



# Product Life Cycle and Ecological Footprint



# Aims:

## **1. Deepen the Understanding of Life Cycle Assessment (LCA)::**

- Introduce the essence of Life Cycle Assessment (LCA).
- Identify what the ecological footprint entails.

## **2. Introducing circular economy thinking to makerspace visitors:**

- Provide insight into the circular economy and its significance in sustainable production.
- Development of product eco-design.

## **3. What should be considered to promote the production and distribution of environmentally friendly products?**

- Sustainable materials, resources, technologies.
- Discuss the possibilities to enhance the selection process of materials and technologies in the context of sustainability.

# Target groups:

## 1. **Small and Medium Enterprises (SMEs):**

Specific examples and tips on incorporating LCA and circular economy principles into daily operations.

## 2. **Interest groups:**

Engagement in discussions on sustainable production and possibilities of life cycle thinking.

## 3. **Business Support Organizations:**

Practical tools and resources to assist companies in adopting life cycle thinking.

## 4. **Regional Government Institutions:**

Discussions on regional initiatives and their impact on business.

## 5. **Local Government Institutions:**

How to utilize life cycle thinking in local policies and project development.

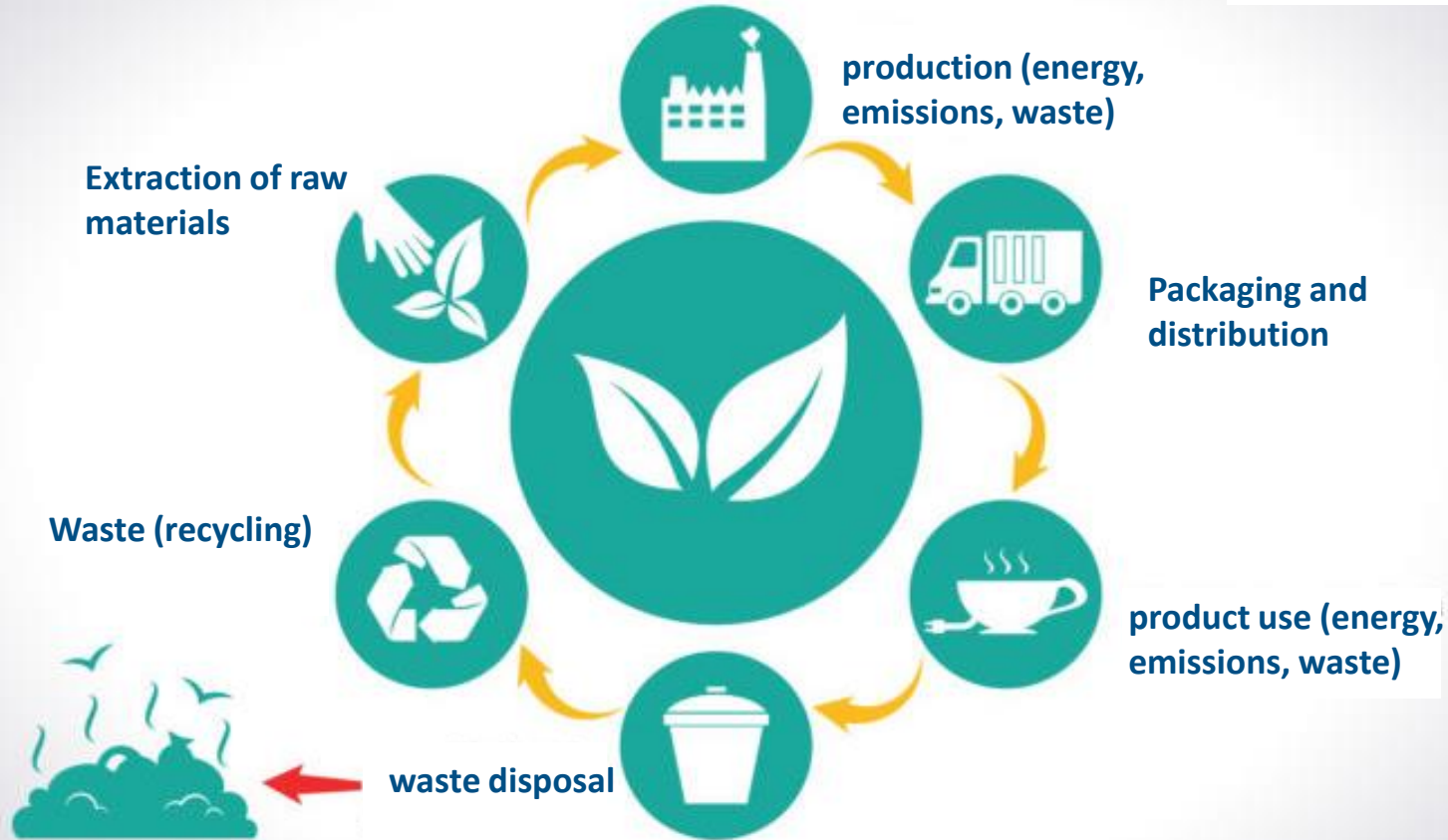
# Task

1. Find your team member and pair up in twos.
2. Choose an item/product and think of possible actions to:
  - reduce the consumption of raw materials and energy in its production;
  - possibly extend its usage life;
  - make it possible to recycle it.

# The main principles of ec-odesign:

- reduce consumption of raw materials (economy of materials, reduced consumption of natural resources)
- reduce energy consumption (reduced consumption of energy resources)
- use cleaner materials – replacement of hazardous components
- use cleaner production processes (includes safe alternatives)
- extend the life of the product (economy of materials, reduced consumption of natural resources)
- provide an understanding of eco-design (for the user and the client)

# Product life cycle



The purpose of life cycle assessment is to identify environmental aspects related to the life cycle of products or services and to provide information to producers, consumers and other stakeholders about environmental impacts. This information makes it possible to develop and choose more sustainable solutions that would reduce the negative impact on the environment.

# The essential components of a life cycle assessment include:

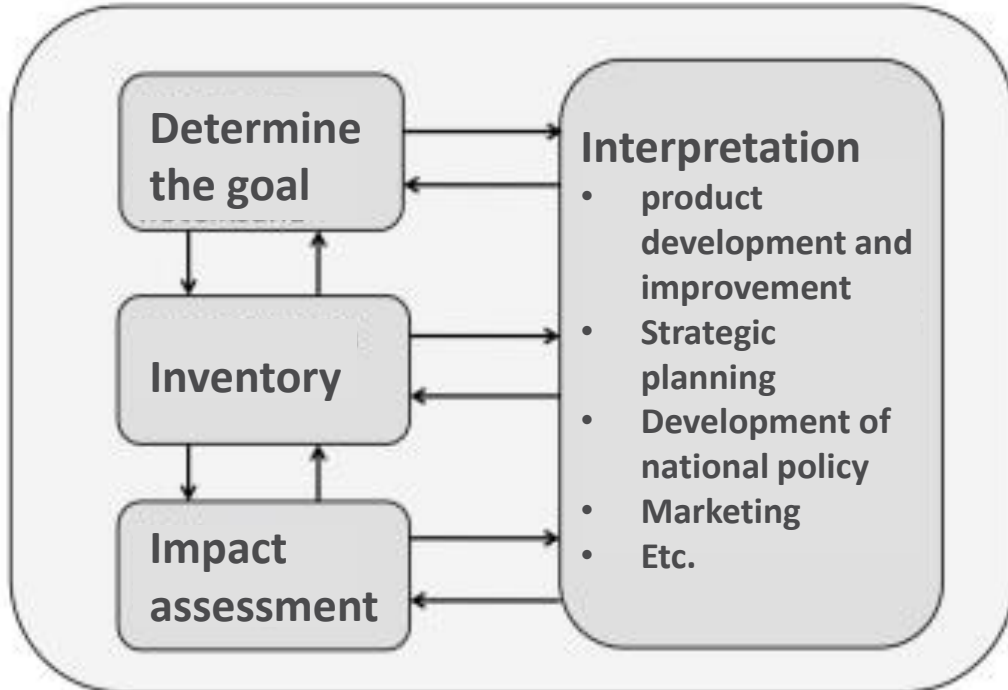
**Extraction and processing of raw materials:** At this stage, the raw materials needed to create products or services are analyzed. This includes extracting raw materials from nature and transporting them to the manufacturing site.

**Production:** At this stage, energy consumption, emissions and use of resources in the production process are evaluated. This includes both the evaluation of production technologies and the pollution caused during operation.

**Usage:** In this phase, the use of the product and the related impacts, such as energy consumption and emissions related to the use of the products or services, are analyzed..

**Waste management:** This stage evaluates how products or services are managed after their end of life. This includes waste processing, recycling methods and reuse of raw materials.

# LCA distinguishes four steps :



1. **Determine the goal**: helps to explain the essence of the problem and to decide the tasks and scale of the research. Determining the boundary of the studied system and functional units, which will serve as a reference point for comparing the studied objects, is of crucial importance.
2. **Inventory**: accounting of all the resources used for the production and use of the product or service and the resulting emissions into the atmosphere, water, soil in relation to the accepted functional unit.
3. **Impact assessment**: determines the impact of listed emissions and resource use on the environment.
4. **Interpretation**: explains the results of each previous step to determine the most important factors and decide how to reduce the environmental impact more effectively.

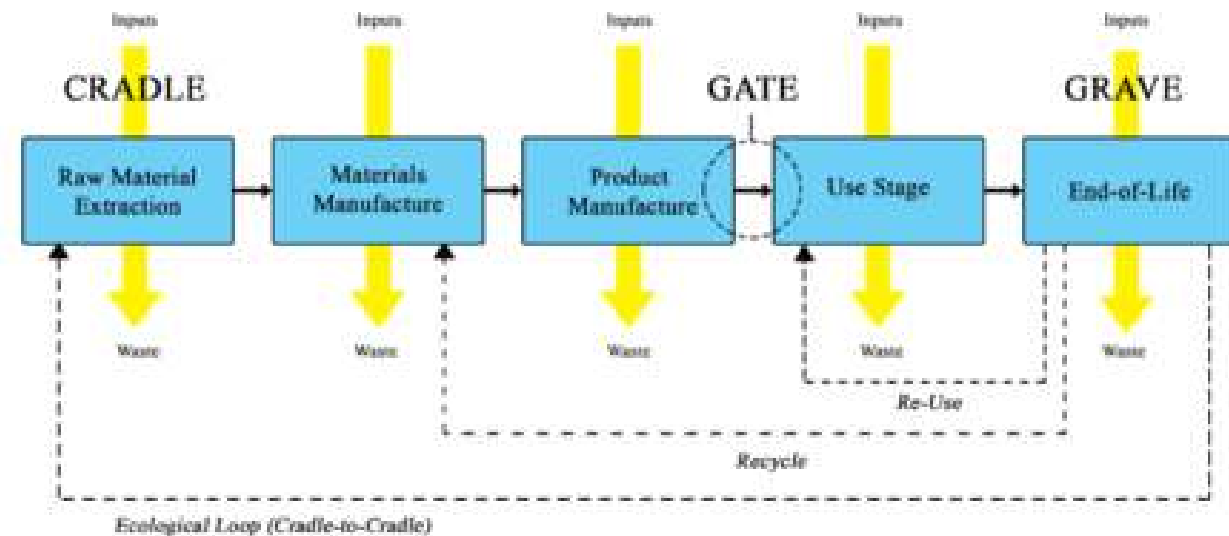


# System boundaries(ISO 14040)

**Cradle-to-Gate:** from raw material extraction to the factory gate.

**Cradle-to-Grave:** from the extraction of raw materials to the use and disposal of the product.

**Gate-to-Gate:** from one specific point in the life cycle (for example, where raw materials enter the production building) to another point further in the life cycle (for example, where the final product is delivered to the end user).



# LCA Software Tools:

## **SimaPro:**

1. Website: [SimaPro](#)
2. Overview: SimaPro is a widely used LCA software that enables users to conduct life cycle assessments, including impact assessment methods, scenario analysis, and reporting.

## **OpenLCA:**

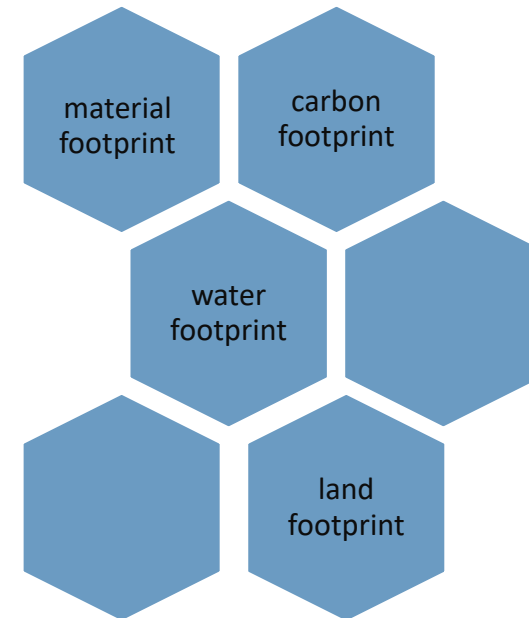
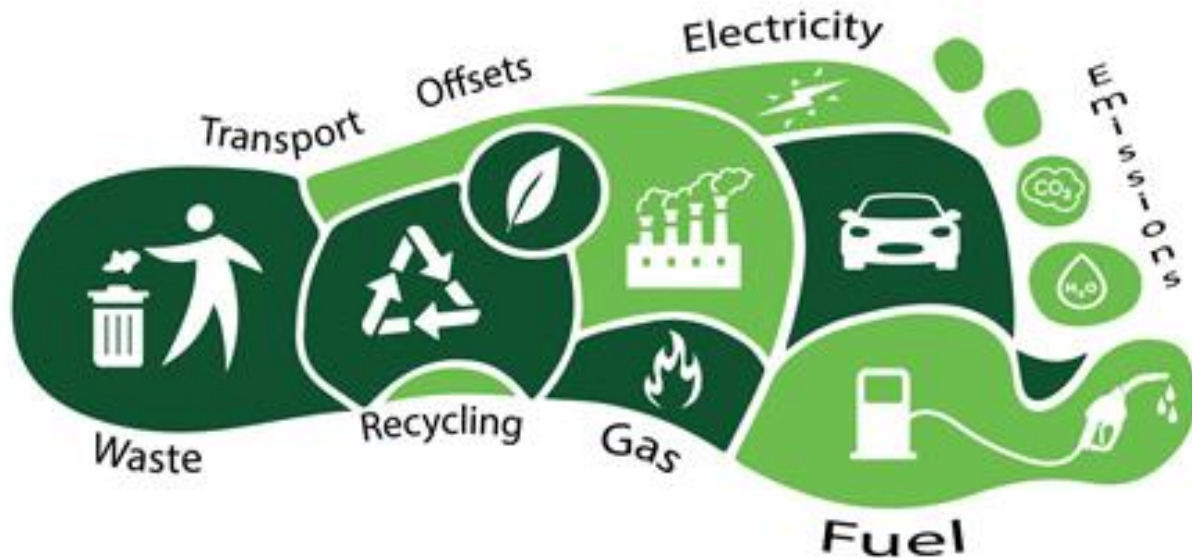
1. Website: [OpenLCA](#)
2. Overview: OpenLCA is an open-source LCA software that allows users to model and assess the environmental impacts of products and processes. It offers a wide range of features and databases

## **Ecochain:**

1. Website: [Ecochain](#)
2. Overview: Ecochain provides LCA software that helps companies measure, monitor, and reduce their environmental footprint. It offers features for product sustainability assessment and supply chain analysis.

# The concept of ecological footprint and its importance

Ecological footprint is a measurement that expresses the impact of a person or organization on the environment, taking into account all aspects of its activities and consumption. This includes resource consumption, energy use and the amount of emissions generated by the production of goods or services and captured during both production and usage.



# The main elements of the ecological footprint are: :

**Life cycle stages:** Similar to life cycle assessment, the ecological footprint takes into account all stages from the extraction of raw materials to waste management in order to determine the full impact on the environment.

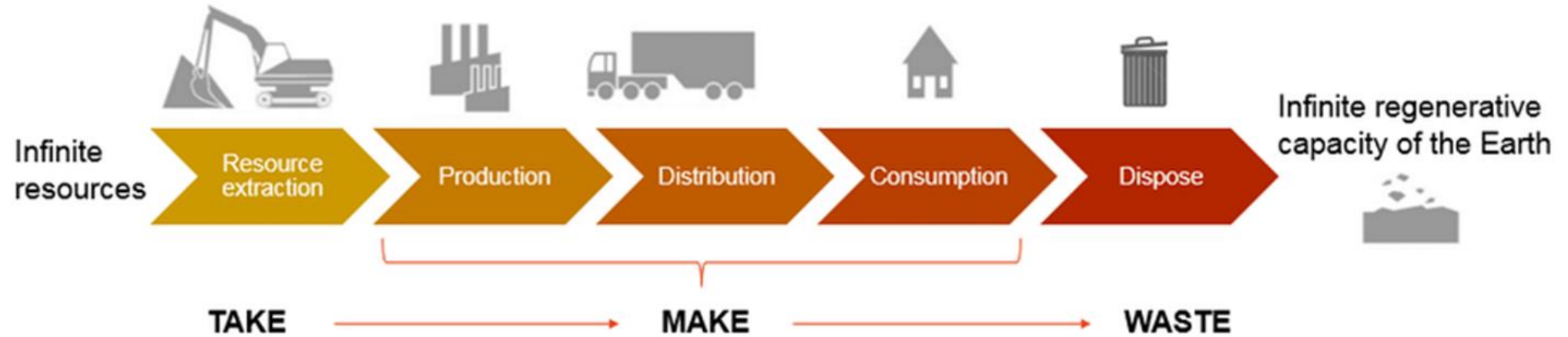
**Resource consumption:** In this context, it is evaluated how many natural resources are needed for the production and use of the specific activity or product. This includes the amount of raw materials, water use, land use, etc.

**Energy consumption:** Assesses energy use, including electricity and other forms of energy used in the production.

**Emissions:** Covers greenhouse gas emissions and other forms of pollution associated with the specific activity or product.

**Waste management:** Includes information on how waste is managed at the end of the product's life and how much waste is generated.

# Linear economy



Fuel (oil)  
Mechanics (metal,  
etc.)

Electricity (coal,  
etc.) Heating (gas,  
etc.) Mechanics  
(metal, etc.)

Electricity (coal,  
etc.)

Fuel (oil)  
Mechanics  
(metal, etc.)



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# How many kg of materials is used by one person in Europe during the year?

*main resource groups: biomass, energy (oil, coal),  
metals and non-metals (minerals)*

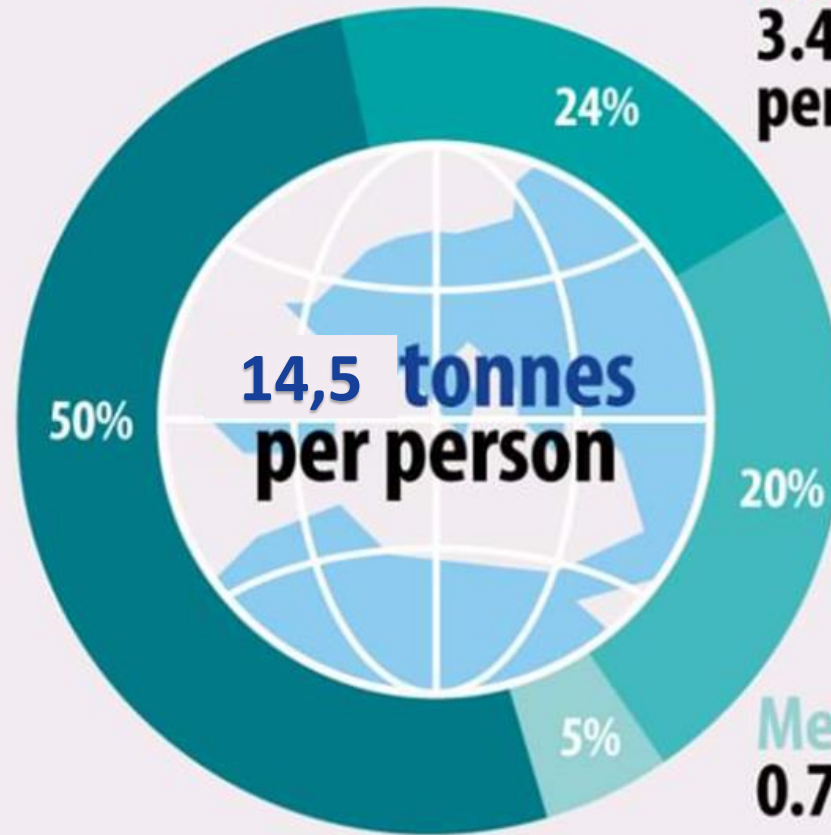


# Domestic material consumption in the EU

(by main material category)



**Non-metallic minerals:**  
7.2 tonnes per person



**Biomass:**  
3.4 tonnes per person



**Fossil energy materials:**  
2.9 tonnes per person



**Metal ores:**  
0.7 tonnes per person

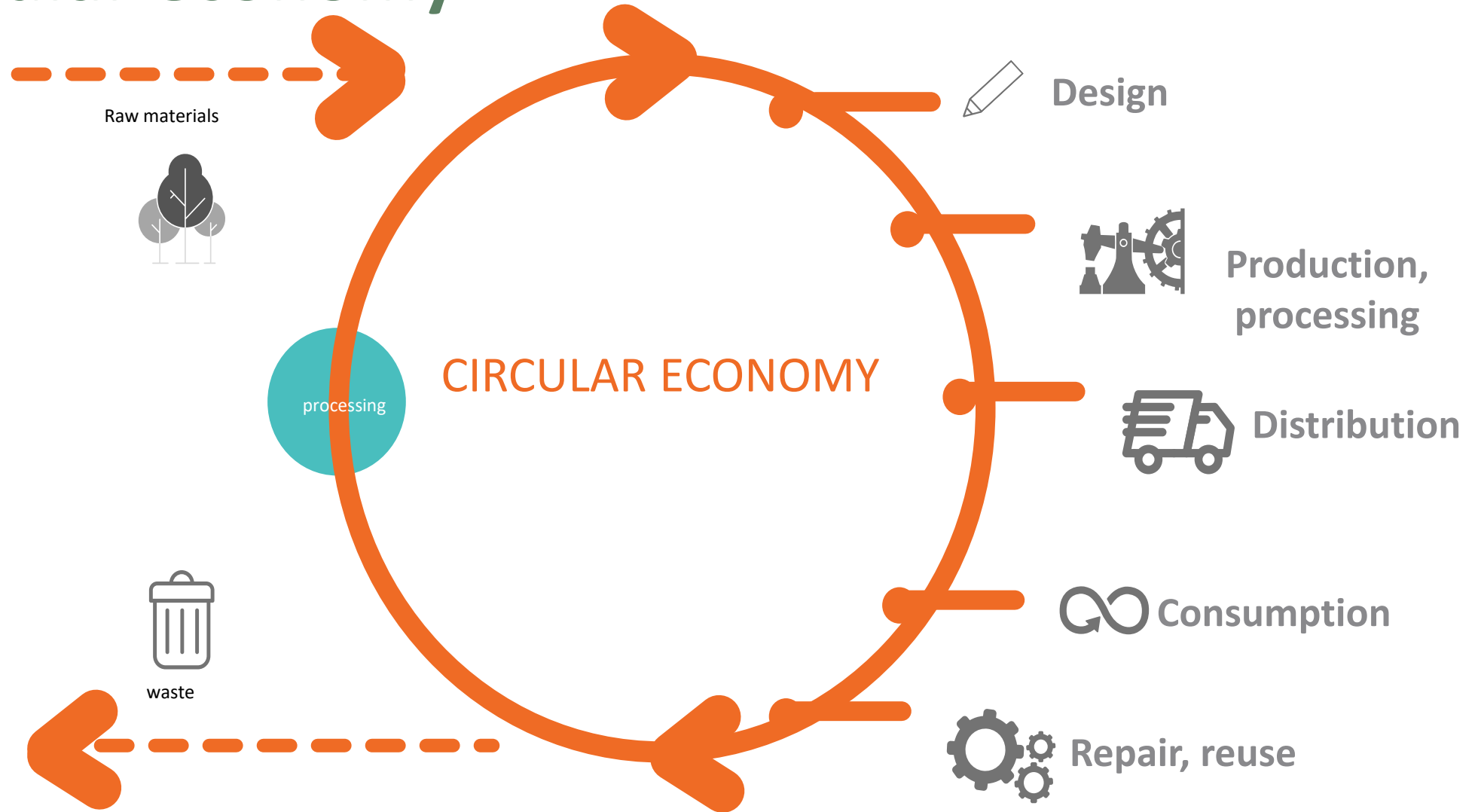


Data do not add up to 100% as 'other products' and 'waste traded for final treatment and disposal' were excluded (close to 0%).

[ec.europa.eu/eurostat](https://ec.europa.eu/eurostat)



# Circular economy





# Why do we need sustainable design and circular economy principles?

TO REDUCE  
GREENHOUSE GAS  
EMISSIONS

(product production/industry is responsible for 45% of emission)

TO REDUCE PLASTIC  
PRODUCTION

(dependency on petroleum raw materials) and thus plastic consumption and pollution

TO MAKE MORE  
VALUABLE USE OF  
DEPLETING RESOURCES

# Connections between LCA and sustainable materials/technologies



With LCA, you can evaluate the environmental impacts of your product or service from the very first life cycle stage to the very last or to any life cycle stage in between.

# Selection of sustainable materials and technologies

**Sustainable materials and technologies aim to reduce the negative impact on the environment, reduce resource consumption and promote sustainable development.**

TASK: Discussion, what in your opinion are sustainable materials and technologies?

# Sustainable materials



Wood



Coconut



Stone



Sand



Beeswax



Clay



Hemp



Wool



Bamboo

*Sustainable  
Materials*

# Sustainable technologies



# An example

## Consumer goods from secondary resources

Online platforms and stores specializing in second-hand products.

**Andele Mandele (Latvia):** is an example where users can sell and buy clothes, goods, etc. from others, promoting long-lasting use of goods.

**Patagonia:** This company specializes in outdoor clothing and offers a "Worn Wear" program where people can sell or buy used Patagonia clothing.

**The RealReal:** This online store specializes in upcycled luxury clothing and accessories.



**The RealReal**  
AUTHENTICATED LUXURY CONSIGNMENT





**IFIXIT**

## An example

### Refurbishment and repair of electronics

Companies specializing in the repair and restoration of appliances, mobile devices.

iFixit offers tools and guides to help users repair their mobile device themselves, promoting long-term use.



# An example

## Modular furniture

Companies that offer modular furniture that can be customized and added to.

IKEA has incorporated modular elements into its designs, allowing customers to customize their furniture as needed and change its appearance.







# An example

## Transportation ecosystem

The transportation ecosystem includes transportation, delivery, car haring, and other similar services.

"Bolt", "Uber" or "Lyft"- are safe and convenient car sharing solutions.





# An example

## Sustainable sports shoes

Adidas Futurecraft.Loop collection uses completely recyclable and reusable materials (no glue).

After wearing out the shoes, users can return the shoes and they will be recycled into new products.



# An example

## Biological packaging

"V.L.T" (Latvia) company specializes in the production of egg boxes and transport pallets using 100% recyclable material - waste paper.

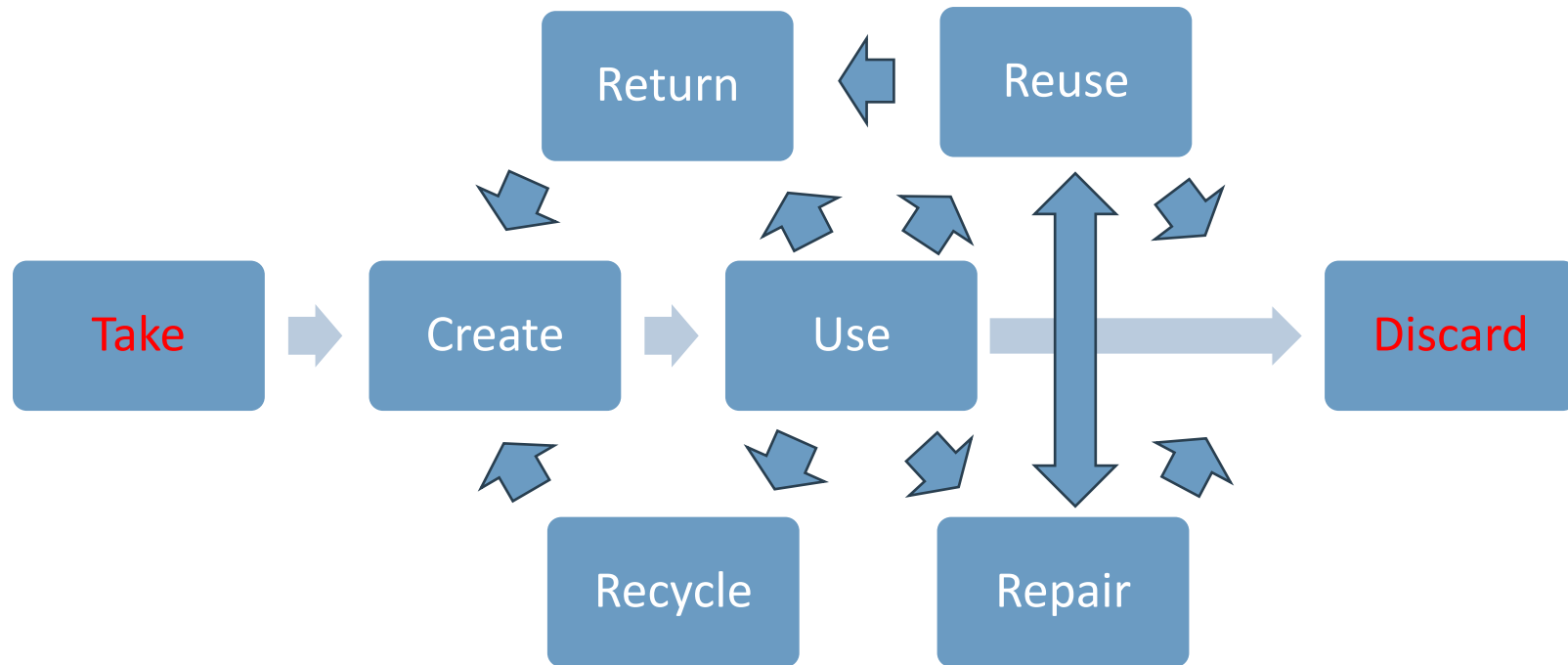


"Rēzekne meat plant" (Latvia) uses 100% recyclable packaging material.



The company "EcoEnclose" (USA) offers biodegradable and recyclable packaging solutions that can be used by entrepreneurs to package their products, thus reducing the impact on the environment.

# Different ways to create value in the circular economy.





# Task

Taking into account the product life cycle, ecological footprint and circular economy principles, develop a product concept, for example :

- Work table;
- raincoat;
- mobile phone holder;
- storage box;
- etc.



**POSITIVE IMPACTS**  
 What are the positive impacts for the organization, the local community or their ecosystems? How do we enable them to regenerate?

**NEGATIVE IMPACTS**  
 What are the negative impacts for the organization, the local community or their ecosystems?



Icon of a group of people

Icon of a question mark

**MISSION**

What mission does the organization aim to fulfill? What basic needs will be satisfied?

**KEY ACTIVITIES**

What are the key value creation activities? What skills are already available? Which ones should we acquire?

**PARTNERS**

Who are our key partners, suppliers and human resources for the creation of value? What activities and expertise do they provide?

**NATURAL RESOURCES**

Which organic resources are needed? Do we facilitate their biodegradability?

**TECHNICAL RESOURCES**

Which technical resources are required? Which products, components, machines or materials are needed?

**ENERGY RESOURCES**

Which energy resources are needed? Is energy consumption optimised? Could the activity be energy neutral?

**VALUE PROPOSITION**

What problems are solved by our offering? What different kind of value is created for all our stakeholders? How would you describe the experience offered? How does it work? What are the key characteristics?

**USERS & CONTEXTS**

For whom is value being created? Who are the core target customers and/or end users? In which contexts does our offering solve the problem?

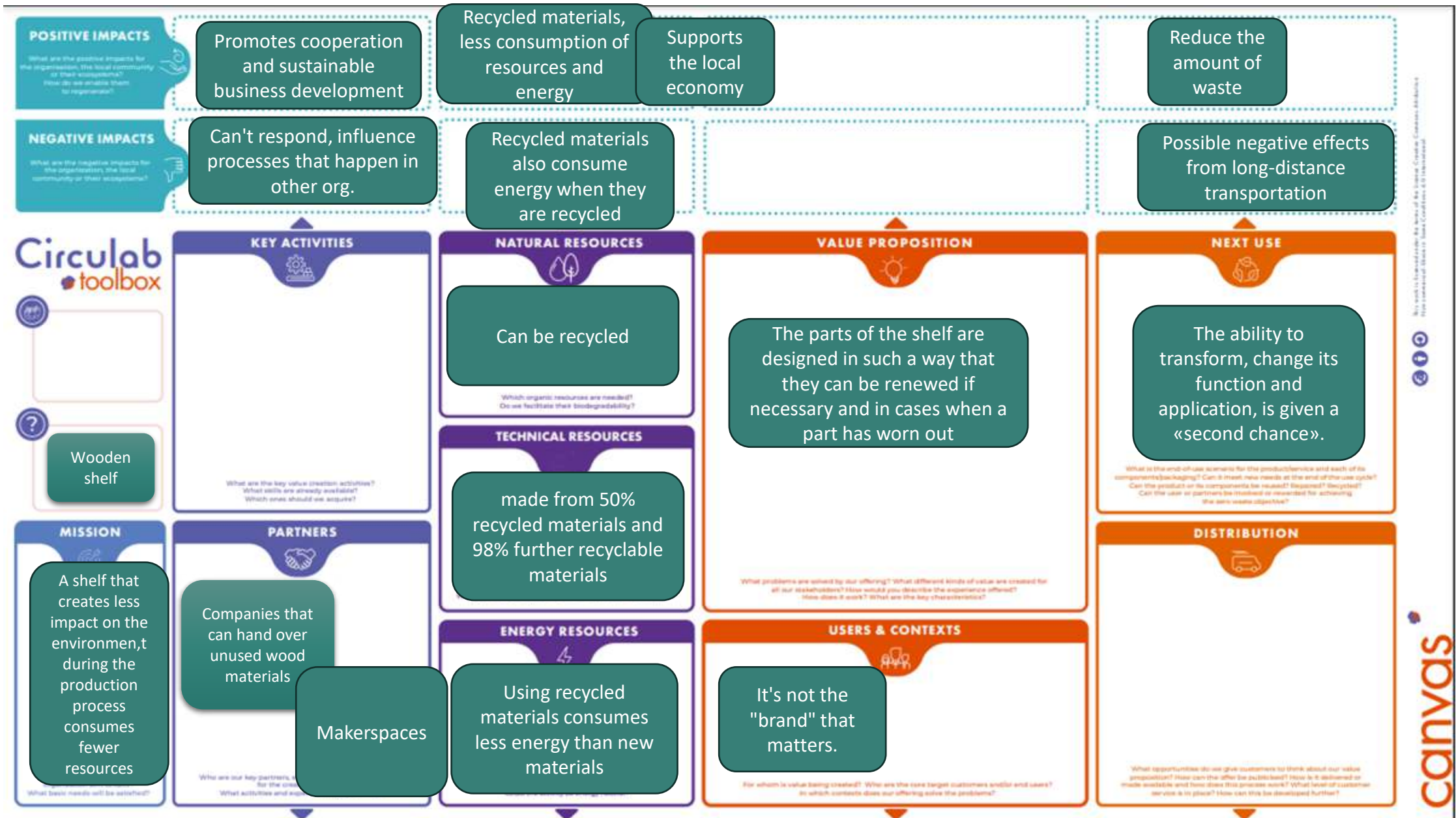
**NEXT USE**

What is the end-of-use scenario for the product/service and each of its components/packaging? Can it meet new needs at the end of the use cycle? Can the product or its components be reused, repaired or recycled? Can the user or partners be involved or rewarded for achieving the zero waste objective?

**DISTRIBUTION**

What opportunities do we give customers to think about our value proposition? How can the offer be published? How is it delivered or made available and how does this process work? What level of customer service is in place? How can this be developed further?

# An example





# A story of experience

Invite a representative from a company that has succeeded in implementing innovative and sustainable practices.

An inspirational story that reflects the experience of implementing sustainable innovations and operating on circular economy principles.

The aim is to engage and encourage others to implement sustainable practices in their company and to think about the life cycle of the product, the ecological footprint.