for durability is insufficient if a product remains idle.
- Privately owned durable goods spend up to 95% of their lifespans unused.
- Redesigning products to withstand continuous, shared circulation increases efficiency.
- High utilization drastically reduces the total number of products required.



End of Responsibility
(Consumer Assumes Disposal)

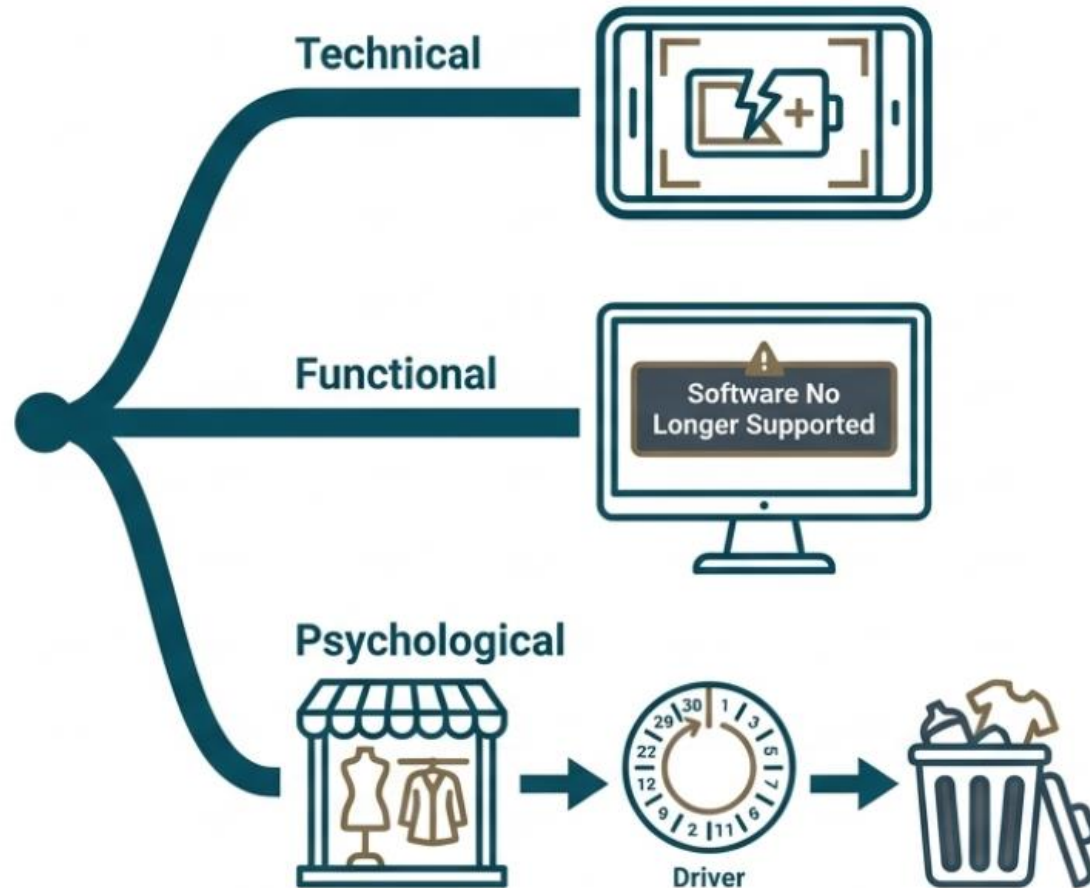


- A structural transition from selling ownership to selling performance.
- Traditional sales incentivize short lifespans and frequent, profitable replacements.
- In Servitization, the producer retains ownership and pays end-of-life costs.
- Creates a direct financial incentive to design robust, repairable products.



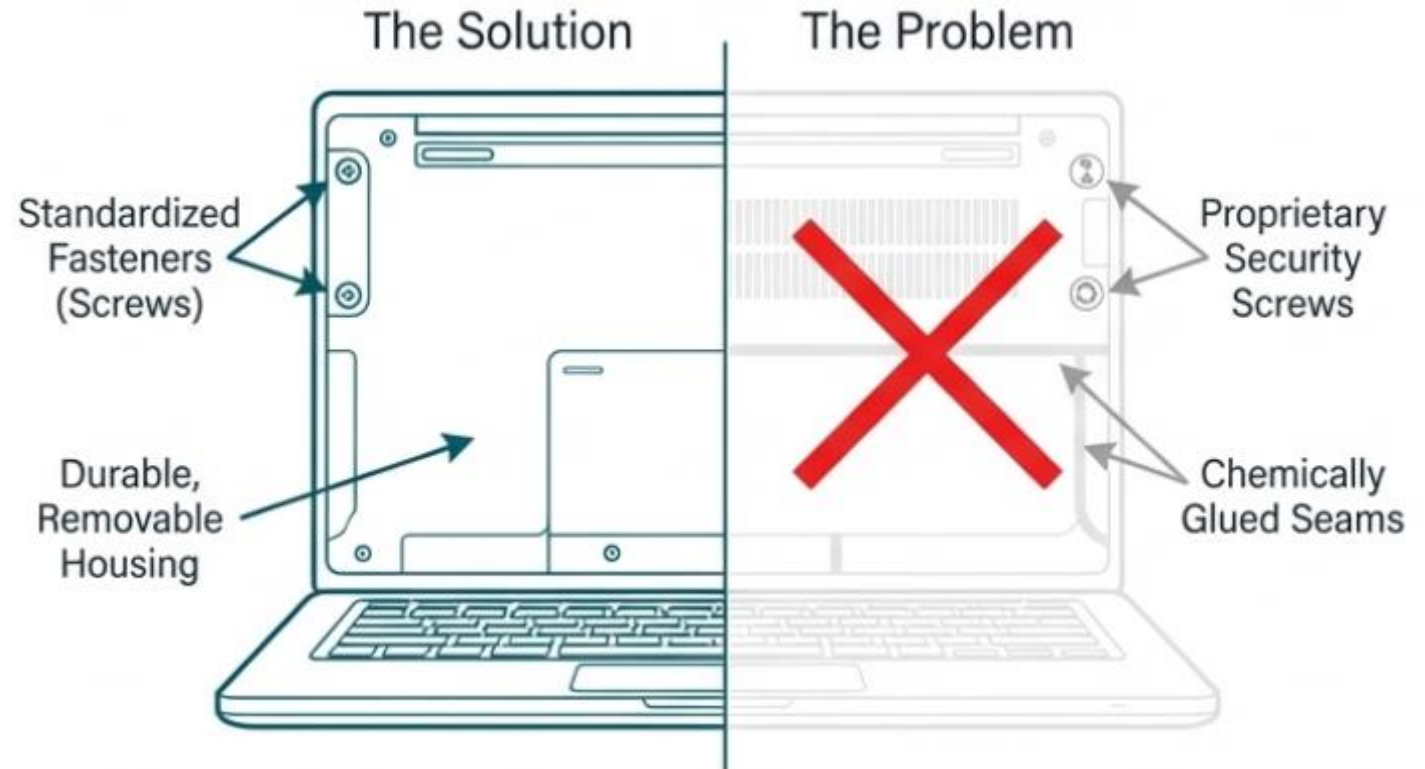
- The deliberate engineering of products to require early replacement.
- Traces roots to 1920s manufacturing strategies to boost slumping sales.
- Relies on engineering consumer discontent and accelerated hardware failure.
- The primary structural barrier forcing functioning goods into the waste stream.

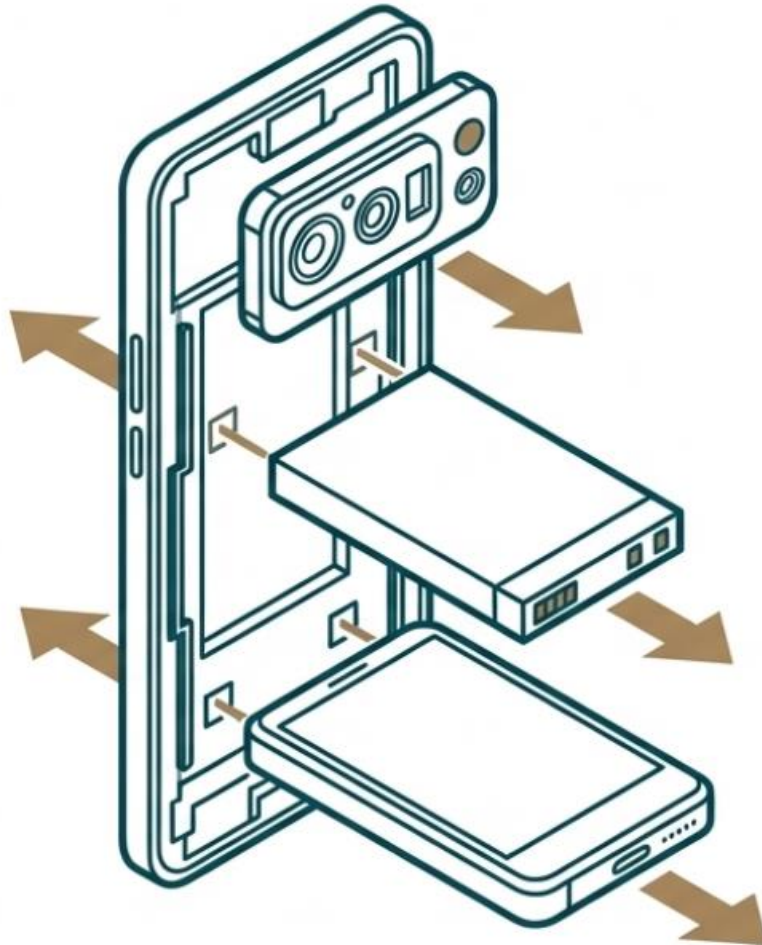
Technical, Functional, and Psychological Obsolescence



- **Technical:** Degradation from physical wear, fatigue, or deliberately inaccessible components.
- **Functional:** Perfectly capable hardware rendered useless when software ecosystems deliberately drop support.
- **Psychological:** Manufactured trend cycles that render functional items socially undesirable.

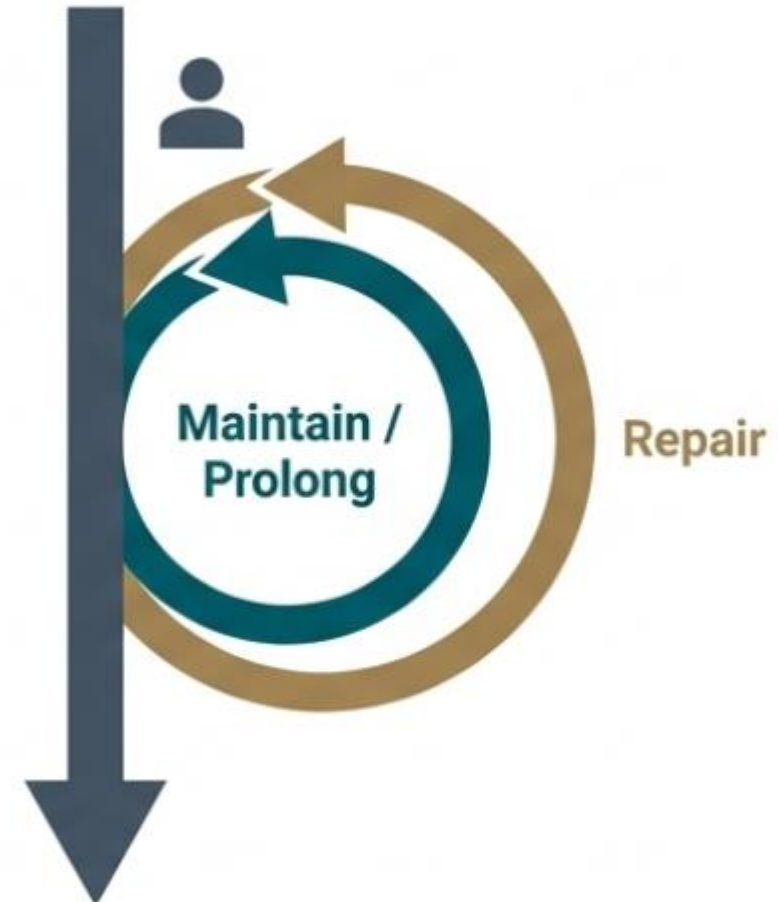
- Circular economy activities fundamentally depend on micro-level physical product design.
- Avoiding glued seams and proprietary tools is essential.
- Standardized components empower users and third-party facilities.
- Eco-design must prioritize an accessible, frictionless cycle of disassembly.

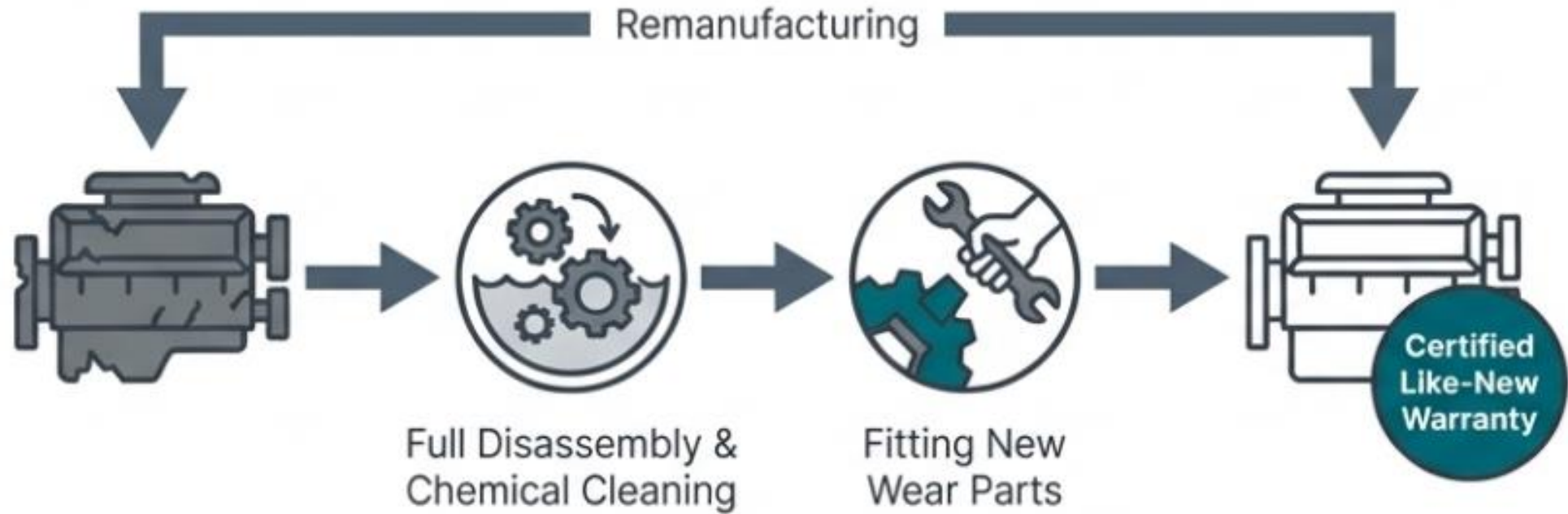




- Modularity separates consumable components from durable components.
- If a single part (like a battery) degrades, the entire device does not become waste.
- Technical nutrients are treated as distinct, accessible units.
- Allows for isolated upgrades and repairs, maximizing the lifespan of the core.

- The circular economy operates on a strict hierarchy of efficiency.
- Technical cycles prioritize keeping products in their existing physical state.
- The innermost loops—maintenance and repair—are vastly superior strategies.
- They occur closest to the user, bypassing the energy requirements of new manufacturing.





- Industrial-scale processes sitting between local repair and raw material recycling.
- Refurbishment updates critical performance aspects while keeping functional parts.
- Remanufacturing fully disassembles the discarded product.
- It reuses the structural core to yield original-equipment warranty standards.

Inner Loops (Maintain, Repair)

Energy Input Required: LOW



Complexity Retained: HIGH



Outer Loops (Recycling)

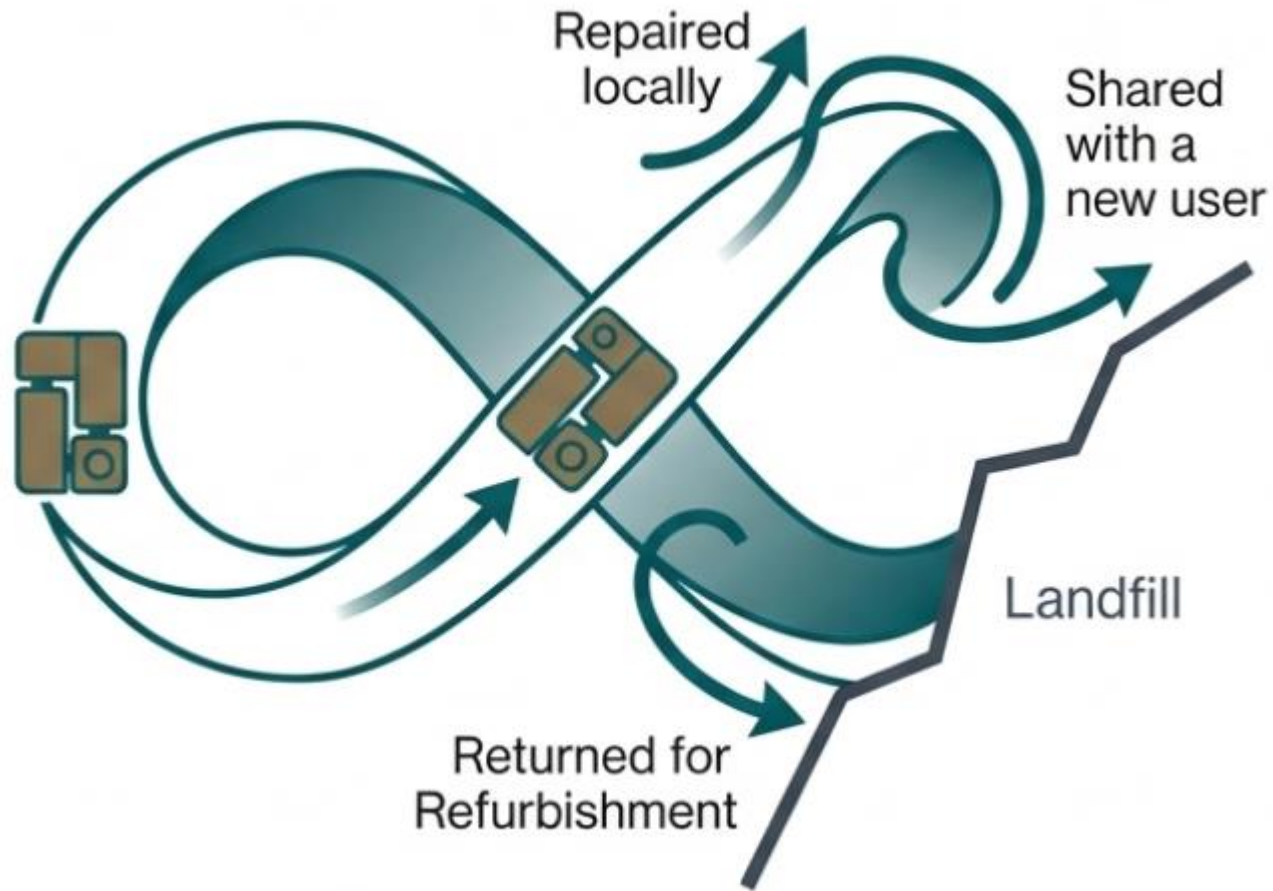
Energy Input Required: HIGH



Complexity Retained: LOST



- A common misconception is that recycling is the ultimate goal.
- Recycling is a last resort—it destroys structural complexity and embedded labor.
- Outer loops reduce products to raw material via energy-intensive smelting.
- Inner loops preserve geometric integrity using a fraction of the energy.



- Transitioning to a restorative economy requires abandoning 'take-make-throw'.
- Shift from ownership to servitization to alter producer incentives.
- Fight planned obsolescence through standardized, modular physical design.
- Eliminate waste at the source and retain maximum value in the human economy.



MICRO-CREDENTIAL

CIRCULAR ECONOMY FOR LAND AND WASTE MANAGEMENT

5.- Solid Waste Streams and Material Flows

Design for durability and repair

CELWS-W05-V02



Co-funded by
the European Union

