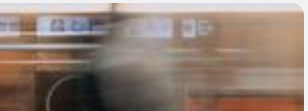
Embedding Circularity in the Programs for ESOs

Nurturing ESOs and Startups for AI-driven Climate Action.

15/10/2025





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Content

- Welcome & Recap
- Learning Objectives - Agenda
- Circular Economy Fundamentals
- Circular Economy & Entrepreneurship – and the role of AI
- Q&A

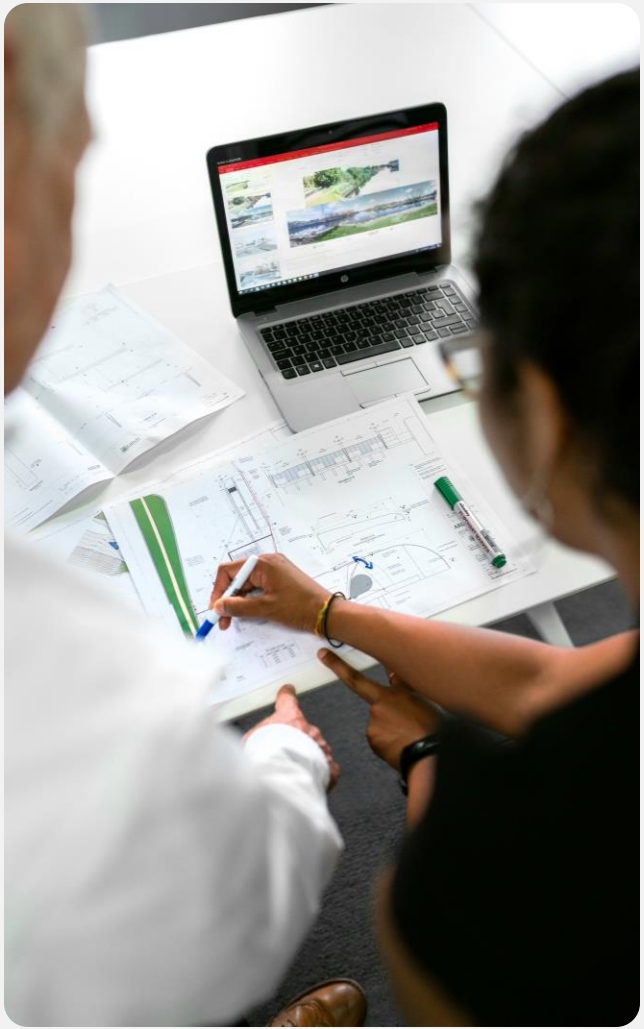
Welcome & Recap

Climate KIC Academy

WELCOME

Emily Amann – Circular Economy Entrepreneurship Lead

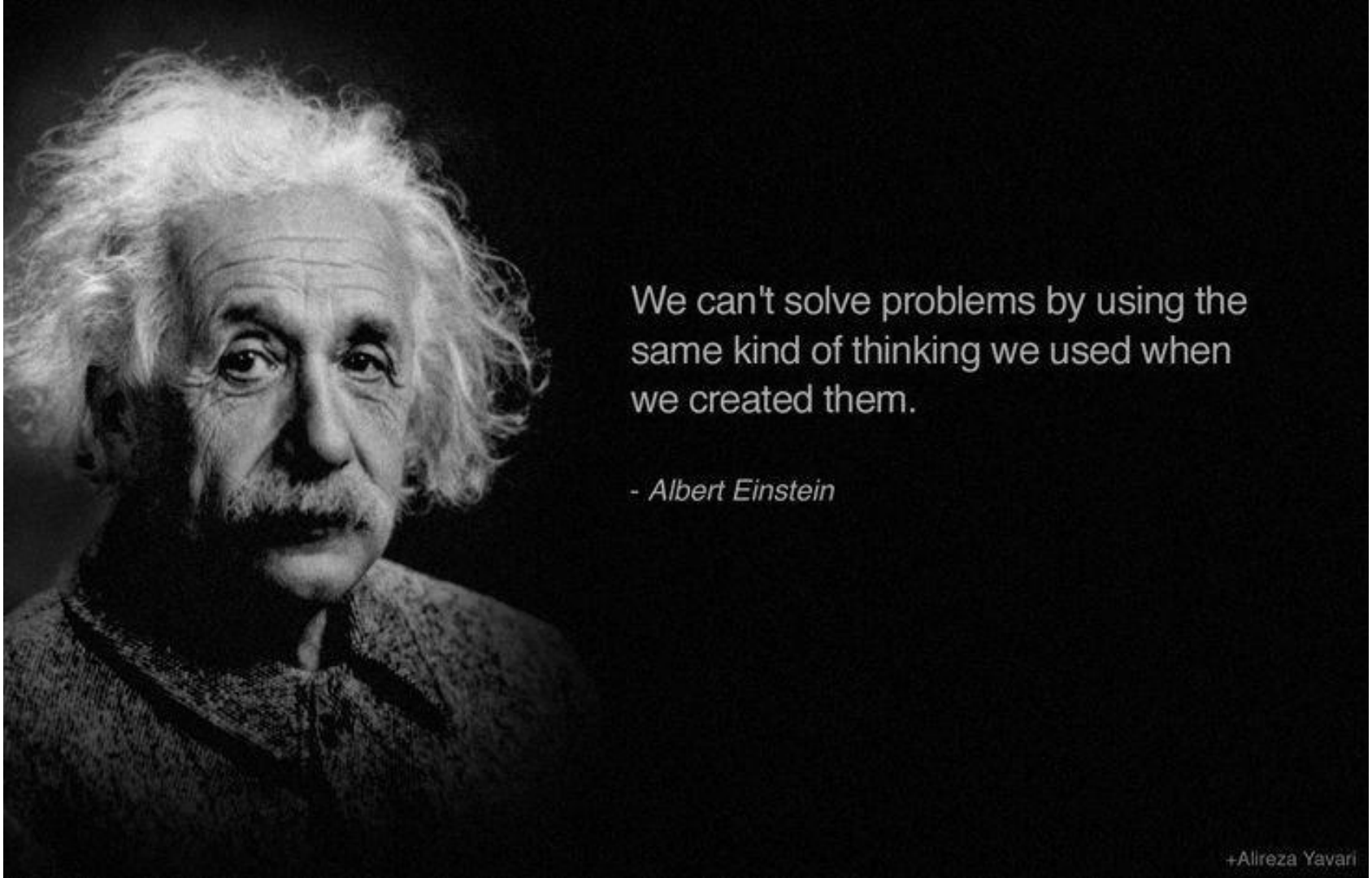
- Background in Economics, International Development and Circular Economy studies
- Programme Manager, Business Advisor, Mentor
- Circularity Mentor for over 200 participants from CE Univ. Berkeley diploma studies
- CE Capacity Building Lead for Bengaluru and Nairobi Circular Economy Innovation Cluster Programme
- Deep Demonstration Circular Slovenia
- Based in Valencia, Spain



Learning Objectives - Agenda

- Learn the **basic principles** of circular **fundamentals** & regenerative economy
- Understand the **current state** of the Circular Economy globally and locally, important **actors and resources**
- Learn **how your** Entrepreneurship Support Organisation **ESO** can **support circular economy startups and understand the role of AI**

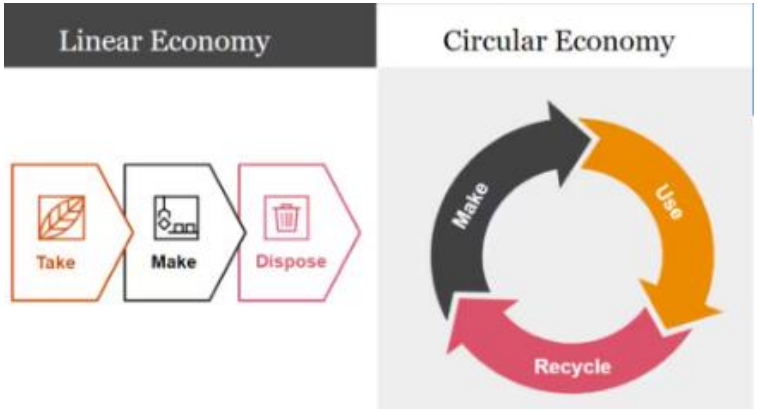
Circular Economy Fundamentals


We can't solve problems by using the same kind of thinking we used when we created them.
- Albert Einstein
+Alireza Yavari


Explaining the Circular Economy and How Society Can Re-think Progress

CE Definitions

FUNDAMENTALS AND PRINCIPLES



Resources, Conservation & Recycling 127 (2017) 221–232

Contents lists available at ScienceDirect

Resources, Conservation & Recycling

journal homepage: www.elsevier.com/locate/resconrec

Review

Conceptualizing the circular economy: An analysis of 114 definitions

Julian Kirchherr*, Denise Reike, Marko Hekkert

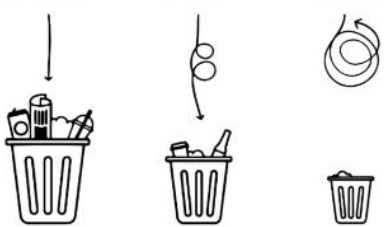
Innovation Studies Group, Copernicus Institute of Sustainable Development, Utrecht University, The Netherlands

ARTICLE INFO

Keywords:
Circular economy
4R framework
Sustainable development
Definitions
Content analysis

ABSTRACT

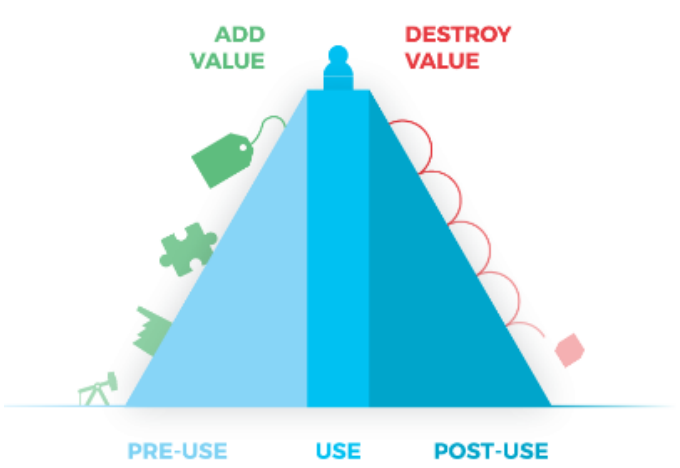
The circular economy concept has gained momentum both among scholars and practitioners. However, critics claim that it means many different things to different people. This paper provides further evidence for these critics. The aim of this paper is to create transparency regarding the current understandings of the circular economy concept. For this purpose, we have gathered 114 circular economy definitions which were coded on 17 dimensions. Our findings indicate that the circular economy is most frequently depicted as a combination of reduce, reuse and recycle activities, whereas it is oftentimes not highlighted that CE necessitates a systemic shift. ...ns show few explicit linkages of the circular economy concept to sustainable ... the circular economy is considered to be economic prosperity, followed by ...t on social equity and future generations is barely mentioned. Furthermore, ...umers are frequently outlined as enablers of the circular economy. We critically ...omy conceptualizations throughout this paper. Overall, we hope to contribute ...ence of the circular economy concept; we presume that significantly varying ... eventually result in the collapse of the concept.

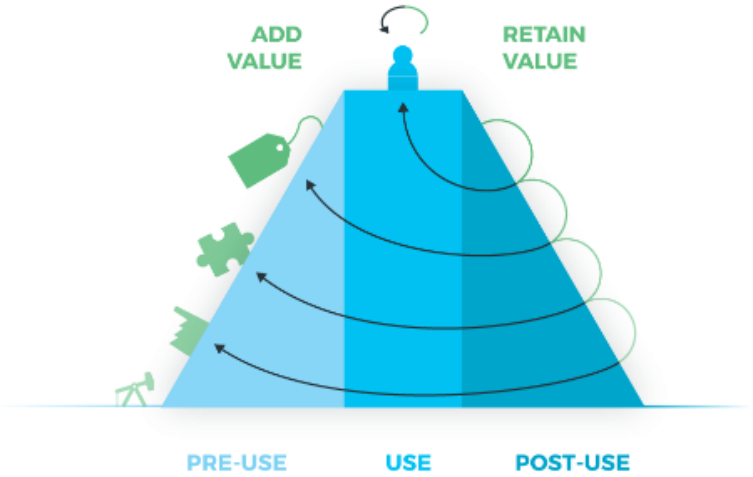


Sources:
https://www.sciencedirect.com/science/article/pii/S0921344917302835
https://www.pwc.com/gr/en/advisory/risk-assurance/sustainability-climate-change/circular-economy-model.html

How do we create value in our Economy?

FUNDAMENTALS AND PRINCIPLES





Source: https://www.circle-economy.com/news/master-circular-business-with-the-value-hill

3 Fundamental Principles of a Circular Economy

FUNDAMENTALS AND PRINCIPLES

It is underpinned by a **transition to renewable energy and materials.** A circular economy **decouples economic activity from the consumption of finite resources.**

It is a resilient system, good for business, people and the environment.

The circular economy is a framework of **systemic solutions** that addresses global challenges such as climate change, biodiversity loss, waste and pollution.

(Source: Cradle to Cradle Principles, Ellen MacArthur Foundation)

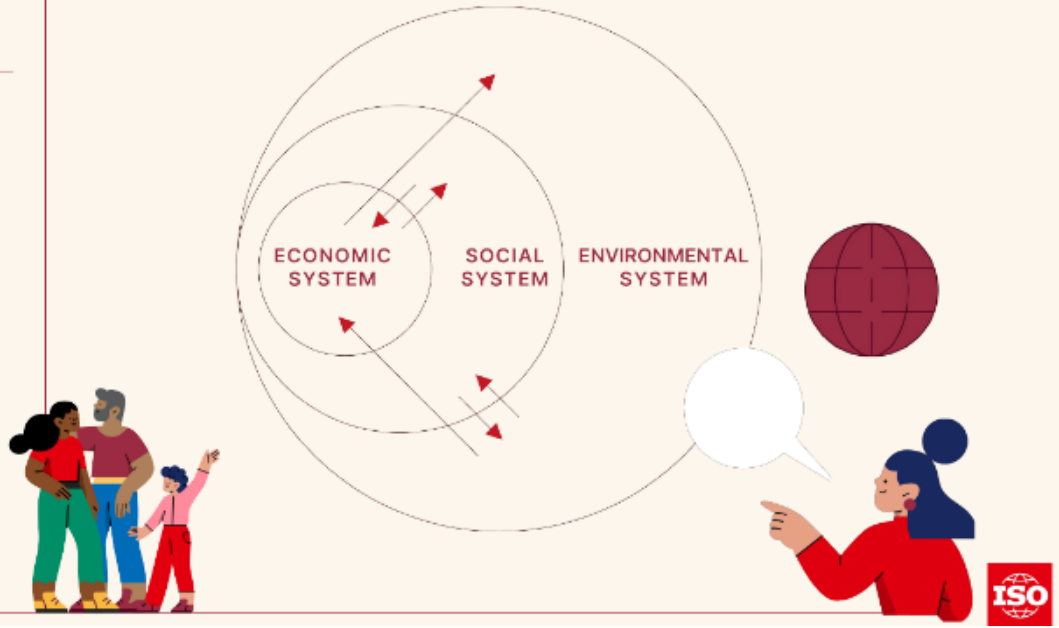
The first international definition

ISO 59004

Circular economy

Economic system that uses a systemic approach to maintain a circular flow of resources, by recovering, retaining or adding to their value, while contributing to sustainable development.

- ☑ Resources can be considered concerning both stocks and flows.
- ☑ The inflow of virgin resources is kept as low as possible, and the circular flow of resources is kept as closed as possible to minimize waste, losses and release from the economic system



A new framework to drive circularity globally (2024)

FUNDAMENTALS AND PRINCIPLES

Answers for the circular economy transition

ISO 59000 family of standards

A common understanding:
Definitions, principles, actions, business models, value networks, measures, assessment, ..., all what is needed to act now!

ISO 59004

Circular economy
Vocabulary, principles and guidance for implementation

ISO 59010

Circular economy
Guidance on the transition of business models and value networks

ISO 59020

Circular economy
Measuring and assessing circularity performance

ISO 59040

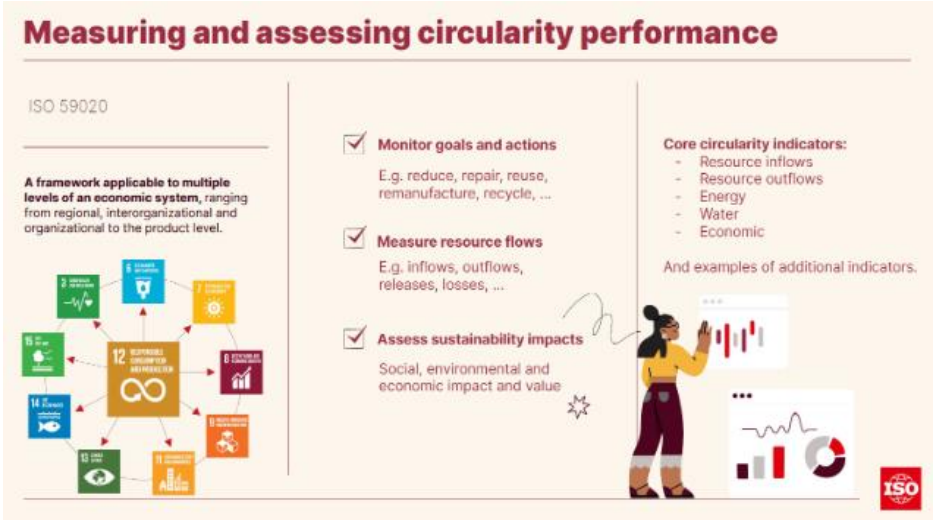
Circular economy
Product Circularity Data Sheet

ISO 59014

Environmental management and circular economy
Sustainability and traceability of secondary materials recovery – Principles, requirements and guidance

A new global framework to drive circularity globally

FUNDAMENTALS AND PRINCIPLES

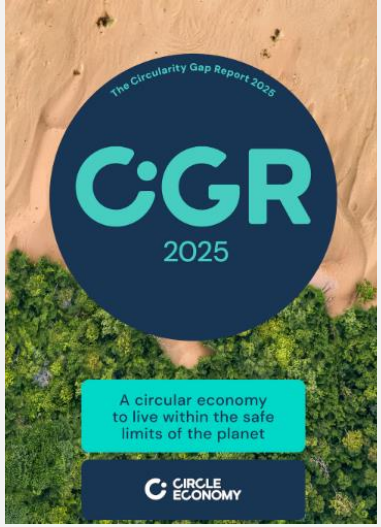


Circularity Global Gap Report

2025

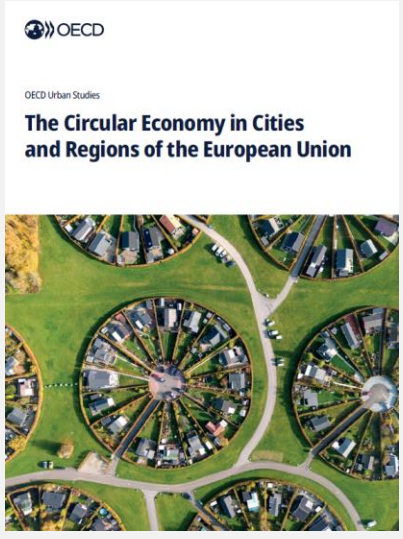
Circular Economy Context – Where are we globally and in Europe?

Global economy is only 6.9% circular



EU-27 countries Circularity Rate 2023:

Only 12% of materials from recycled sources



CIRCULAR ECONOMY BARRIERS

Cultural

- Cultural diversity
- Unawareness nesources
- Current lifestyle

Economic

- Economic viability
- Global supply chain
- Lack public expenditure
- Dependance private capital

Information

- Data availability
- Deficiency of information

Regulatory

- Absence of multilevel supportive framework

Political

- Neoliberalism
- Clashing priorities
- Lack of combined policy-making

Institutional

- Fragmented government
- Lack of cross-sector alliance
- Lack of institutional capability
- Lack of trust in policymakers

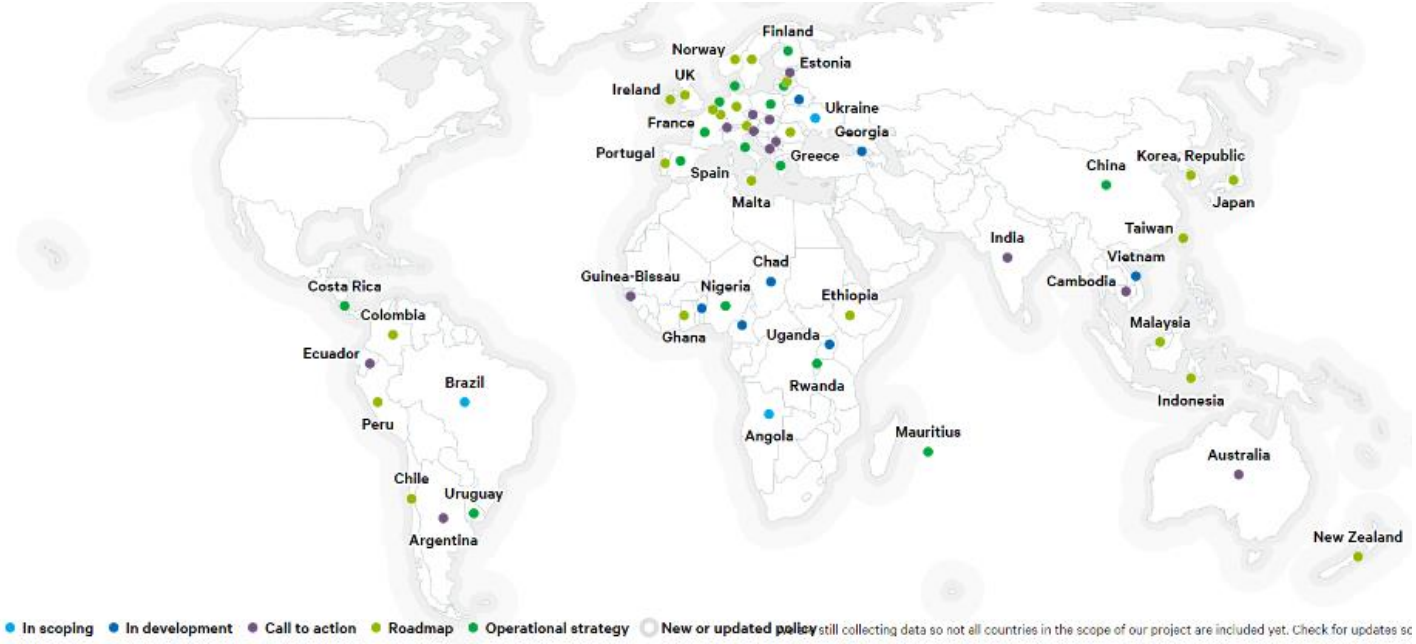
Technological

- Technical limitations
- Lack of operational conditions
- Current linear resources flows

Environmental

- Pollution of environment
- Long-period to renew ecosystems
- Depraved urban resources

Online Tool to access and compare national CE Policies



https://circulareconomy.earth/?policy=cep

ELLEN MACARTHUR FOUNDATION

WORLD CIRCULAR ECONOMY FORUM

CIRCLE ECONOMY

UNIDO

wbcsd

PACE
Platform for Accelerating the Circular Economy

CIRCULAR ECONOMY CLUB

WORLD RESOURCES INSTITUTE

CHATHAM HOUSE
The Royal Institute of International Affairs

Main actors working on CE Globally

AFRICAN CIRCULAR ECONOMY ALLIANCE

COALICIÓN DE ECONOMÍA CIRCULAR
América Latina y el Caribe

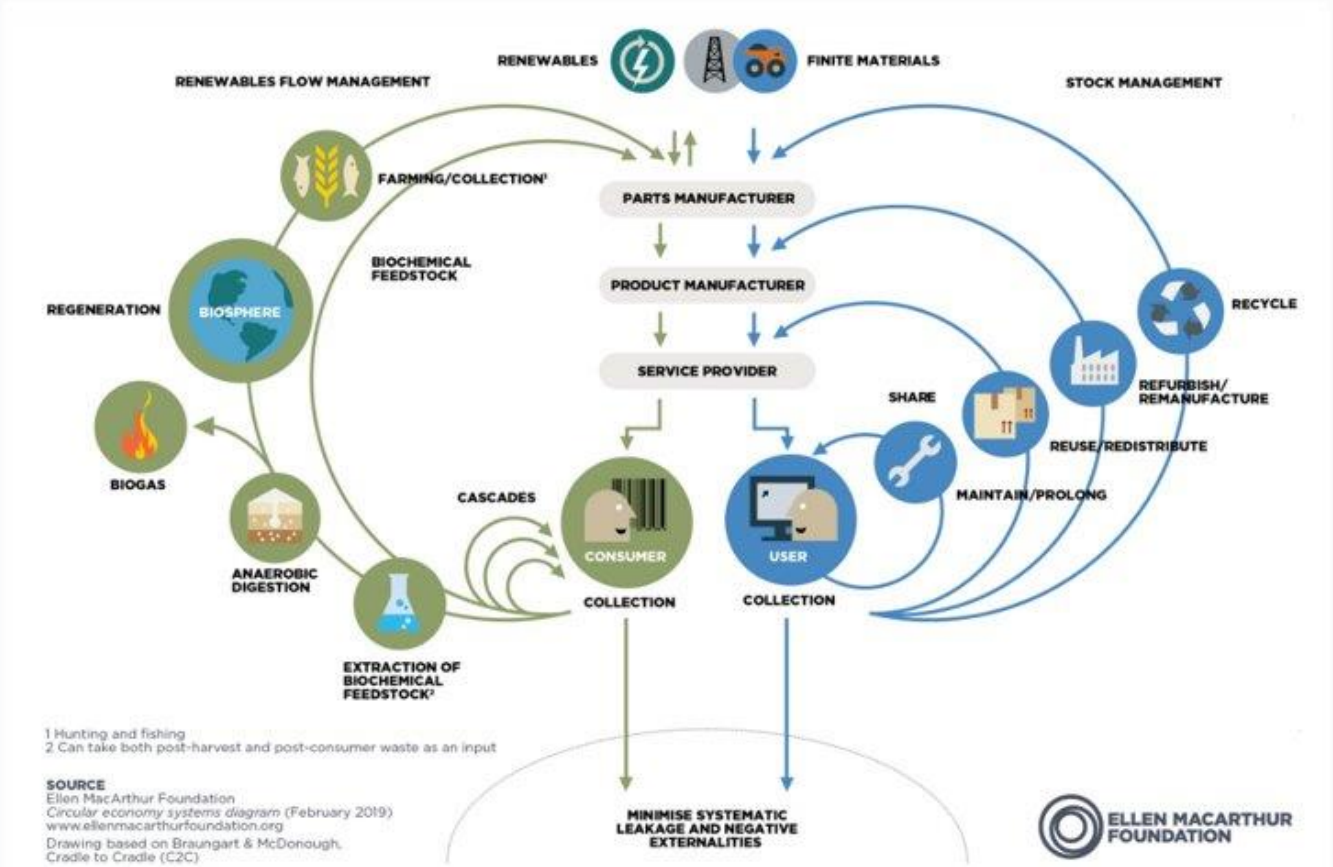
ACEA
ASIA CIRCULAR ECONOMY ASSOCIATION

Main actors working on CE at a Regional Level

Circular Economy Entrepreneurship

Butterfly Diagram - Materials Flow

Biological cycle

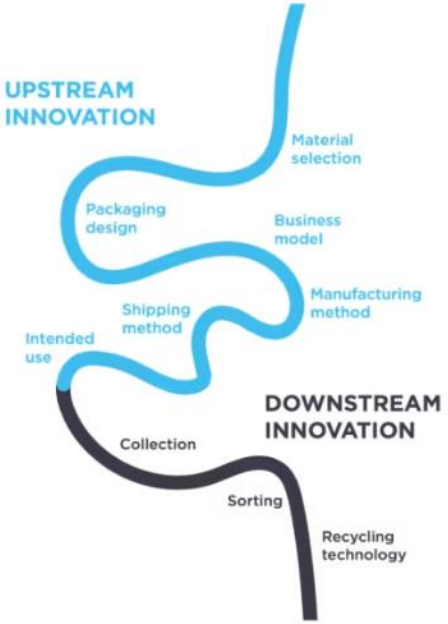


Technical cycle

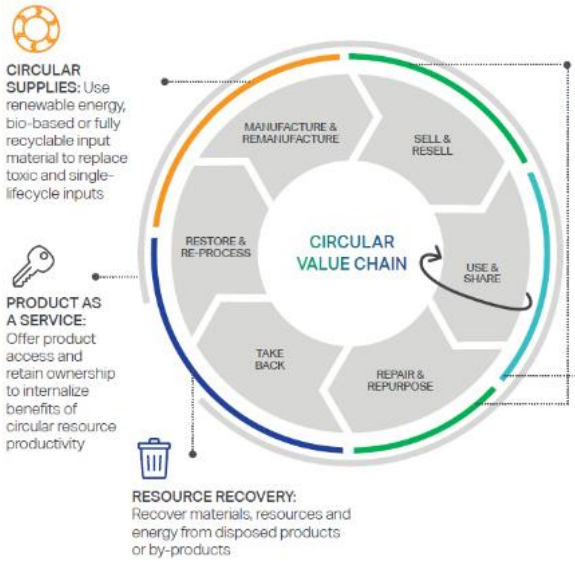
Why focus on the circular design of a product/service?

Product design determines up to 80% of a product's life cycle environmental impact !!!

Design choices: Upstream vs downstream innovation



5 Circular Business Models
3 disruptive technologies



DIGITAL TECHNOLOGIES such as Internet of Things (IoT), big data, blockchain, and RFID help companies track resources and monitor utilization and waste capacity

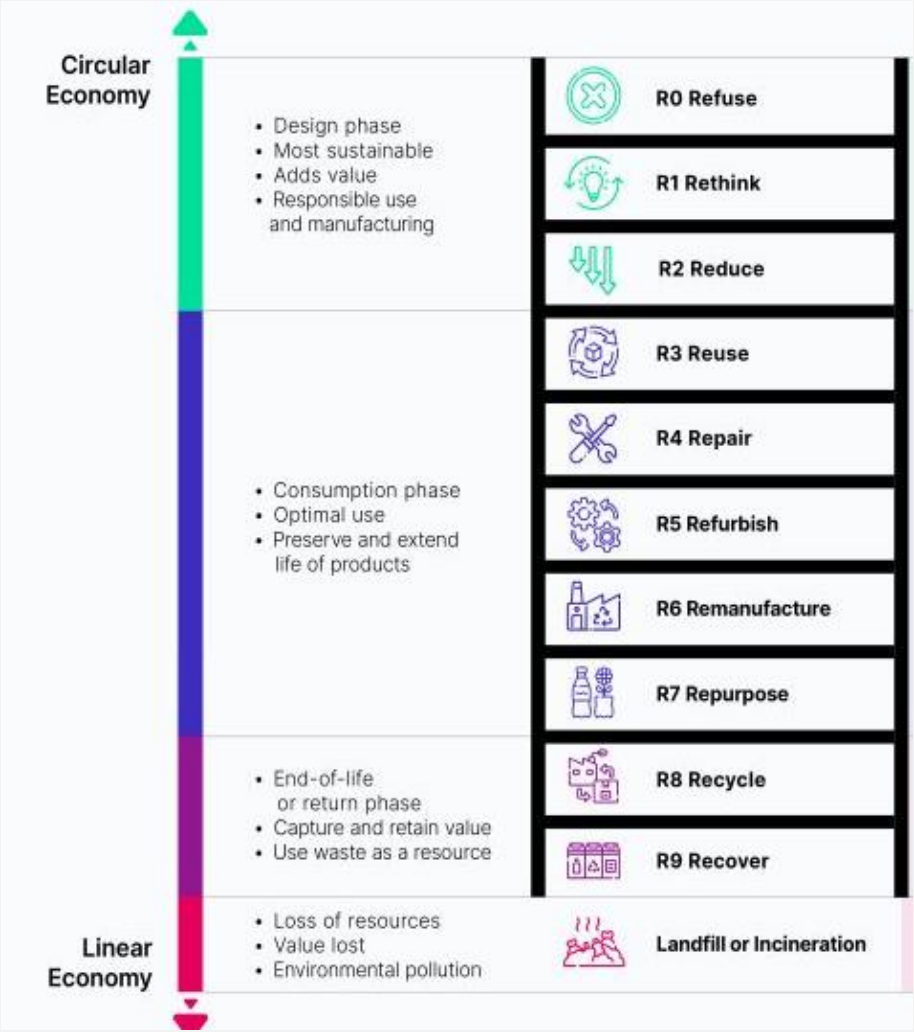
BIOLOGICAL TECHNOLOGIES such as bio-energy, bio-based materials, biocatalysis, hydroponics and aeroponics help companies move away from fossil-based energy sources

PHYSICAL TECHNOLOGIES such as 3D printing, robotics, energy storage and harvesting, modular design technology and nanotechnology help companies reduce production and material costs and reduce environmental impact

Souce: WBCSD CEO Guide Circular Economy

CE ENTREPRENEURSHIP

10R FRAMEWORK



Source: CIRCULARISE

Catalyst for Circular Transformation

AI acts as a catalyst in circular economy transformation by driving sustainable innovation and system optimization.

Data-Driven Decision-Making

AI enables informed decisions by analyzing complex data to improve circular economy operations and sustainability.

Predictive Maintenance & Smart Logistics

AI supports predictive maintenance and smart logistics to reduce waste and increase efficiency in resource management.

Material Traceability & Lifecycle

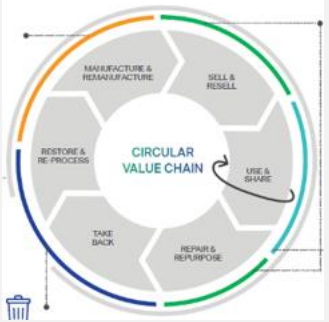
AI enhances material traceability and lifecycle assessments, optimizing resource use and reducing environmental footprint.

Example: a recent upgrade at a recycling facility in Chicago.

In May 2024, LRS installed an AI-powered robotic system developed and designed by **EverestLabs** to capture more aluminium beverage cans, those that often slip through traditional sorting lines and end up in landfills.
This robot, developed by the tech company EverestLabs - AI-Powered Recycling Robots**, uses machine learning and real-time visual recognition to pick out valuable materials that human sorters or older machines might miss**. 👁️

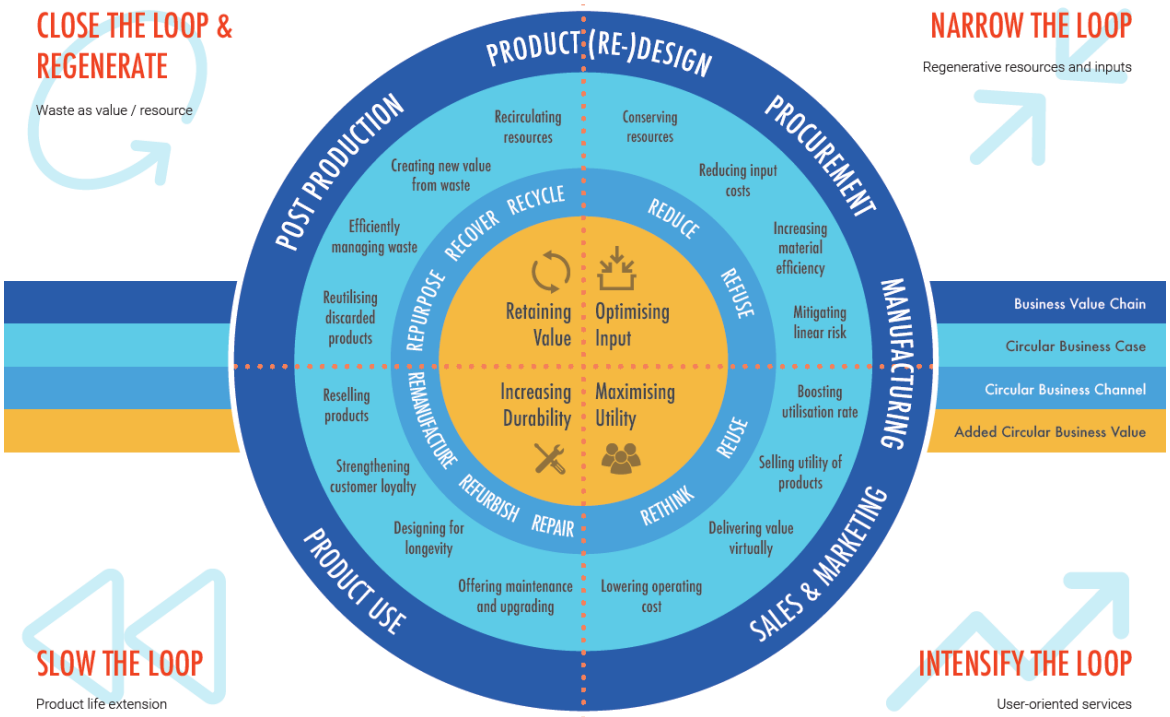
👉🏽 This robot is sorting faster than any human ever could and it's recovering around 12 million cans per month, that would have otherwise been lost.
That's roughly 4.2 million pounds of aluminium saved each year, all thanks to one smart robot doing what humans can't: spotting and grabbing specific materials in the blink of an eye
That is a step forward! 🤯
This is backed by beverage packaging giants like Ardagh and Crown Holdings, not for PR points, but because it makes business sense 💡

CE ENTREPRENEURSHIP – The role of AI



Circular Economy Value Chain Phase	AI Application	Example
Design	Generative design for modularity & recyclability	AI tools for eco-design (e.g., Autodesk Generative Design)
Production	Process optimization, energy efficiency	AI reduces energy use by 25% in lithium battery recycling [link.springer.com]
Consumption	Smart product usage tracking	IoT + AI for usage-based pricing in PaaS models
End-of-Life	Waste sorting, predictive maintenance	ZenRobotics AI robots improve recycling accuracy by 20% [rpra.ca]

Circular Enterprise Taxonomy



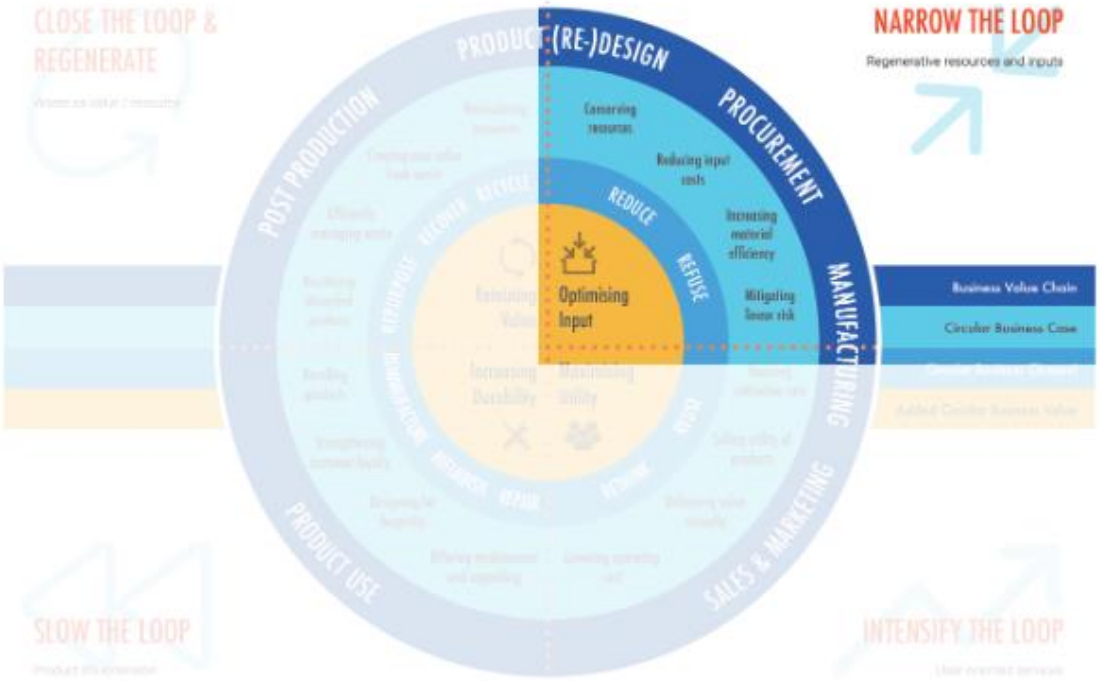
Source: Circular Enterprise Taxonomy developed and illustrated by adelphi research gGmbH

Envision the **production process** and the **flow of resources** involved in creating a product

Circular Business Model is a
A LOOP!!
Minimize the entry of new resources into the loop
or
Prolong the retention of resources within the loop

Source: Circular Enterprise Taxonomy developed and illustrated by adelphi research gGmbH

Narrowing the Loop - Optimizing Inputs



Shrink Shrink Shrink!!

Use fewer resources

↓

Few resources enter the loop

↓

Loop Shrinked!

What do we achieve with this?

- Increased efficiency,
- Lower production costs,
- Decreased dependency on the global supply chain.

Source: Circular Enterprise Taxonomy developed and illustrated by adelphi research gGmbH

Circular Term for Narrowing the loop -

Reduce

Reduce resource consumption

Project Avani: Sustainable Textiles from Agricultural Waste

- Avani, based in Uttarakhand, **converts pine needles** and **natural fibers** into **eco-friendly textiles.**
- **Reduces forest fires by removing dry pine needles, which are a fire hazard.**
- **Provides employment to 200+ rural women** by training them in natural dyeing, spinning, and weaving.
- Enables self-help groups (SHGs) to create sustainable income sources.

https://www.avaninaturals.in/

and

1 Leaf = 200 straws!

Refuse

Refuse unsustainable materials

Intensifying the Loop - Maximizing Utility

Same resource BUT High Impact

Take a product

↓

Make it work harder and smarter

↓

Reach more audience

↓

Loop Intensified!

What do we achieve with this?

- Lowering Operating Costs,
- Delivering Value Virtually,
- Selling Utility of Products,
- Boosting Utilization Rate

Source: Circular Enterprise Taxonomy developed and illustrated by adelphi research gGmbH

Circular Term for Intensifying the loop -

Rethink

Rethink about Product ownership

and

Reuse

Encouraging the Reuse of products

Product as a Service PaaS

FLYROBE

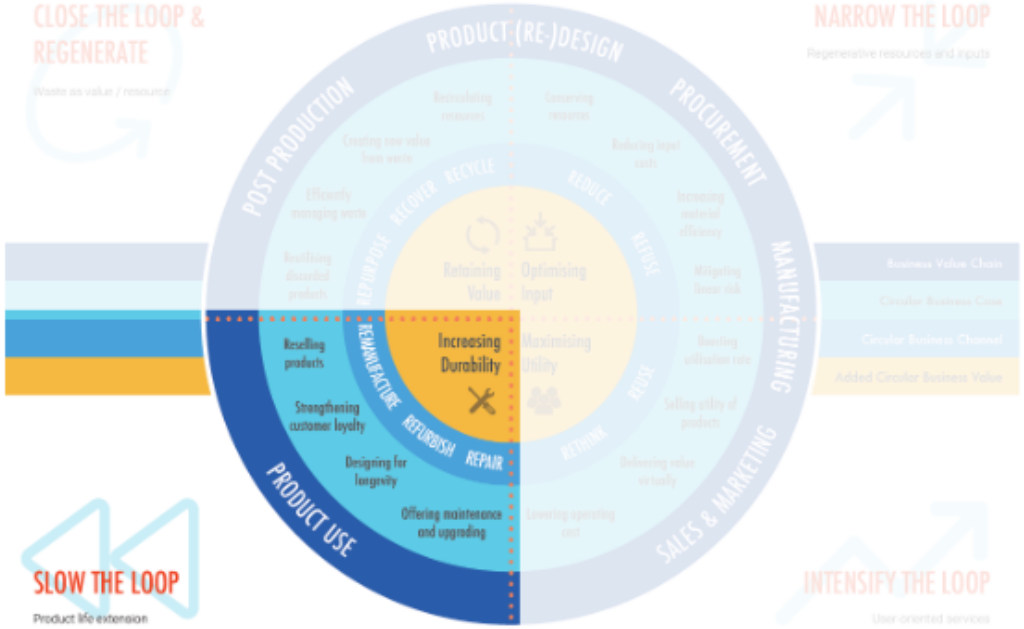
India's First & Largest Rental Fashion Service.

Loop

Designed for Reuse

Sale and collection of reusable and returnable versions of conventional single-use products

Slowing the Loop - Increasing Durability



Use, use again, use some more, use in a different format.

Retain resource & Enhance longevity

Extend the Lifespan of product

Divert the product from becoming waste

Loop Slowed!

What do we achieve with this?

- Reselling Products,
- Strengthening Customer Loyalty,
- Designing for Longevity,
- Offering Maintenance & Upgrading

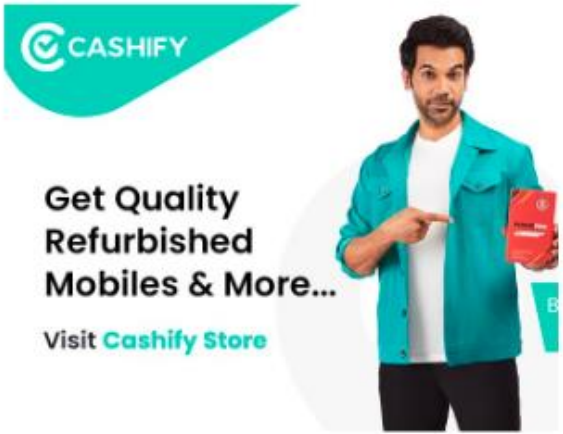
Source: Circular Enterprise Taxonomy developed and illustrated by adelphi research gGmbH

Circular Term for Slowing the Loop -

Repair

Refurbish

Promoting a culture of repair and reuse rather than disposal.



Circular Term for Slowing the Loop -

Remanufacture

CATERPILLAR®

World's leading manufacturer of construction and mining equipment

Caterpillar's Remanufacturing Process

As a world leader in remanufacturing, Cat Reman is making progress possible finding new ways to reduce, reuse, recycle, and reclaim materials which once would have gone into a landfill.

A leader in remanufacturing technologies and processes, Cat Reman returns products at the end of their lives (called 'core') to like new condition and helps reduce owning and operating costs by providing our customers like new quality at a fraction of the cost of a new part. Through the remanufacturing process Caterpillar reduces waste, lowers greenhouse gas production and minimizes the need for raw materials.

Closing the Loop & Regenerate - Retaining Value

Is it a waste? or a resource?

Trash or Gold?

Waste -> Collected -> Repurposed -> new product -> Resource

Loop Closed!

What do we achieve with this?

- **Reutilizing Discarded Products,**
- **Efficiency in Waste Management,**
- **Creating New Value from Waste,**
- **Recirculating Resources**

Source: Circular Enterprise Taxonomy developed and illustrated by adelphi research gGmbH

Circular Term for Closing the Loop & Regenerate

Recycle

Saahas Zero Waste creates products made with recycled post-consumer waste (Multi Layer Packaging)

Eco Board Outdoor Seating

65000
KG - Waste diverted from landfills every day

37400+
MT CO2e - Greenhouse gas reduction every year

252
People employed from the lower socio-economic groups

Recover

Arecana Snack Plates

Arecana Trays and Serveware

Repurpose

Tamul Plates: Biodegradable Areca Leaf Tableware

- **Uses fallen areca palm leaves (agro-waste) to create biodegradable plates and cutlery.**
- Provides a sustainable alternative to plastic without deforestation.
- Works with **tribal communities and women** in Assam, offering training and employment.
- Supports micro-enterprises in rural areas, increasing their income by 40-60%.

https://tamul.co.in/

Circular Term for Closing the Loop & Regenerate

Recycle

PHOOL

MADE FROM TEMPLE FLOWERS

Our Purpose

We collect millions of sacred flowers offered in the temples of India and employ 300+ women from marginalized communities to upcycle these flowers into the world's first certified, handcrafted incense products.

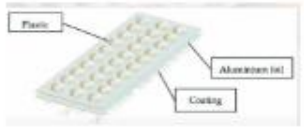
Recover

Repurpose

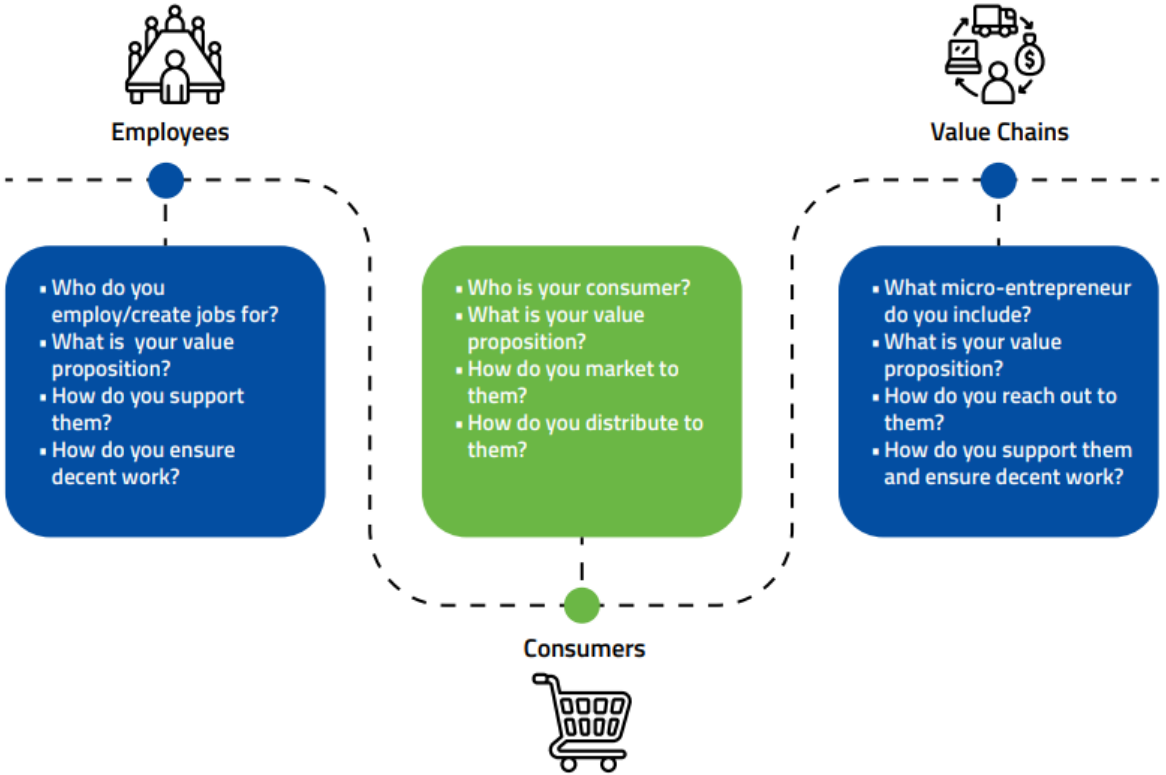
Ecoveda focuses on **recycling multi-layered blister packaging waste** (commonly used for medicines and food items) and developing a biodegradable alternative.

- Converts **non-recyclable aluminum-plastic waste into valuable raw materials** through a sustainable mechanical and chemical separation process.
- **Partners with waste pickers and informal recycling workers** to collect and segregate blister packaging waste.
- **Provides skill development and financial inclusion**
- **Creates awareness** about responsible disposal and promotes inclusive waste circularity.

https://india.socialimpactaward.net/project/ecoveda-blister-recycling-in-circular-way/ .



How can a Circular Business Model also be Socially Inclusive? - Interventions at different levels



Source: BopInc

Success Stories

Sparxell | The Next Big Thing | Circular Economy

Sparxell

United Kingdom – 2022 – Global Grand Finalist

Sparxell has developed 100% natural, biodegradable pigments derived from plant-based cellulose

Their technology is chemical-free, and replicates vibrant, fade resistant colours found in nature.

Sparxell's pigments have applications across cosmetics, fashion, packaging and food industries. By replacing harmful synthetic pigments, they reduce environmental pollution, while ensuring minimal ecological impact.

To date, Sparxell has raised a total of USD $3.2 million in investment from Joyance Partners and L'Oreal Group.

Find out more at www.sparxell.com.

Fibe

United Kingdom – 2022 – European Regional Finalist

Fibe creates sustainable textile fibres derived from potato stems and potato harvest waste.

They have developed a non-toxic process to transform agricultural byproducts into durable, soft natural fibres, offering an eco-friendly alternative to traditional textiles such as cotton and linen.

Fibe is actively developing supply chains, logistics and harvesting techniques to valorise potato waste, aiming to integrate seamlessly into existing textile manufacturing processes.

To date, Fibe has raised USD $1.3 million for their venture, supported by Patagonia's Tin Shed Ventures.

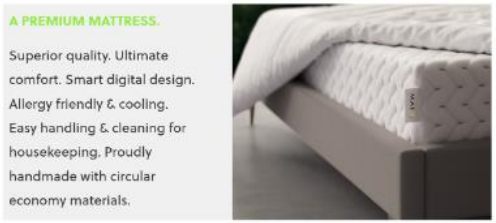
Find out more at www.fibe.uk.

Product as a Service - PaaS

Pay per service unit
Product renting

MATR®

ClimateLaunchpad
2021 Global Winner



Benefits:

- Broader customer base
- Cheaper raw materials
- Recurring revenue
- Strategic cost constraints: easier asset control, refurbishment, remanufacturing, recycling
- Stronger and longer lasting relationship

Challenges:

- Potentially large initial investment to keep ownership of products.
- Customers desire a convenient service with minimum hassle and simple payment terms.

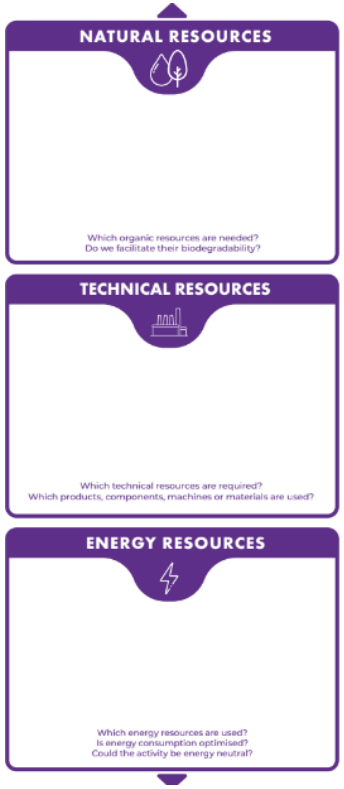
http://circulareconomytoolkit.org/products-as-a-service

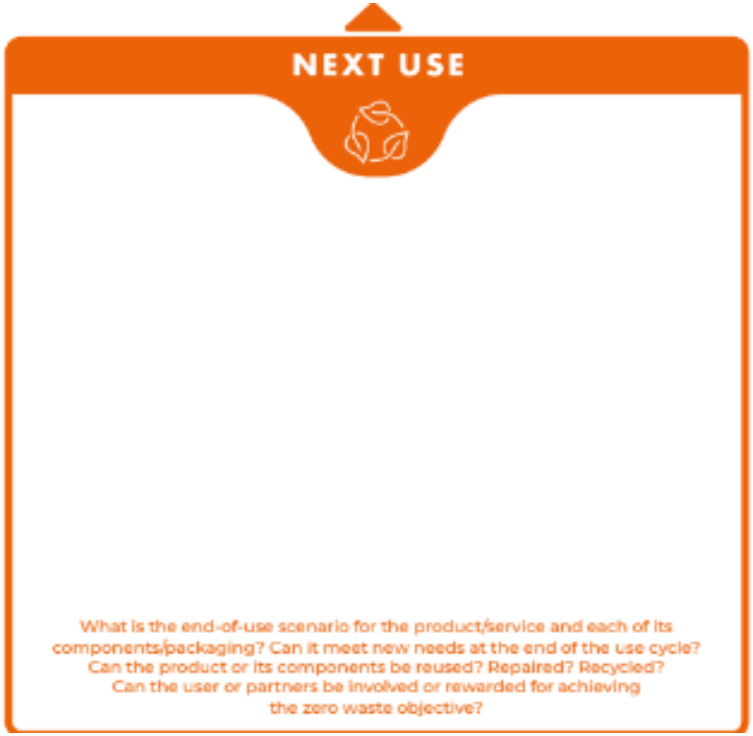
Tool:Circular Business Model Canvas

A circular business model *creates, delivers, and captures* value by closing resource usage loops:

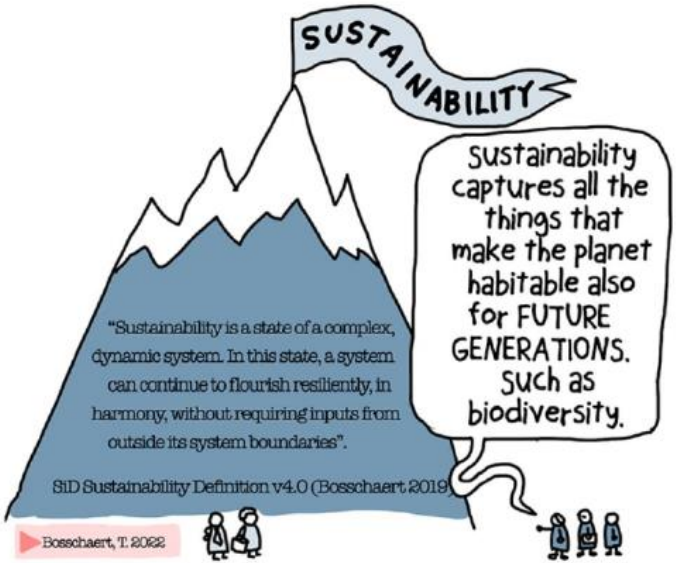
- designing out waste and pollution
- keeping products and materials in use at the highest value for the longest possible and
- regenerating natural systems.

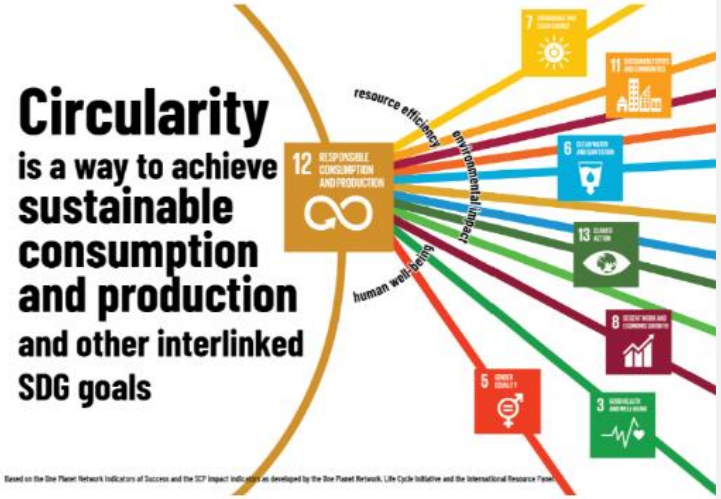
CE ENTREPRENEURSHIP

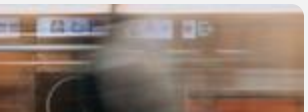




Is Circularity and Sustainability the same?

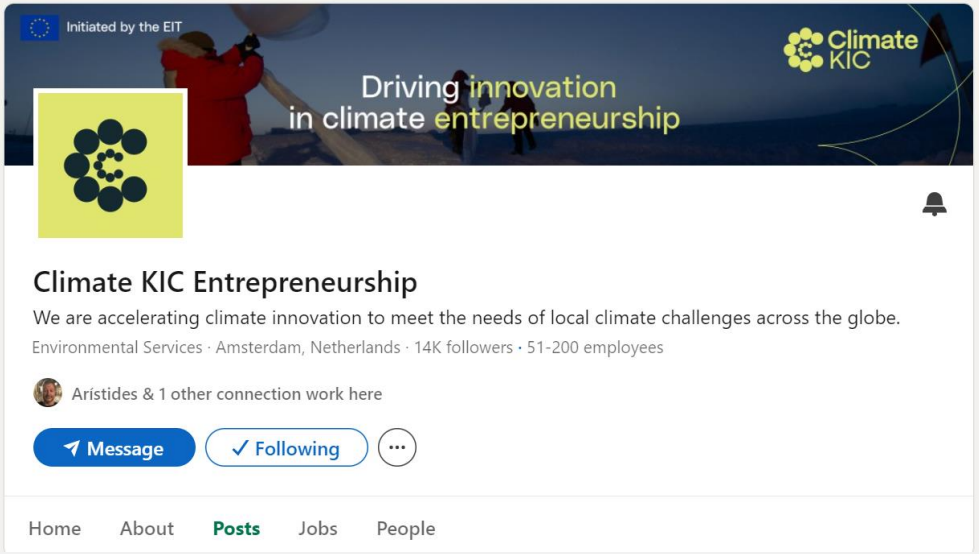






How can your ESO support circular startups

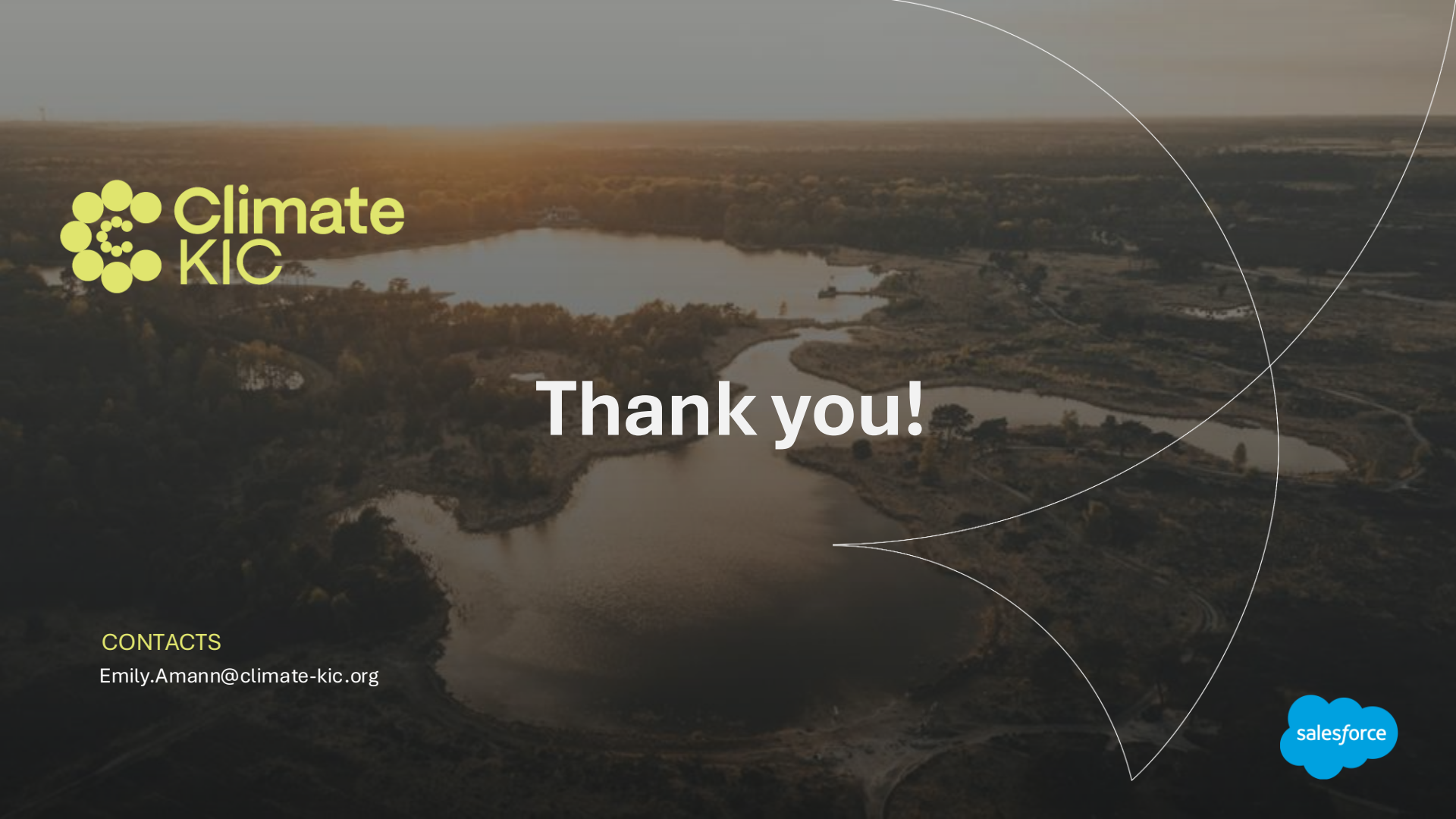
- **Focus on Sector-Specific Circular Models and Upstream innovation for more impact:** Tailor support to sectors like agriculture, textiles, and plastics, depending on local context, where circular practices are already gaining traction.
- **Invest in Capacity Building:** Offer training in circular design, lifecycle thinking, circular business models and circular impact assessment. + also for investors!
- **Promote Collaboration:** Encourage industrial symbiosis and partnerships between startups (e.g., waste-to-resource models).
- Integrating **AI** can help ventures **scale** effectively to tackle sustainability challenges with **data-driven innovation.**
- **Support Policy Navigation:** Help startups understand and leverage incentives, licensing, and compliance frameworks.
- **Highlight Success Stories:** Showcase local startups that have scaled circular solutions to inspire and guide new ventures.



Stay tuned:

- 30.10.2025 Launch of 3 Guiding Principles for ESOs supporting circular ventures
- With more tools and resources

https://www.linkedin.com/company/climate-kic-entrepreneurship/


Climate
KIC
Thank you!
CONTACTS
Emily.Amann@climate-kic.org
salesforce