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Workshop Policy Options to enhance circularity
Circular product-service-systems

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Dr. Manuel Bickel

Wuppertal Institute for Climate, Energy, Environment

Co-Head of Research Unit Production and Consumption Systems

manuel.bickel@wupperinst.org

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Circle of Tools
Remanufacturing of Machining Knives

BMBF Project Circle of Tools - Circular Solutions in the Metalworking Industry

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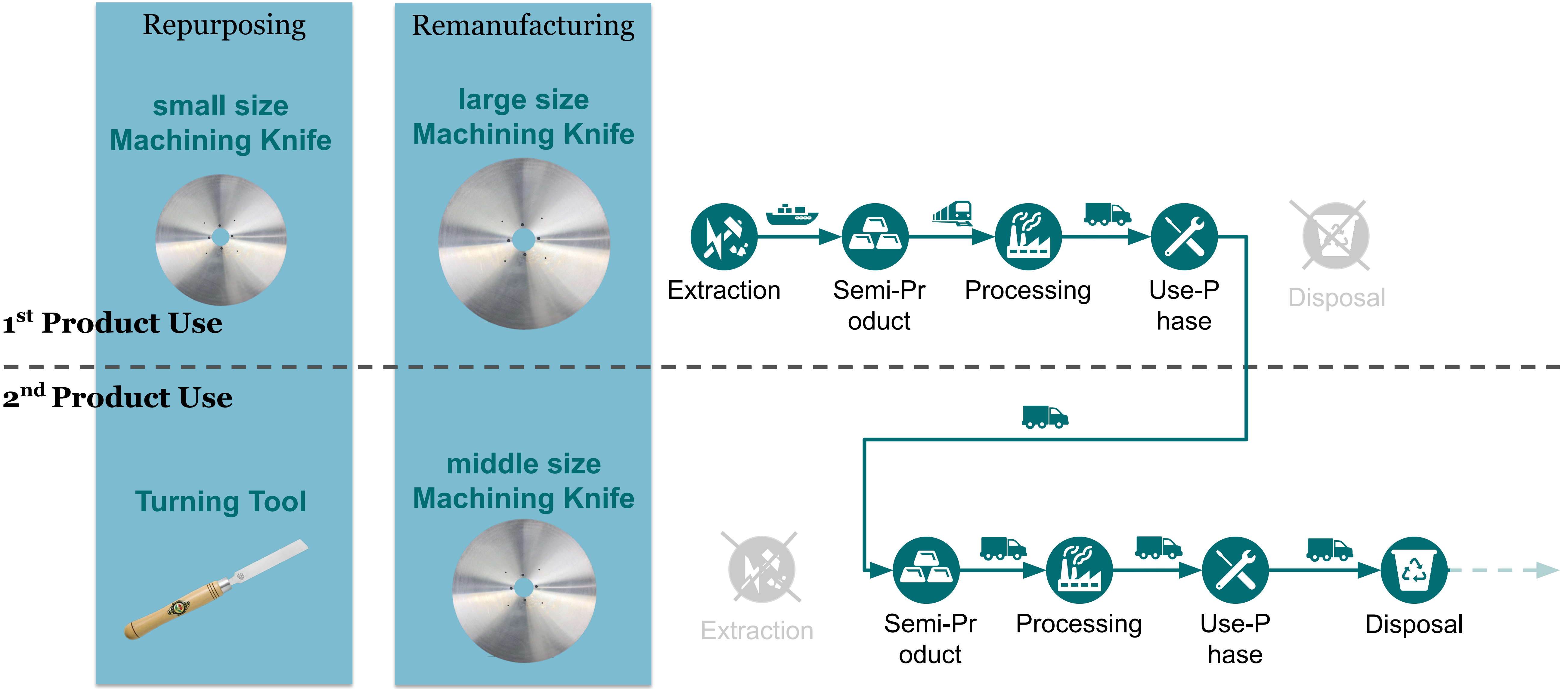
Remanufacturing and Repurposing



Source: WI, Hagedorn

source: https://innovative-produktkreislaeufe.de/Projekte/Circle+of+Tools+_+CoT_/_/BMBF_COT_Schlussbericht_033R230A_bis_F_Teil2.pdf

Selected Opportunities and Barriers

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Environment

By altering the production process, some energy-intensive processes such as heat treatment and steel smelting become redundant. The implementation of **repurposing** e.g leads to a **reduction** of the **carbon footprint of a turning tool of 50%**.

Profitability

The economic analysis shows that **remanufacturing leads to significant cost savings**. Especially the raw material and the shortened production process decrease the costs. The **economic savings** are between **30-50%**.

Waste

Currently, 91% of the knife remains as waste at the EoL and is sent to recycling. This **waste stream is avoided** and instead fed into a second life cycle. The metals used to adjust material properties (alloys) can thus be used once again and are not lost during smelting.

Selected Barriers

Law

Conformity with the law is not. **Public law is not clear and conflicts with private law in Germany.** It must be evaluated if the product is waste. The contract design does not circumvent the waste declaration. **A legal opinion must be prepared.**

Profitability

Repurposing is not profitable in this case under current market conditions. Product selection should consider the target costs in advance. Also, the price should allow to set the prices for the environmental benefits. This would be given for e.g. kitchen knives (B2C).

Collaboration

Working together to merge production processes **demands openness, transparency and commitment**. The exchange of data, some of which is sensitive, is necessary. An official cooperation or partnership for commitment and permanence is helpful.

source: Hagedorn (2021): Industrial Symbiosis – When disposed Machining Knifes become Raw Material 10th Life Cycle Management Conference – Sustainability of Business Models and Innovations

Circular by Design
Circularity of fridges from a design perspective

BMBF Projekt: Ressourcenwende über nachhaltiges Produktdesign von Konsumgütern am Fallbeispiel Kühl-/Gefriergeräte; Förderkennzeichen: 033R244, Tochtrop et al. 2021

BMBF Project – Circular by Design
Design Scenarios for the Fridge of the Future

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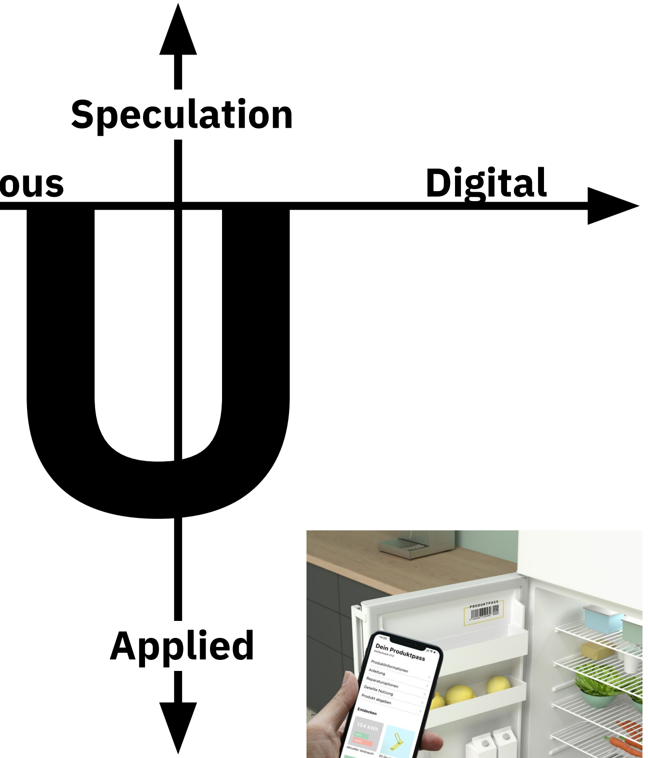
Uncool Catalogue



Food Hub

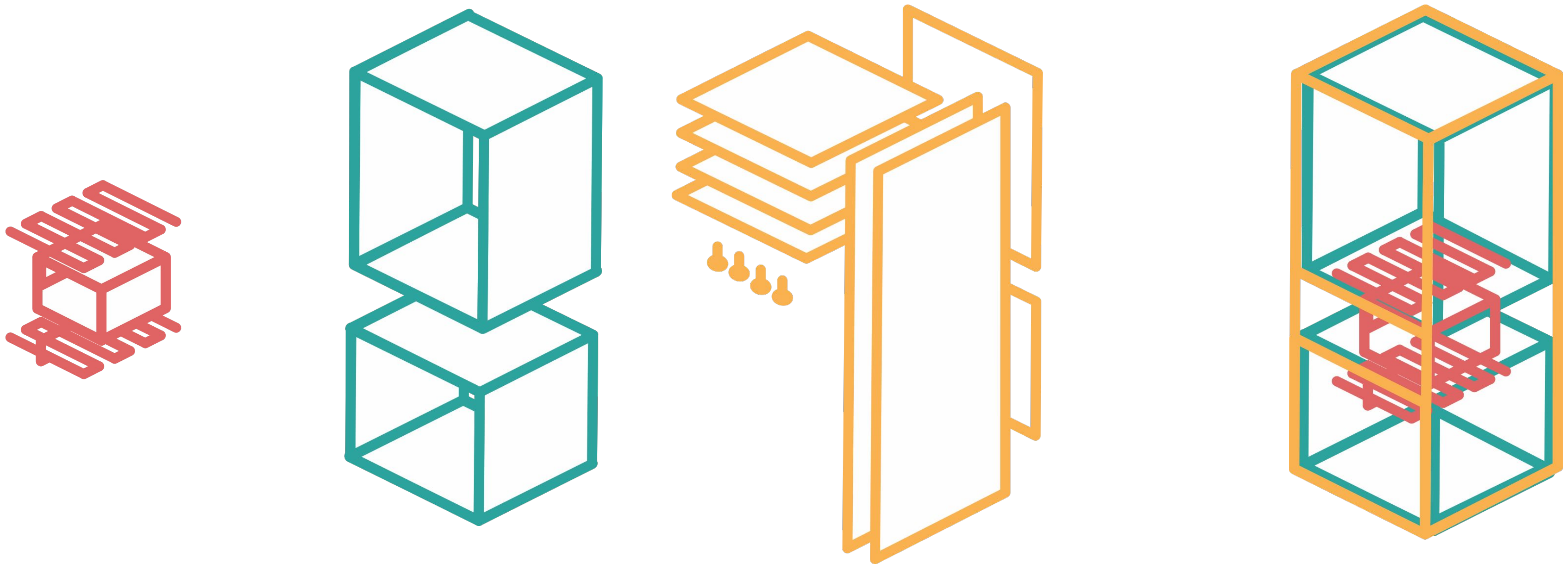
Modular fridge

data for sustainability

BMBF Projekt: Ressourcenwende über nachhaltiges Produktdesign von Konsumgütern am Fallbeispiel Kühl-/Gefriergeräte;
Förderkennzeichen: 033R244, Tochtrop et al. 2021

BMBF Project – Circular by Design

modular concept “Kühl & Schrank”



Technical unit + *insulation* + *cabinet elements* = *fridge-freezer*

BMBF Projekt: Ressourcenwende über nachhaltiges Produktdesign von Konsumgütern am Fallbeispiel Kühl-/Gefriergeräte;
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BMBF Project - Circular by Design

modular concept “Kühl & Schrank”

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Modular construction for:

- replaceability
- repairability
- upgradeability
- more efficient logistics
- cleaner dismantling
- Resource and energy efficiency (Outer shell no longer made of steel. Where possible, structural steel used instead of stainless steel. Insulation structure remains the same.)

Honest note: target conflicts, e.g., regarding energy efficiency, not evaluated due to limited budget

Policy note: Manufacturers pay the same fee for disposal of one device regardless of the circualrity of the design -> not incentive for circular design

BMBF Projekt: Ressourcenwende über nachhaltiges Produktdesign von Konsumgütern am Fallbeispiel Kühl-/Gefriergeräte; Förderkennzeichen: 033R244, Tochtrop et al. 2021

Business Model for increasing the quality of recyclates by improved separation

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Major design variants of refrigrator cases:

- coated low-alloyed steel case
- chromium steel case

Problem:

- both types are shredded in one batch
- chromium entering standard steel recycling route is lost forever (technical reasons)

Solution approaches:

1. Material-based separation of refrigerators and separate shredding could theoretically increase chromium recovery and increase revenues
2. Standardize the material of the case

Empricial challenge:

- Pricing for shredding fractions not transparent / confidential
- Rough estimate: chromium enriched fractions could have app. 40% higher economic value than mixed fraction

BMBF Projekt: Ressourcenwende über nachhaltiges Produktdesign von Konsumgütern am Fallbeispiel Kühl-/Gefriergeräte;
Förderkennzeichen: 033R244, Bickel 2021

Policy impulses for circularity

Policy impulses for circularity from BMBF projects and BMUV project MetallKIDD

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Potential for transformative solutions

- **Follow hierarchy of R strategies**
  - do not prioritize recycling but rethink/refuse
  - increased circularity is ultimately not throughput decreasing
- **Leverage potentials of product design**
  - key decisions for material flows are made at the “start of the circle”
- **Consider product and material characteristics**
  - oversimplified recycled content ratios may lead to non-recycling-friendly designs (paperback of plastic packaging)
- **(controlled) experimental legal sandboxes**
- **impact-orientated LCA perspective** (all phases) on matter and energy consumption
  - prioritize options based on ecological impact (metals have higher footprints than plastics)
  - Carbon Footprint becomes less important as we integrate more renewable energies -> Material Foorprint
- **Consider materials enabling advanced functionality**
  - only on the mass materials such as steel, etc. but also, e.g., technology metals (digitlaztion, alloys, etc. / additives in plastics)

Standard policy options to optimize the state of the art

- Funding Programs (push the limits, demonstrate potentials, support networks and knowledge transfer)
- Steering and monitoring systems
- Resource taxes on primary resources
- Reduction of taxes on materials or parts circulated within the inner cycle (R3-7)
- Improved digital sharing of information across value chains / life cycle stages

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source: Bickel (2024). DIW Policy Workshop on Circularity /based on projects MetallKIDD (https://wupperinst.org/p/wi/p/s/pd/1951), Circular by Design, Circle of Tools

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Profile of Division
Sustainable Production and Consumption

https://wupperinst.org/en/research/divisions/sustainable-production-and-consumption

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The aim of our research is to enable a comprehensive ***"dematerialization"***
of production and consumption by means of
efficiency, consistency and sufficiency *strategies*
for creating a sustainable, resource-light society, and a socio-ecological market economy in which ***products and services*** *offer a high quality of life and are produced in a sustainable way, either globally or locally.*

We analyze, evaluate and develop
technological and social innovations in ***real-world laboratories and living labs****.*

https://wupperinst.org/en/research/divisions/sustainable-production-and-consumption

Targets, topics, methods, outputs

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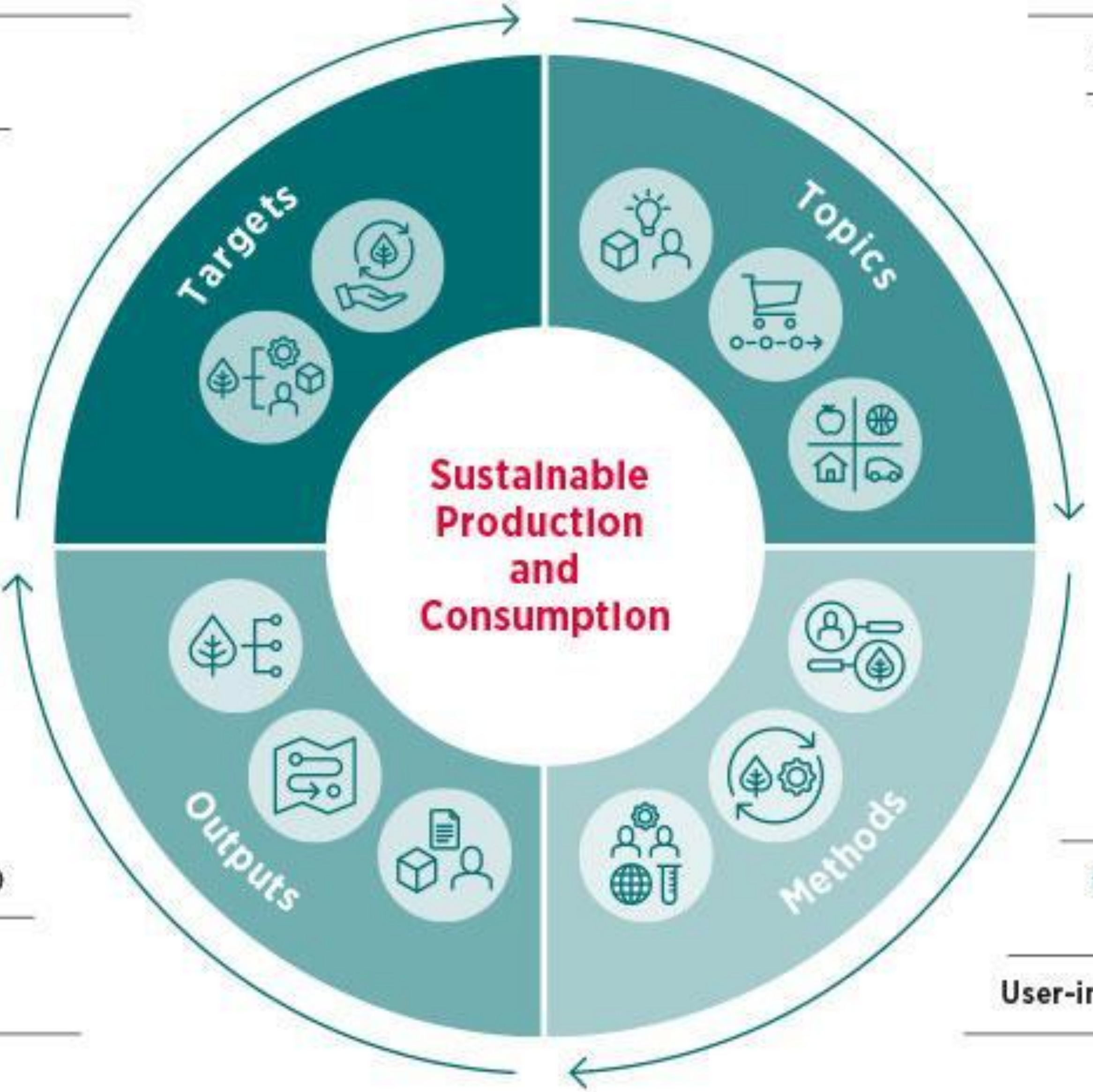

Targets

- Resource-efficient & climate-neutral society
- Development of sustainable technologies, products & lifestyles

Topics

- Product & service innovations
- Value-creation chains & consumption systems
- Lifestyles: Nutrition, leisure, mobility & home living

Methods

- Life cycle analyses / footprinting
- ✩ Assessment of sustainability
- Transition design / Design for sustainability
- ✩ Co-creation / Co-evaluation in living labs
- User-integrated design in living labs
- Open didactic development
- Scenario-building & roadmapping

Outputs

- Resource/sustainability profiles & mission statements
- Integrated roadmaps & strategies (e.g. for households, businesses)
- Social innovations & concepts for products and services
- Learning & teaching material
- Exhibitions, media reports

https://wupperinst.org/en/research/divisions/sustainable-production-and-consumption

✩ key characteristic of the division