

Textiles in CE

Challenges and opportunities

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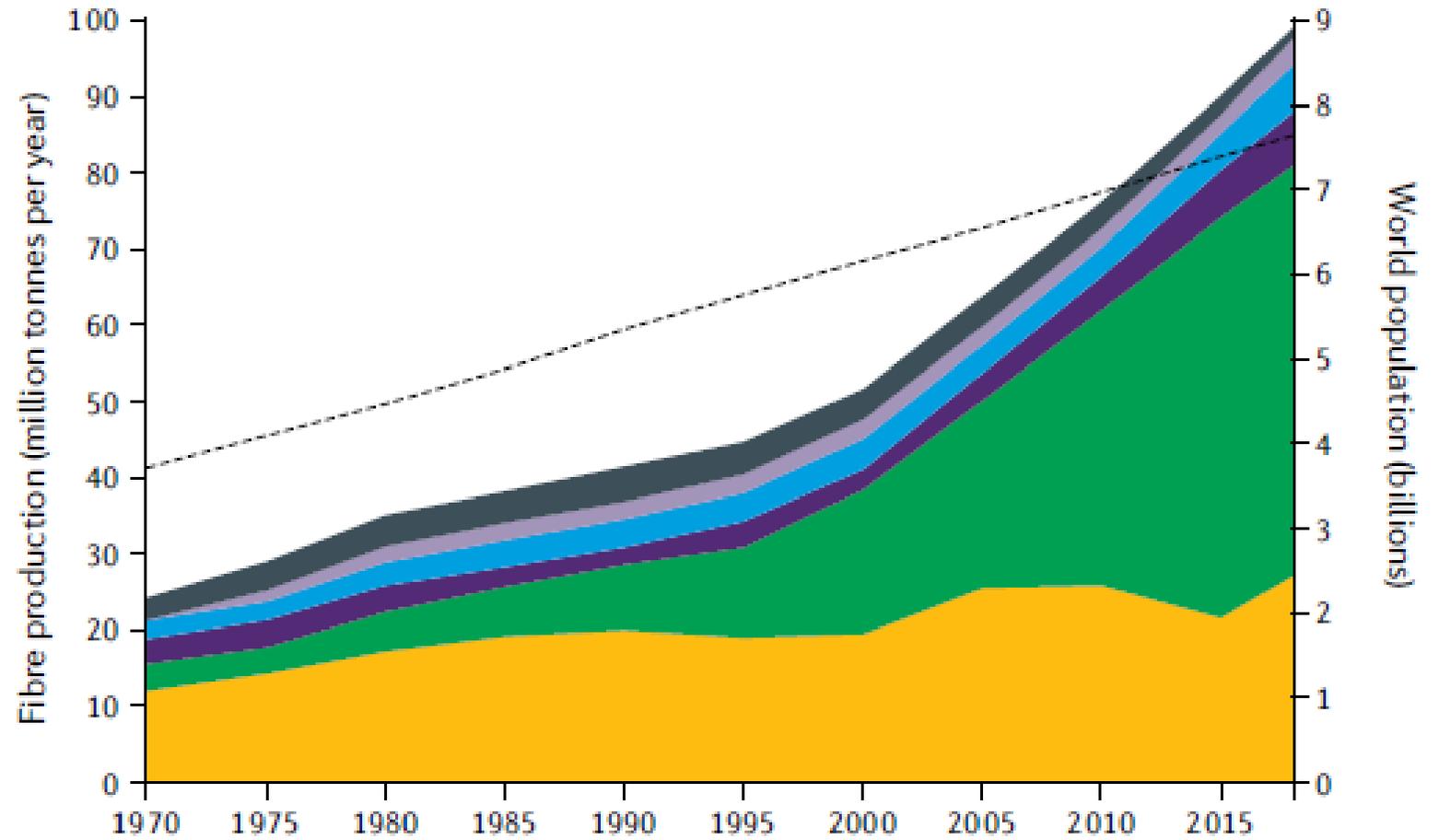




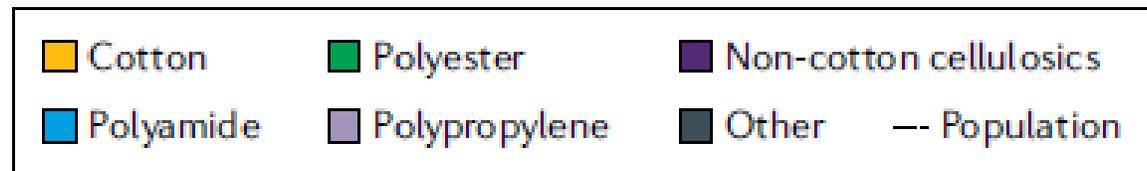
Global textile and fashion industry

Textile & fashion industry

- The annual consumption of textile fibres has increased dramatically during the past decade; from 50 million tons to more than 70 million tons (Floe, 2011).
- The global production of man-made cellulosic fibres is predicted to increase from the present (5.7 million tons in 2013) (CIRFS, 2015) to 19.0 million tons by 2030, due to increases both in per capita consumption and in population (Sixta et al., 2015).
- The human population is growing, and global economic development creates pressure towards Western ways of consuming, meaning increasing the use of many products, including textiles and especially fashion items (Määttä et al. 2019).



Niinimäki et al.
2020



Fashion system

- Mass manufacturing of clothing in cheap Asian countries has ended up in situation where cheap product prices lead consumers to impulse purchases and unsustainable consumption behavior: overconsumption, very short use time of products and premature disposal of the product.
- Accordingly the environmental impact of this industry is every increasing and simultaneously the textile waste is more than ever filling the landfills.



Textile waste

- 17kg/person/year in Finland
- 24 kg in Sweden
- 32 kg in USA



Textiles in CE

Challenges and opportunities

- New system level balance, system level understanding
- New system for CE (economical + technical)
- New business reality
- New design guidelines
- Consumer acceptance

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Linear
Vs
Circular system

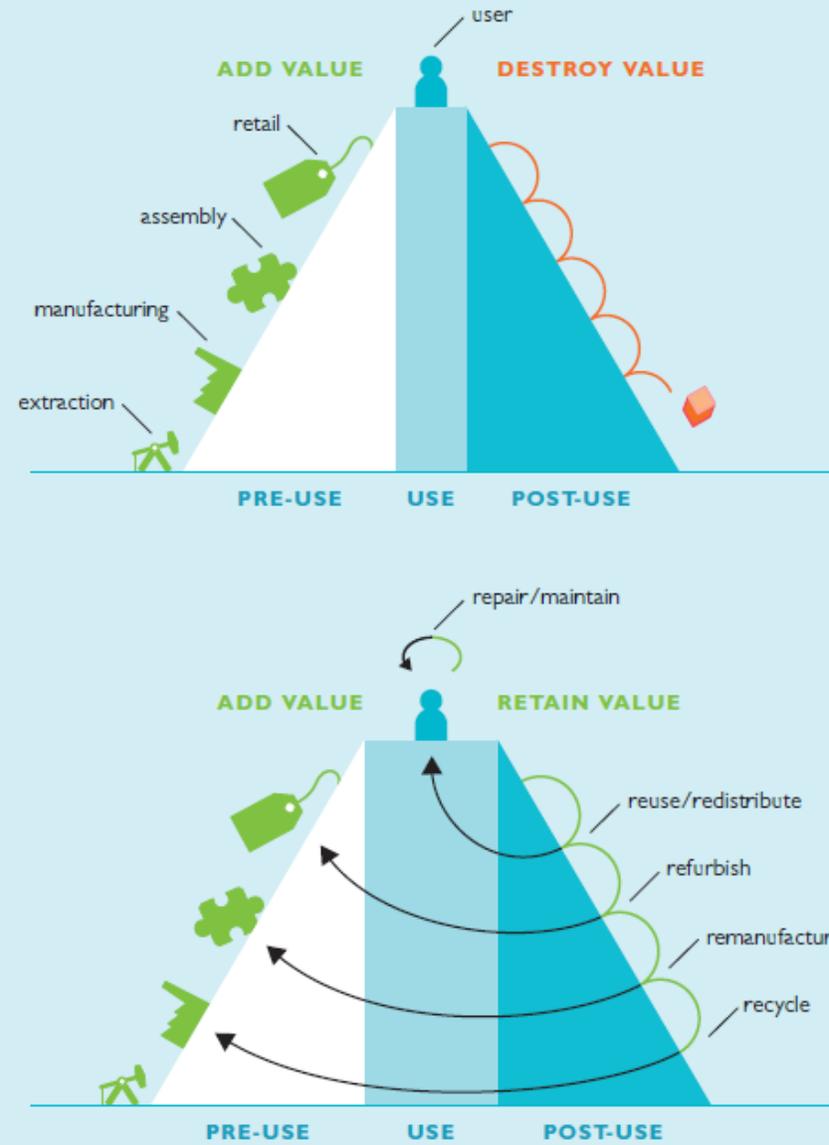
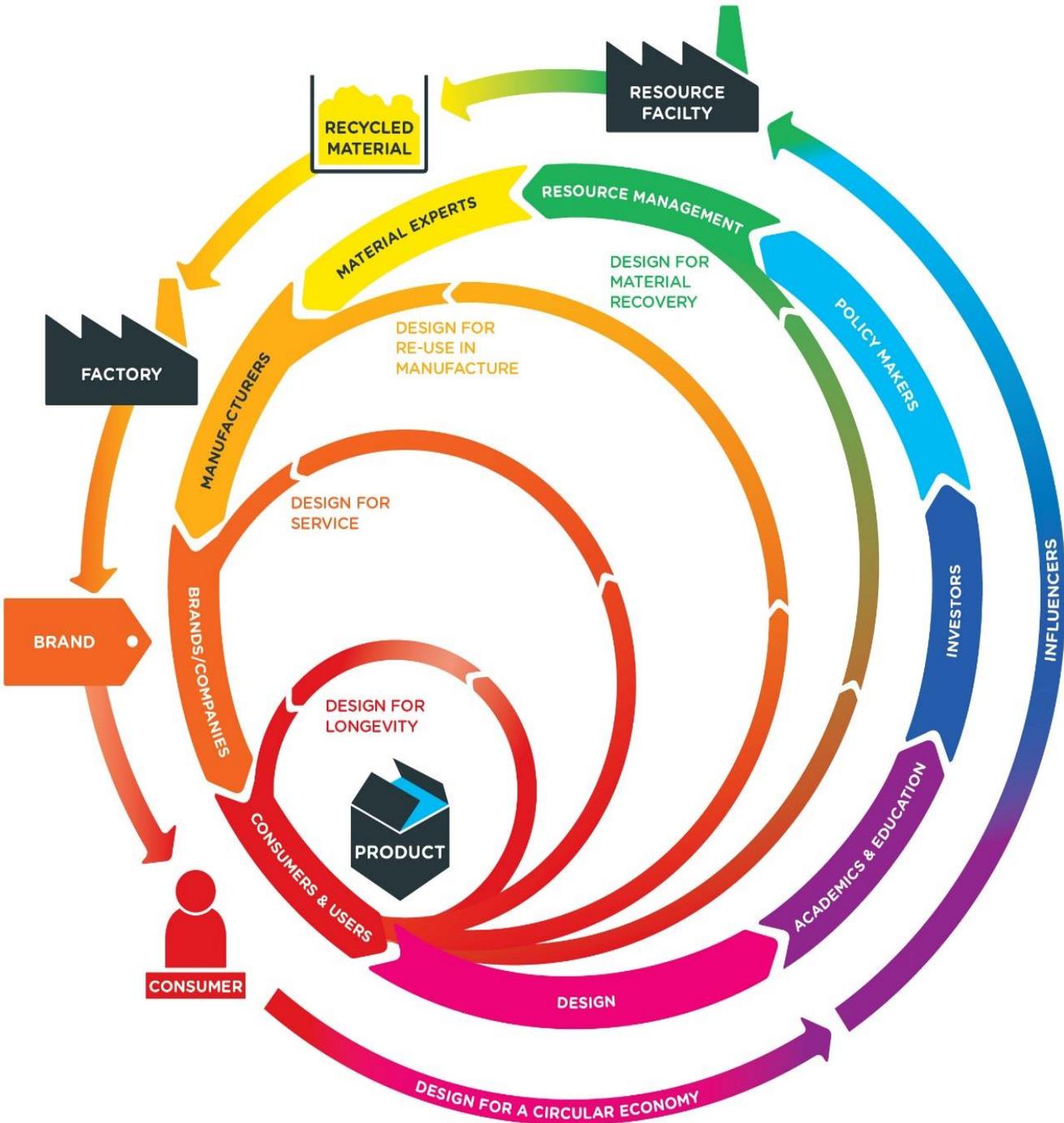


Figure 1. From destroying value in a linear economy to retaining value in a circular economy (Achterberg et al. 2016).

Circular economy

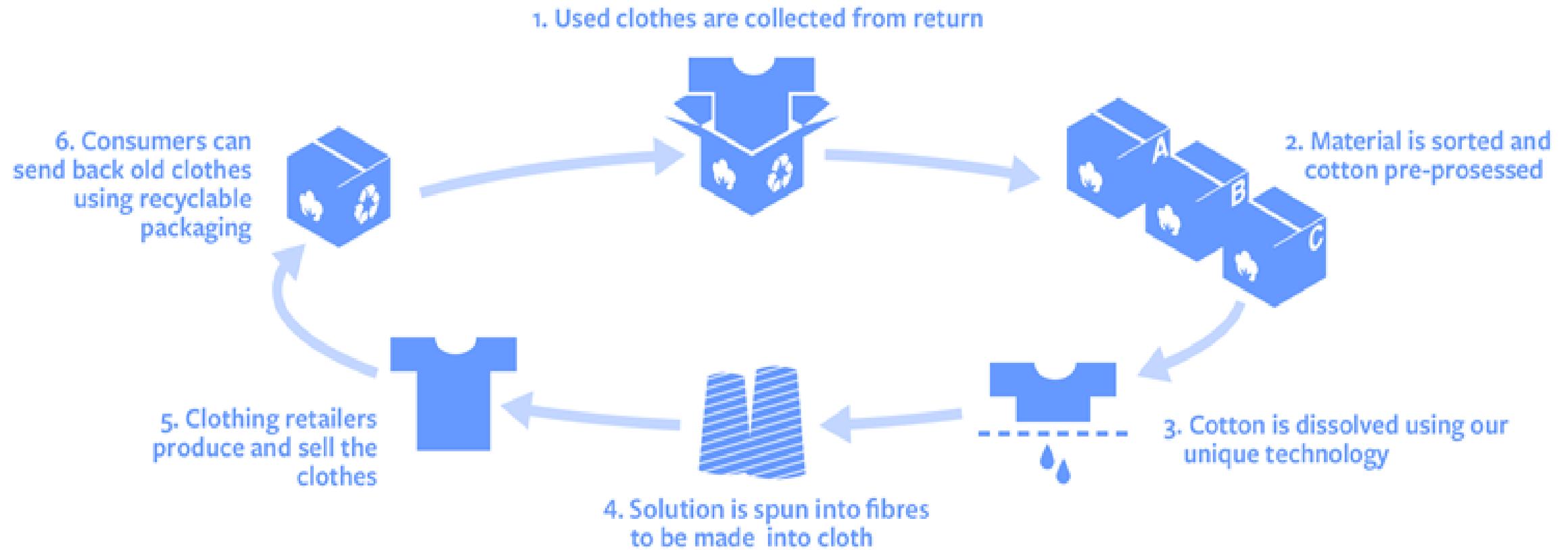
The Four Models of DCE,
Design in a circular economy
(RSA Great Recovery)



Textiles in CE

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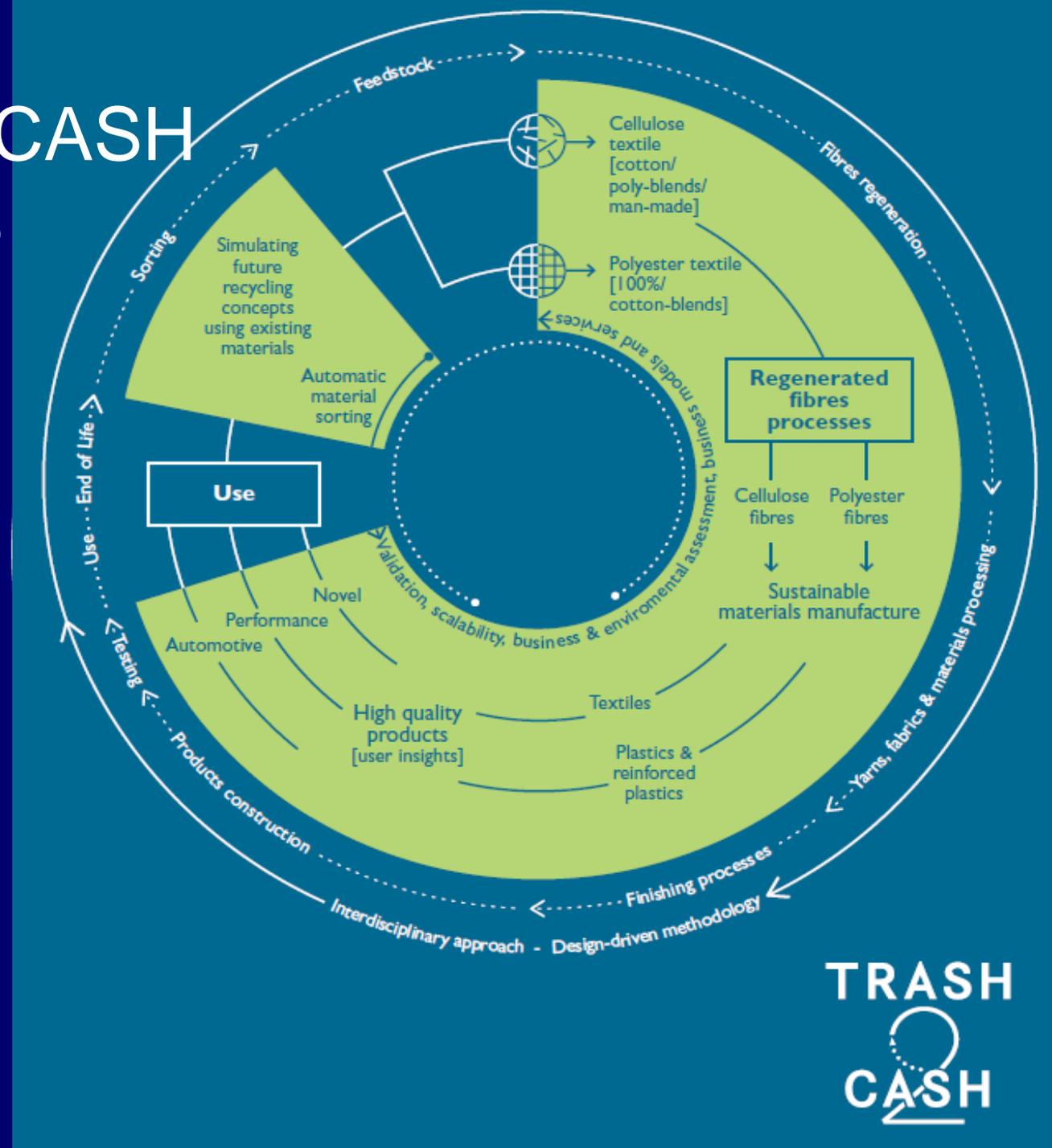
- New system level balance
- **New system for CE (economical + technical)**
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Relooping Fashion project (Relooping Fashion, 2016)

TRASH-2-CASH 2015-2018

- Creating high-end textiles from waste via ground-breaking process and material innovations
- Trash-2-Cash will turn cellulose and polyester waste fibres into new materials for high quality products through an international collaboration of design, business and technology research
- 18 partners from 10 countries
- Design-driven material innovation



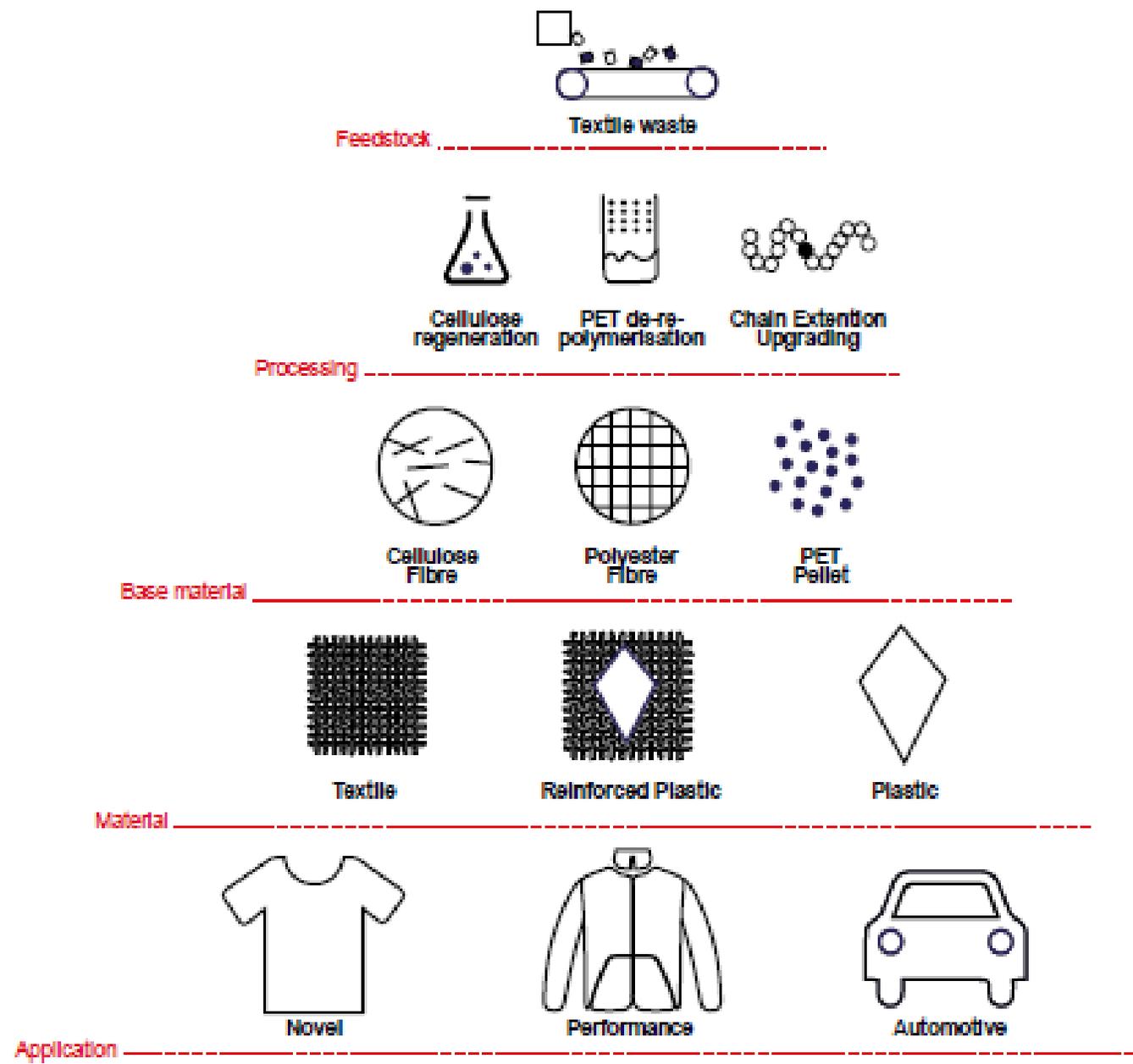
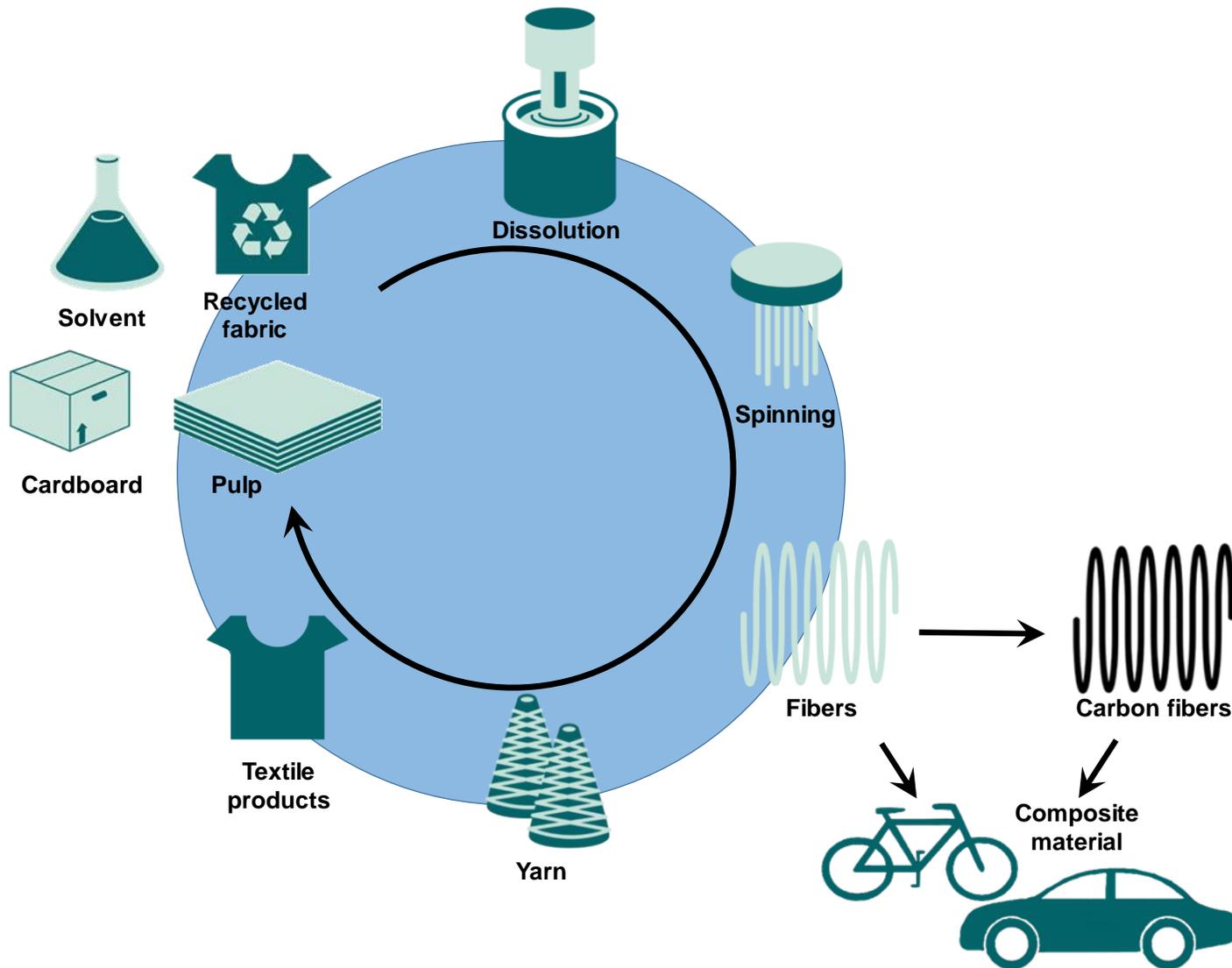


Fig. 1 T2C Materials Pathways Map

IONCELL





Eugenia Smirnova 2017, Photo Eeva Suorlahti, Aalto University

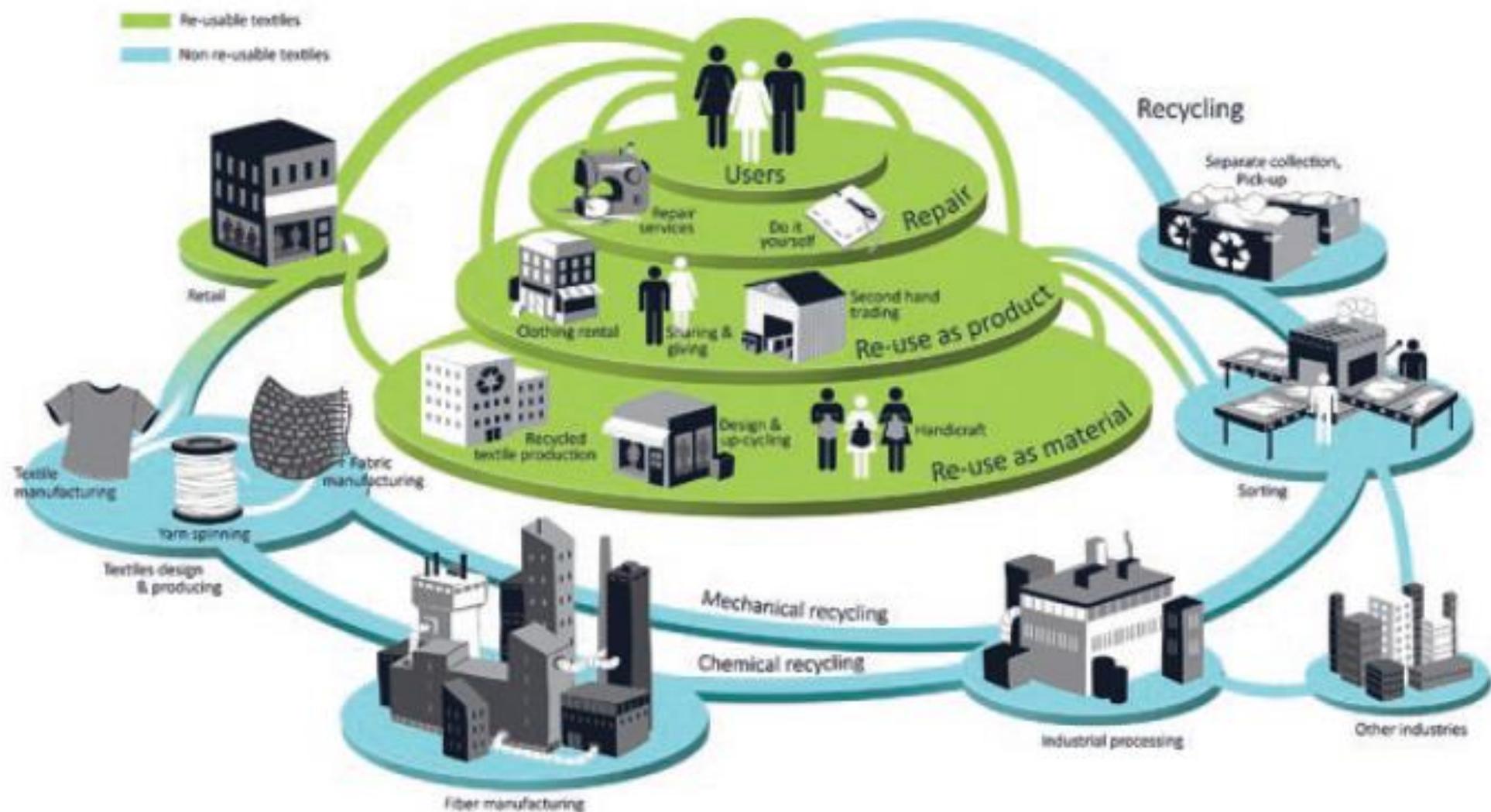


Figure 1. Model of a circular business ecosystem for textiles (Fontell & Heikkilä 2017).

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Giving New Life
to Waste:
Recycled Jeans
as Terry Towels

Finlayson

Old jeans can be used as a raw material
for terry towels (photos by Finlayson).

(Photo by Finlayson)

TouchPoint

Possible to recycle 8
times = 40 years



Fashion leasing



Vigga, Children's wear
leasing service from
Denmark

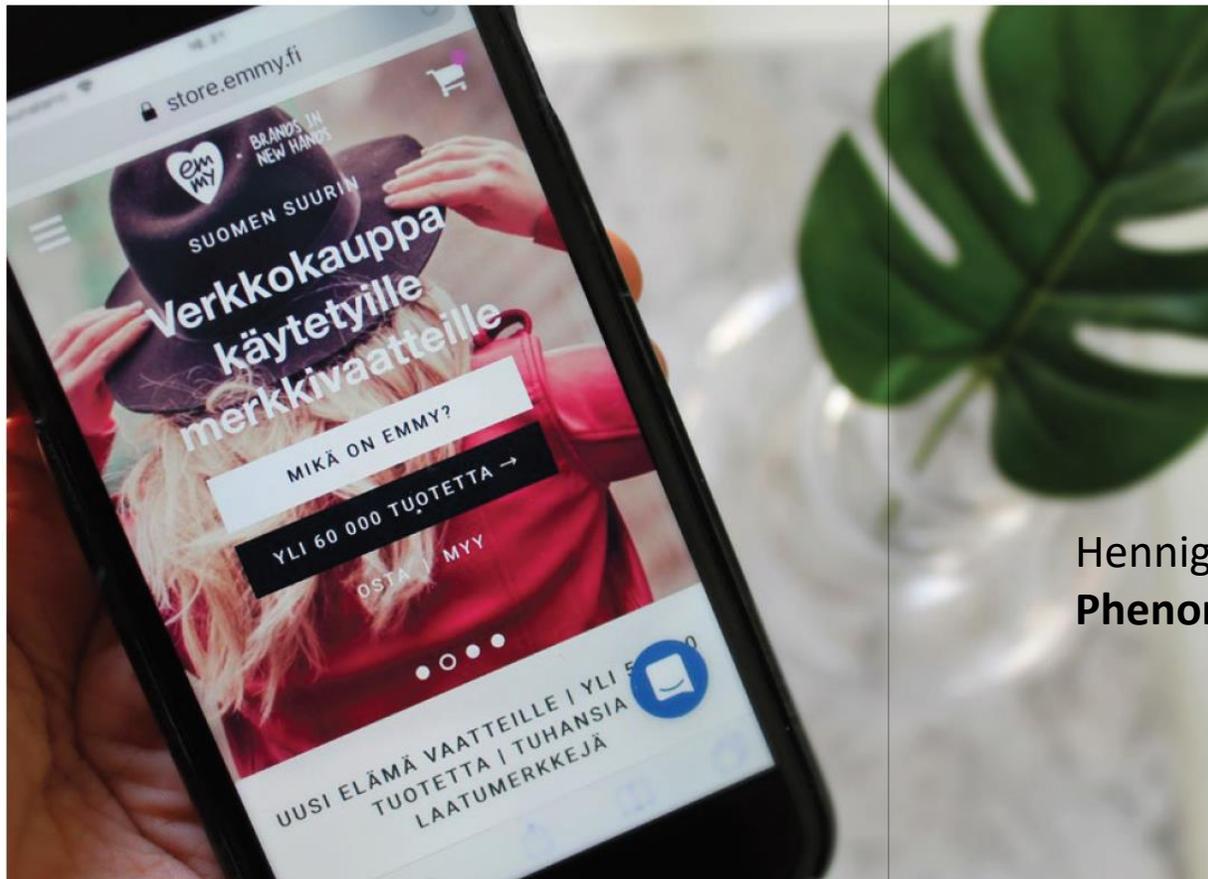
Collaborative consumption Disruptive innovation?



- Decrease in clothing purchasing
- Increase in sharing economy,
- e.g. swapping, leasing, renting
- C2C and platform economy

Leasing Fashion
Can Be Fun!
Vaatepuu

Sharing economy, Platform business and consumers' new roles



Henniger, C., Bürklin, N. & Niinimäki, K. (2019) **The Swapping Phenomenon – When Consumers become Suppliers.**



* BRANDS
IN NEW
HANDS

Crowed funding

- Exact amount of production is decided beforehand
- Each garment has a buyer before the production starts (pre-order)
- Manufacturing starts only when the orders are full
- Better control over manufacturing and doing business
- No extra production



THE CURATED WARDROBE

A perfect wardrobe that is simple rather than excessive and is created to last and evolve over time

A selected wardrobe that is maintained and cherished, that can be updated in new ways

Filippa K

Second-hand fashion



Nudie
Jeans

Business out of textile waste

- Logistics
- Collection
- Fibre identification
- Disassemble
- In which recycling process
- Outcome: quality, functional properties, application areas
- Using recycled materials
- Recycling the material again

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Design guidelines for CE

Design approaches for CE

Design for quality

Design for satisfaction

Design for long-term use

Design from recycled materials

Design for re-use

Design for recycling

Design for CE system

Niinimäki, K (2017) Fashion in a circular economy. In Henninger, C., Alevizou, P., Goworek, H., Ryding, D. (Eds.) *Sustainability in Fashion- A Cradle to Upcycle Approach*. Cham, Switzerland: Palgrave Macmillan/Springer, pp. 151-169

Intentional design for circularity

Mechanical
recycling

Waste resources
Quality
Fibre content
Textile structures
Garment structures
Prints, finishings
Colours
Chemicals
Lifetime

Chemical
recycling

Niinimäki, K. & Karell, E. (2019)
Closing the Loop: Intentional Fashion
Design Defined by Recycling
Technologies

Table 1. Design guidelines in a CE.

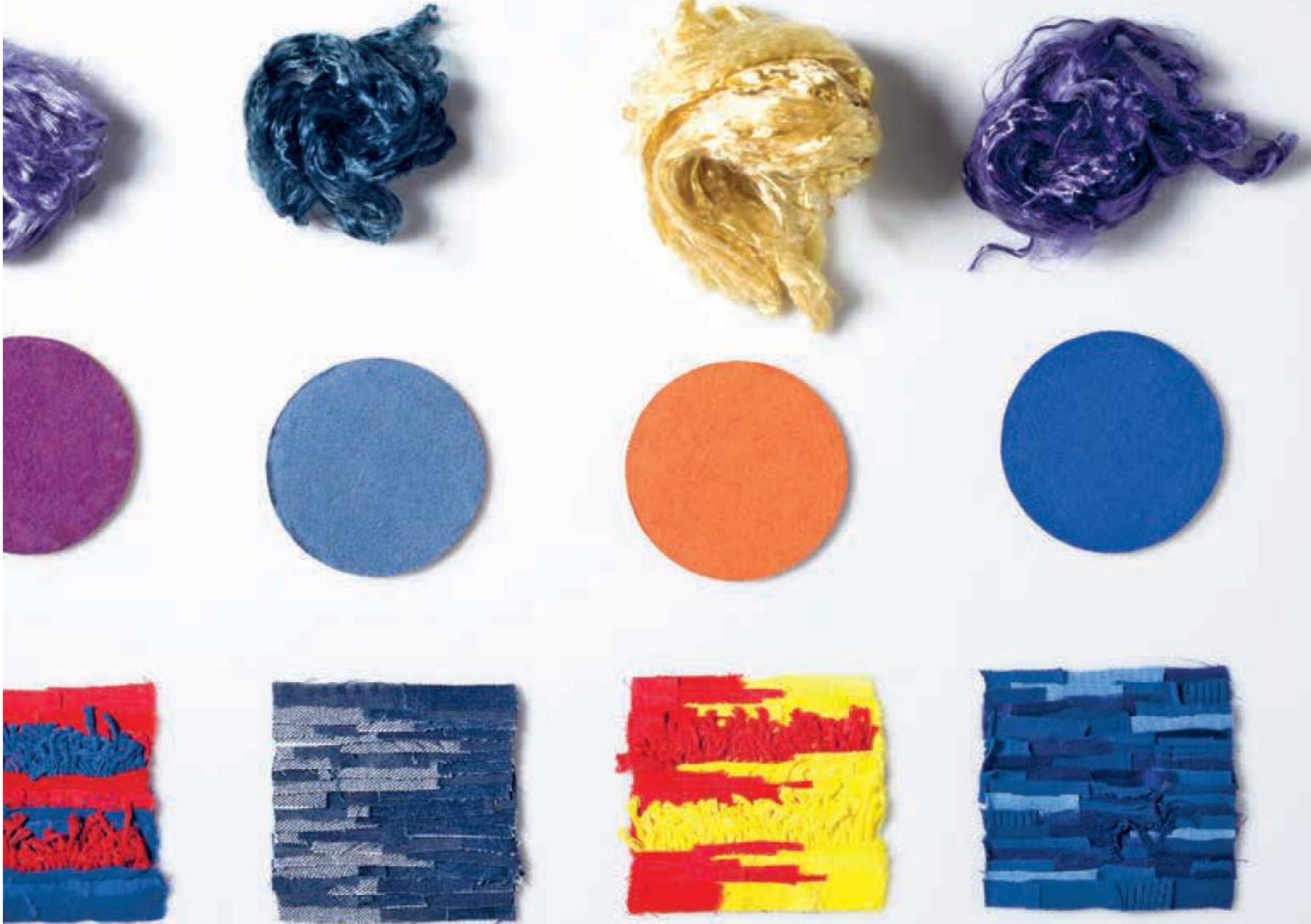
DESIGN	KEY STAKEHOLDER	IMPACT
Design for quality and long-term use	Business, Users	Extending the lifecycles, aesthetical aging, product satisfaction
Emotional Design	Users	Slowing consumption through deep product satisfaction and person-product attachment
Design for easy repair, reuse and redesign	Business, Users	New business models (e.g. services)
Design within new business models (e.g. swapping, second-hand business, PSS, renting, leasing)	Business, Users	Extending or intensifying the use
Design from recycled materials	Industry, Business	Creating demand for recycled materials
Avoid harmful, toxic chemicals and substances	Industry	Supporting CE system
Design for recycling (easy disassembly or made from mono-materials, recycling all materials and chemicals in a closed loop manner)	Industry, Policy	Creating CE system
Design for transformation	All	New paradigm

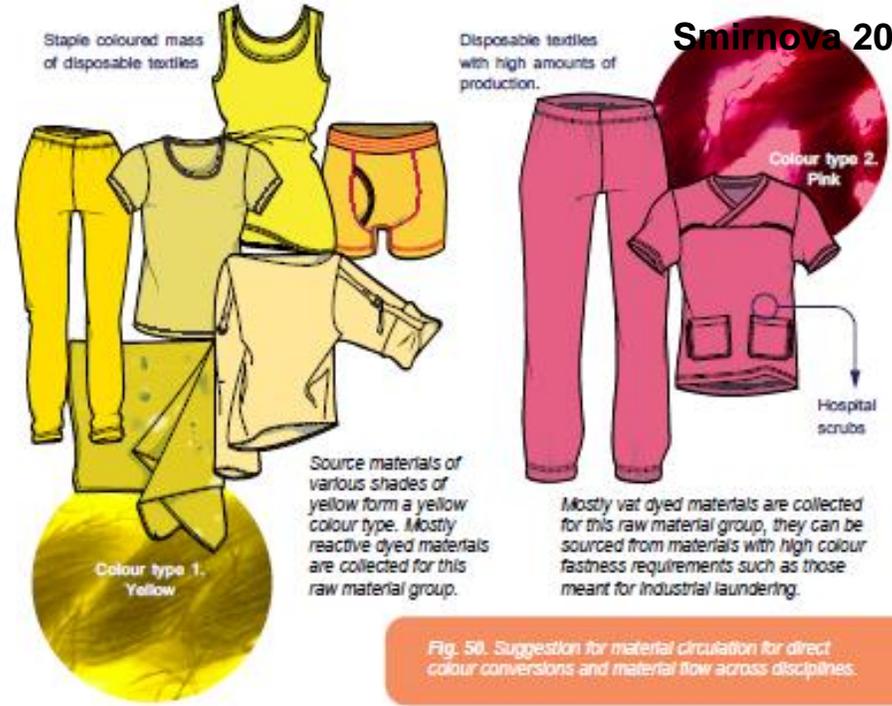
Niinimäki 2018

COLORS IN CIRCULAR ECONOMY

(EUGENIA SMIRNOVA 2017)







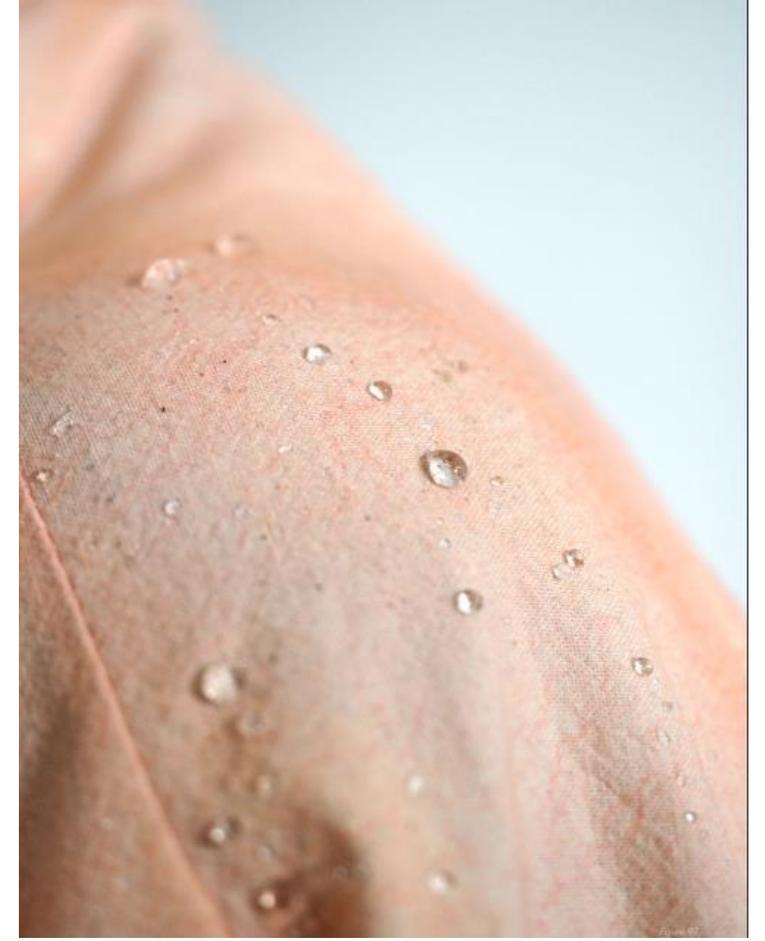
ALTERNATIVES FOR REMANUFACTURING



Designing Lifecycles

New Materials

Matilda Tuure, Ma thesis 2018,
Sustainable and Biodegradable Clothing
and Material Research for Outdoor Sports



Redesigning, new aesthetics

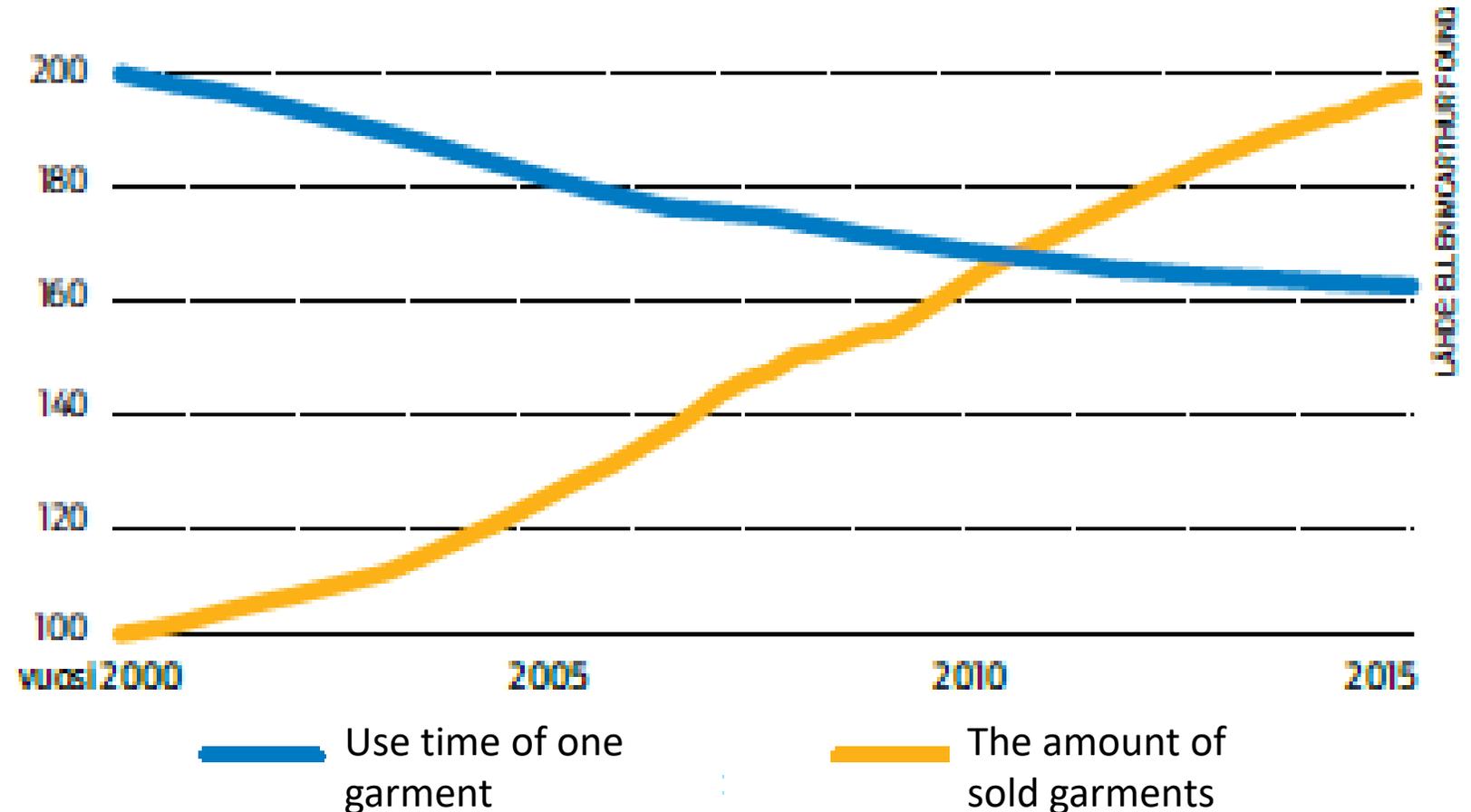


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The use time of garments are decreasing while the amount of garments are increasing



Extending the use

Table 2. The effect of extending the use time of garments (WRAP 2012, 23).

EXTENDING THE USE WITH	CARBON SAVING	WATER SAVING	WASTE SAVING
10% = 3 months	8%	10%	9%
33% = 9 months	27%	33%	22%

Four steps for sustainable design

1. Repair
2. Refine: Where we are, especially in the use of new technologies and materials to reduce the environmental impact of products
3. Redesign: e.g. closed loop thinking
4. Rethink: Next shift, requires a radical change in mindset, and it can offer breakthroughs for new lifestyles, the ways of living and doing things, as well as approaches to fulfill consumer needs. This approach needs strategic innovations that lead to new business models and new sustainable living

(Tischner and Charter 2001, 127)

Currently, changes to existing products are mainly made on the operational level, but **new solutions should also offer value through sustainability and reduce the environmental impact of products and consumption in total.**

Designing lifestyles?

Paradigm change

Challenge for the future

- How to design, manufacture and identify quality and durability of yarns, textiles and garments?
- How to design a lifetime into a product? How to design lifetimes?
- How to decide the end of life procedures and include this information into a product? (fibre content, chemicals, finishes, use time)
- How to close the material loop and move towards CE? In practice and in bigger scale?
- How to include business thinking/models into forementioned?
- How to understand and include waste as a part of the textile and fashion business? (EPR, extended producer responsibility, different ways of doing fashion business)

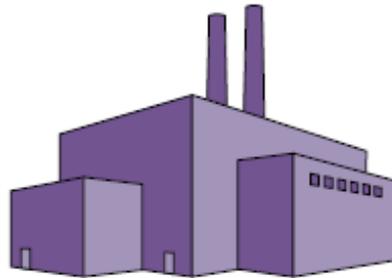
Enhancing transformation towards CE

Policymakers



- Legislation
- Regulation
- Green taxation
- Tools for better balance and a slower system
- Policy for extended producer responsibility

Industry



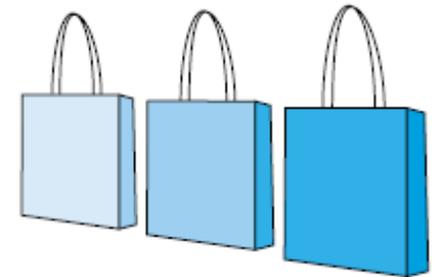
- Prevent waste
- Invest in pollution-control technology
- Avoid surplus production
- Close the material loop
- Supply-chain transparency

Retailers



- New business models to support slower consumption and circular economy
- New pricing system to consider the environmental impact of a product

Consumers



- Extend products use times
- Conscious consumption
- Slower consumption



**Thank you
Kiitos**

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<http://ftfutures.aalto.fi/>

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