

Designing in a Circular Economy

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Current system

Linear economy



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Linear economy

- Take-make-dispose
- Mass production, produces sameness
- Production in lower cost countries
- Super effective manufacturing, marketing, logistics
- Waste treatment vary
- Serving Western consumers vanity consumption needs and global companies profit making

Value

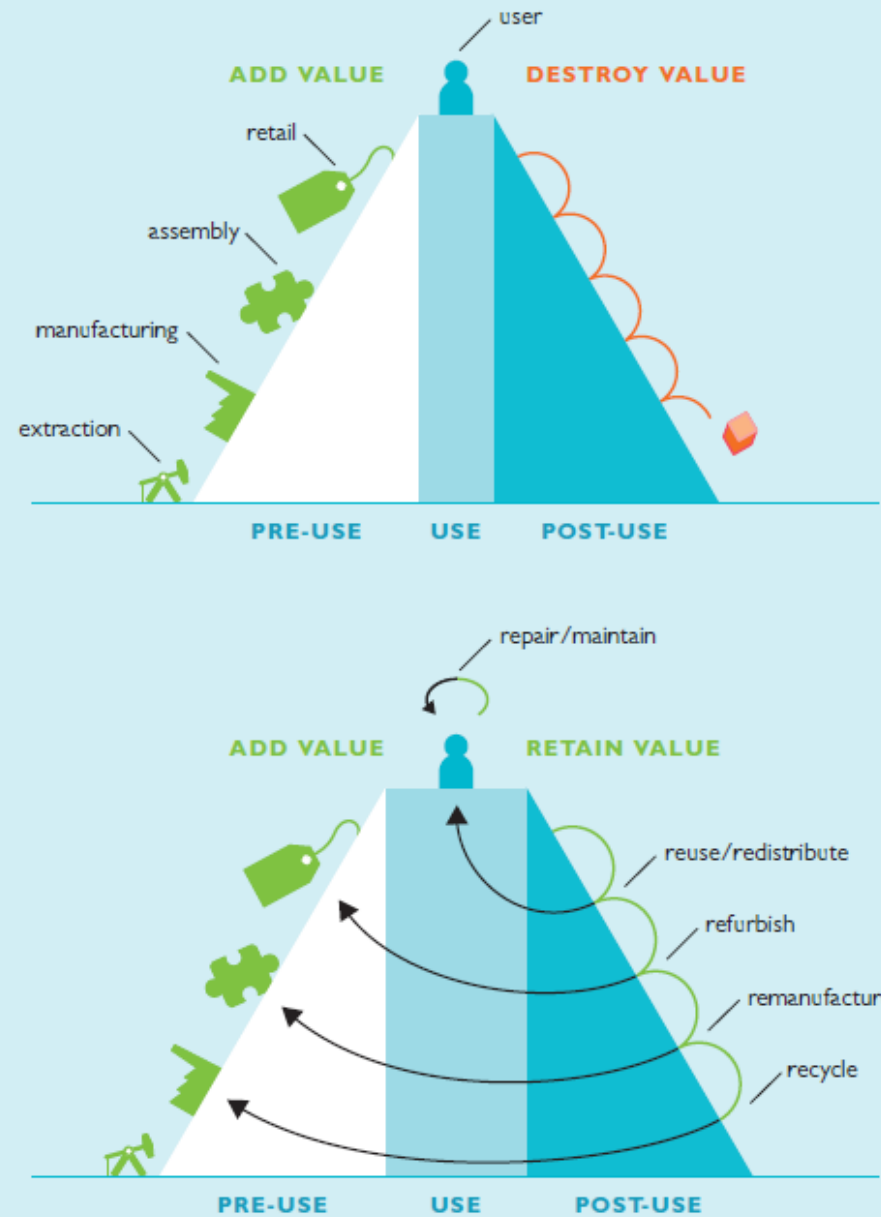


Figure 1. From destroying value in a linear economy to retaining value in a circular economy (Achterberg et al. 2016).

(Bocken et al., 2018)

Linear economy and business

- Based on one time selling
- To keep the profit high, we have to increase the sales, increase production, market effectively to increase consumer desires, speeding up consumption
- Design-manufacturing-business-consumption

Speeding up

- Globalization and opening the international trade in 1990s
- Industrial production moved to Asian countries in increasing amount
- Import taxation changed
- At the end of 1990s emerge of fast fashion phenomena
- Fast changing trends, lead times shortened, the race for cost efficiency was very tight
- Garment prices have decreased, =fast and cheap fashion
- Impulse shopping, short use time, premature disposal

Zara

- Zara, a well-known brand in the fast fashion arena, introduces about 11 000 different design items into manufacturing annually (in five to six colors and five to seven sizes), which means 12–16 collections a year.
- Although the company does not present sixteen collections a year, it sustains consumers' interest by introducing new garments at intervals of only a few weeks. (Tokatli 2007)
- Zara lure fashion lovers into their shops every other week with new garment offerings, which are available only for a limited time and in limited amounts (Christopher, Lawson, & Peck, 2004; Frings, 2002).

Textile & fashion industry

- The annual consumption of textile fibres has increased dramatically during the past decade (2000-2010); from 50 million tons to more than 70 million tons (Floer, 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 number of many products, including textiles and especially fashion items. (Määtänen et al. 2019)

Unsustainable system

- The dominant textile industry paradigm relies on short-lived textiles coupled with fast-fashion business models.
- It is water, waste and pollution intensive generating 10% of industrial CO2 emissions, 35% of microplastics entering the ocean and 16% of pesticides used globally in this sector
- It also takes land from food production and causes biodiversity losses.
- Relying on sourcing from low-cost countries, this model comes with frequent human rights violations and pays below living wages.

Environmental impacts

CONSUMES

4%

OF GLOBAL FRESHWATER
ANNUALLY

PRODUCES

10%

GLOBAL INDUSTRIAL CO₂
EMISSIONS

IS RESPONSIBLE FOR

16%

GLOBAL PESTICIDE USE

ACCOUNTS FOR

20%

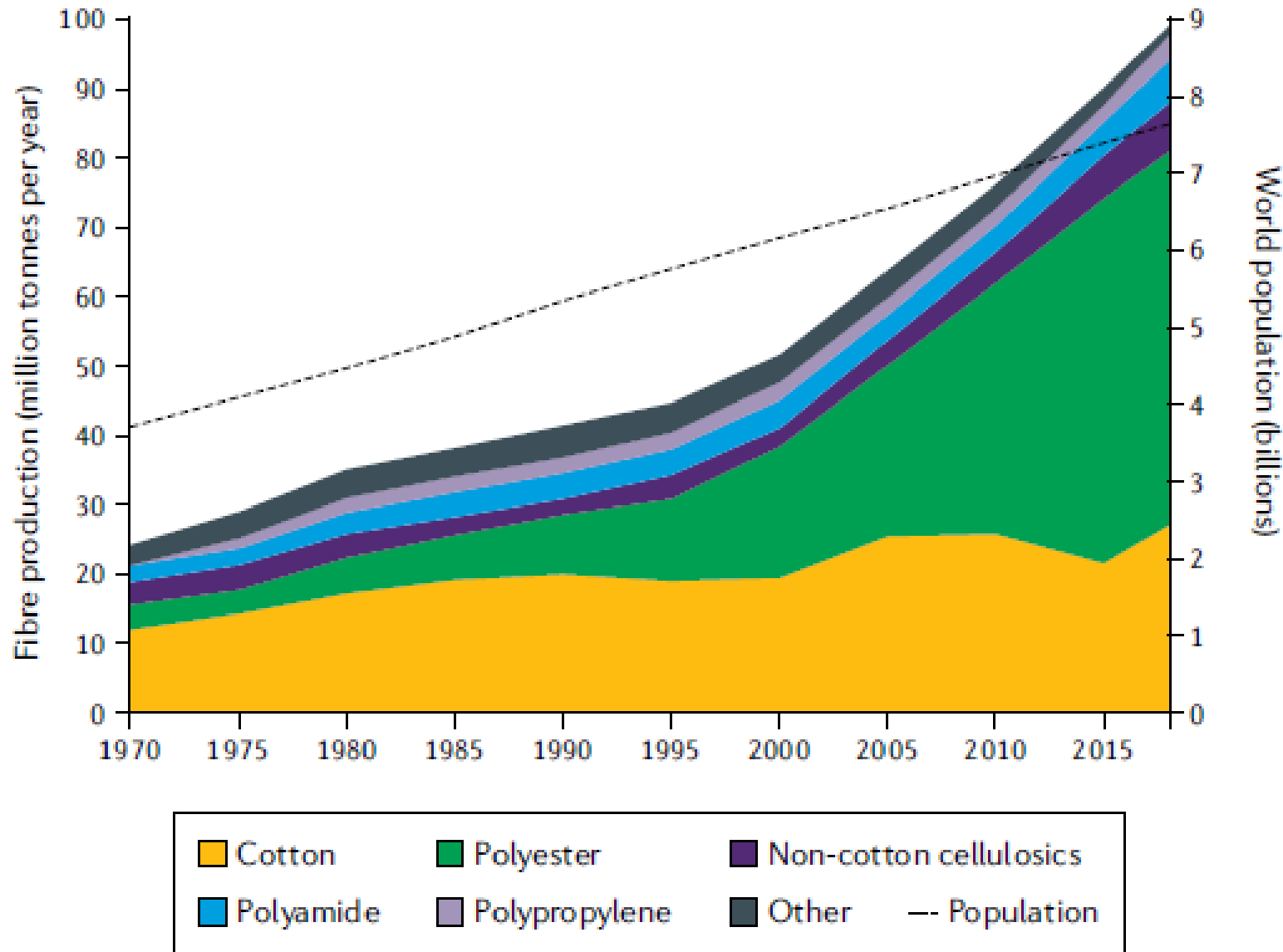
GLOBAL INDUSTRIAL
WASTEWATER EMISSIONS

IS TO BLAME FOR

35%

OF OCEAN-BOUND
MICROPLASTICS



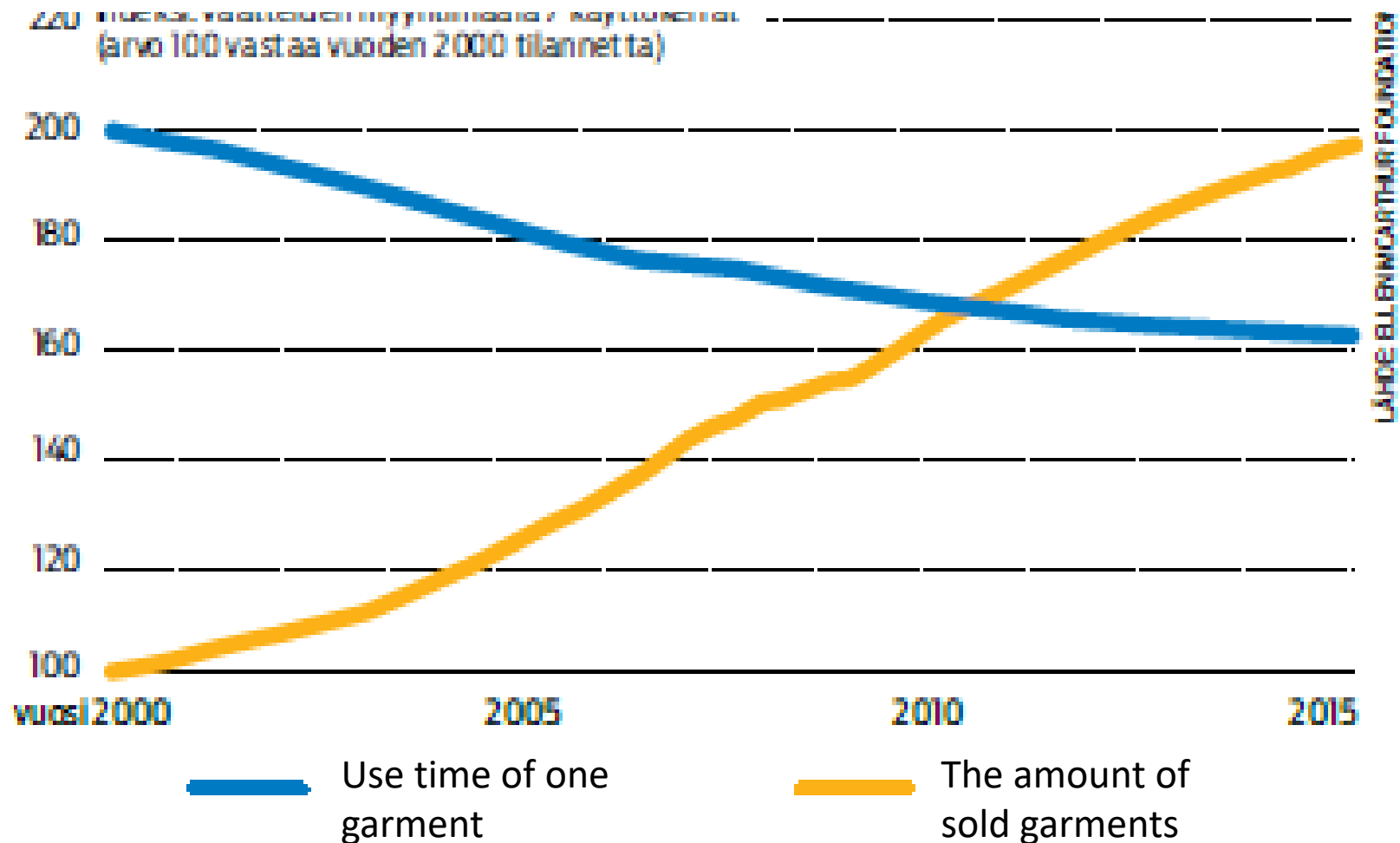


Niinimäki, K., Peters, G., Dahlbo, H., Perry, P., Rissanen, T. and Gwilt, A. (2020) **The Environmental Price of Fast Fashion.** *Nature Reviews; Earth and Environment*

Clothing Consumption

- Currently clothing is far cheaper compared to household incomes than a few decades ago.
- 1950s 30%, now 5% of household income went to garments
- Textile and clothing prices have fallen and currently the consumer possesses more and more cheap garments and low quality textiles.

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



Consumption

- Products are disposed of, not only because of the low quality (causing a short use time), but also because new trends make products look out of fashion (planned obsolescence).
- Consumers are actively seeking novelty and at the same time evaluating their appearance and the product world in a social and temporal context.
- The increase in waste streams can thus be understood as failed person-product relationships in the context of sustainable development (Chapman 2009: 20).

Textile waste

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



- Markets are oversaturated
- Part of the clothes are not sold
- Companies try to protect the brand value and even burn the unsold clothing rather than release them on sales

ReUse Republic
event 2011



Circular economy



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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

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?

Designing value

- Conventional actions in sustainable fashion can at best only slow down the destruction, not save the Earth. (Ehrenfeld 2015)
- Current actions in the industry do not create sustainability, they only reduce unsustainability.
- Concentrating in, e.g. technical eco-efficiency improvements, CSR or eco-materials only fool the designers, manufacturers and consumers into believing that they are doing all it takes to create sustainability-as-flourishing. (Ehrenfeld 2015)

Value

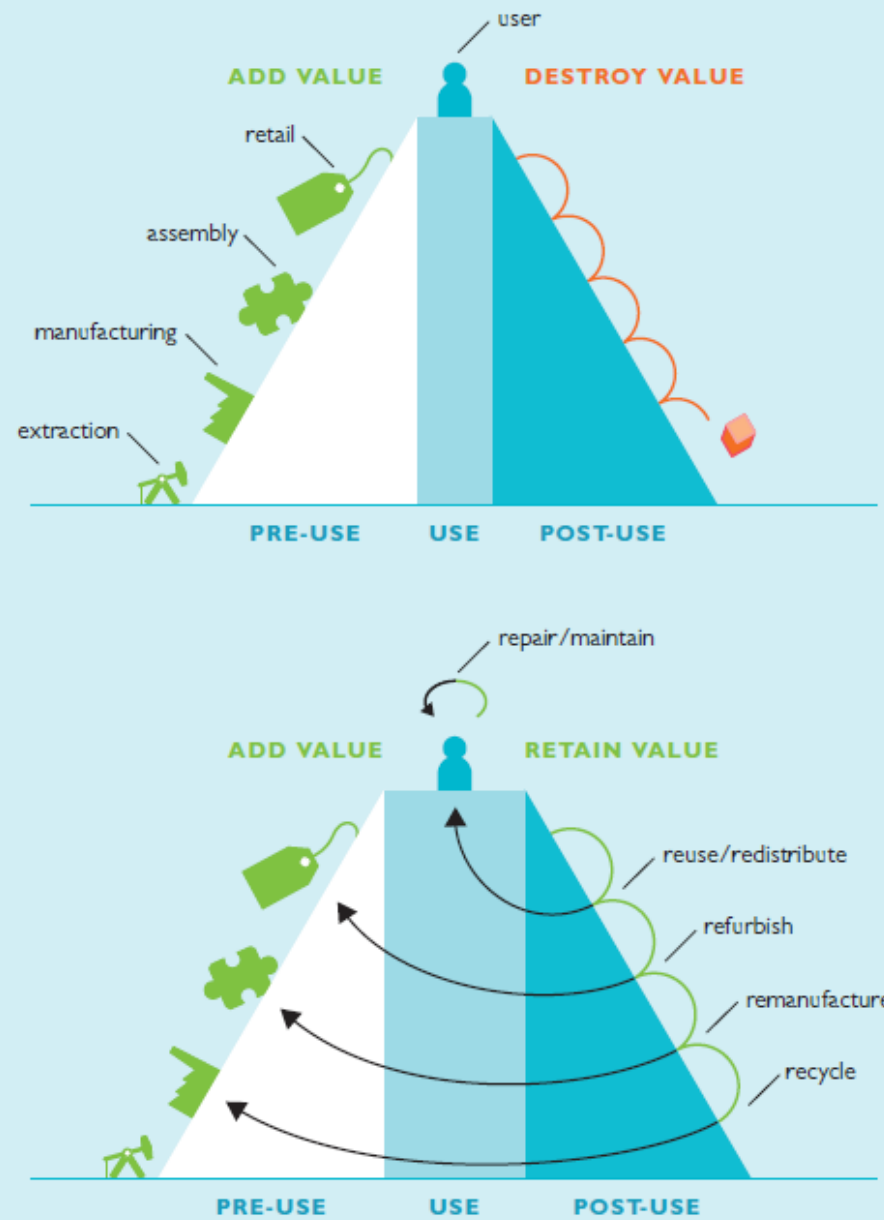
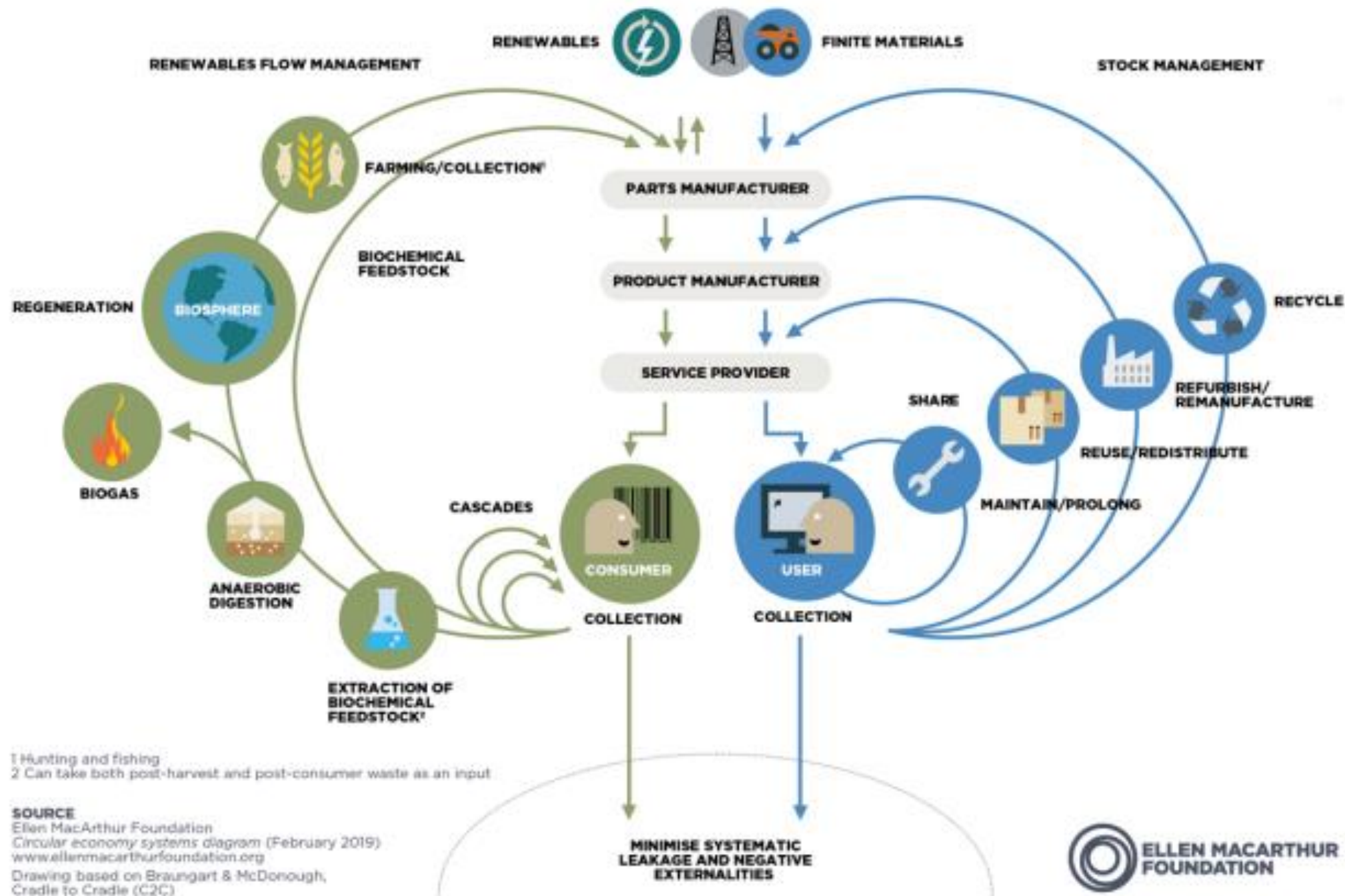
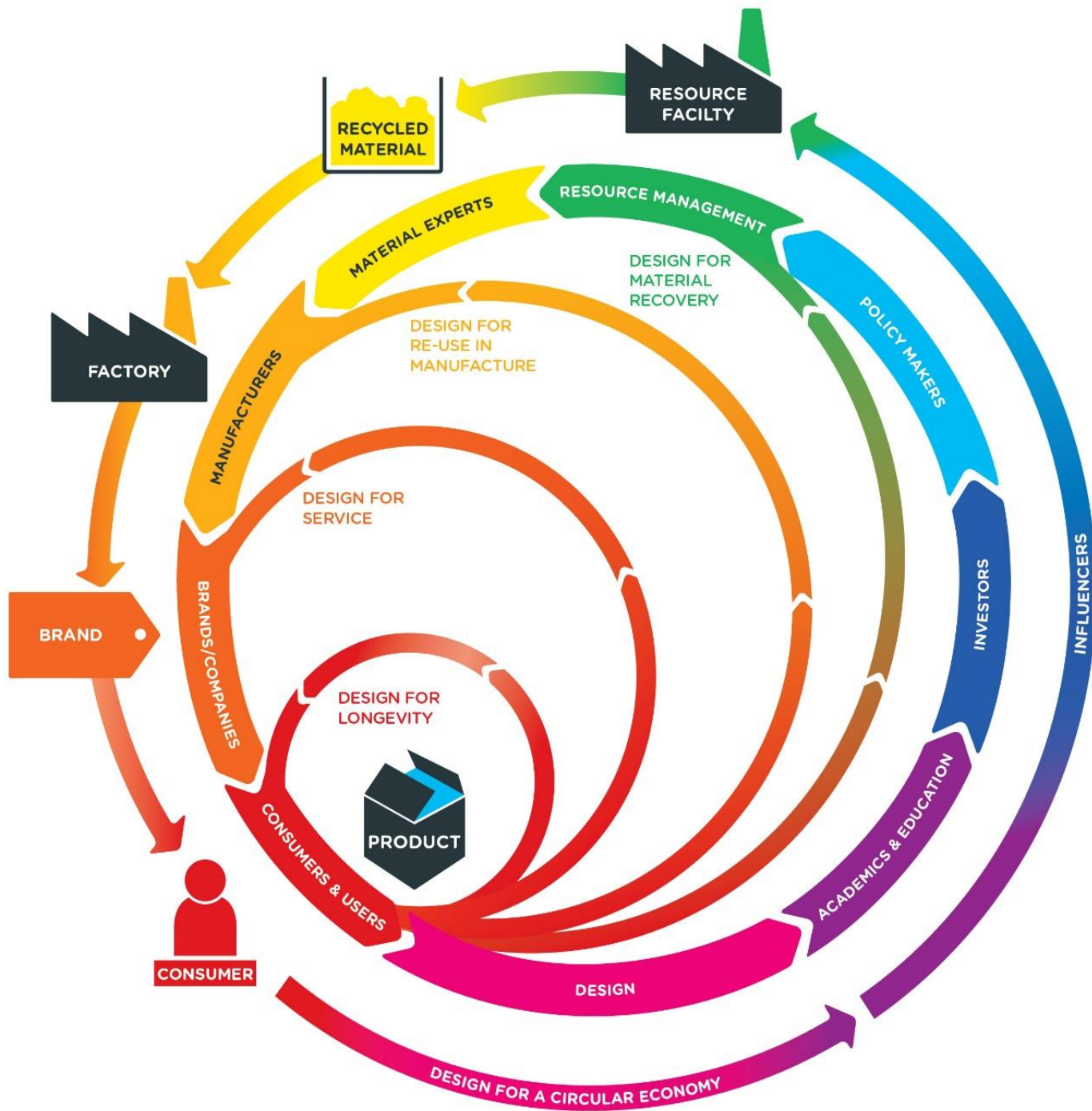


Figure 1. From destroying value in a linear economy to retaining value in a circular economy (Achterberg et al. 2016).

(Bocken et al., 2018)





*The Four Models of DCE,
Design in a circular economy
(RSA Great Recovery 2016)*

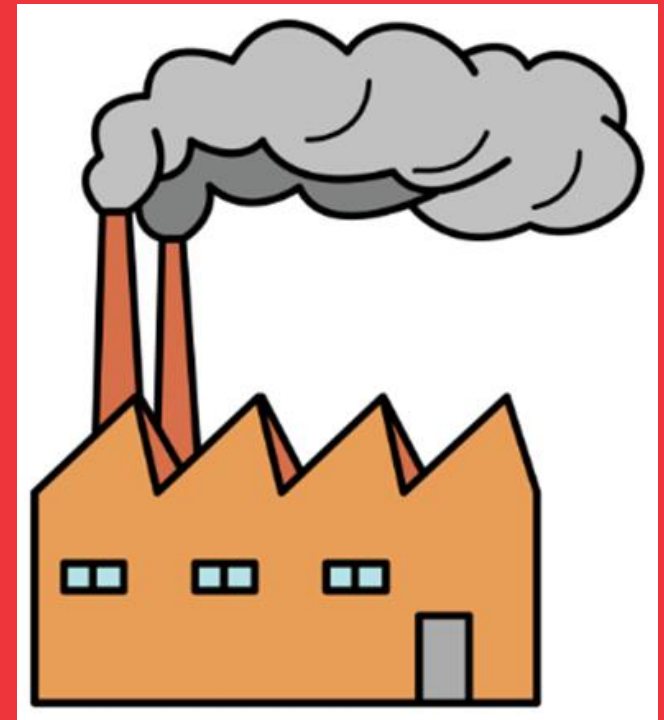
Circular economy

- System level change
- Focus on use
- New value understanding
- New time perspective
- Slowing the material throughput in the system
- Extending product lifetime, repairable and recyclable products
- New business models
- Slower consumption

Manufacturing



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Manufacturing process

- Mass manufacturing in lower cost countries
- Local production, better environmental legislation and control
- Distributed manufacturing
- Consumers as part of the supply chain (sharing economy)
- Participatory design
- Open design
- DIY

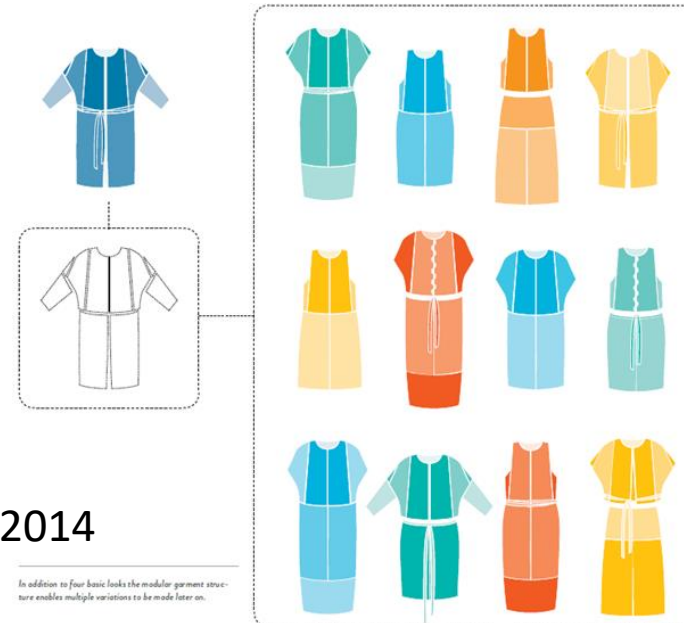
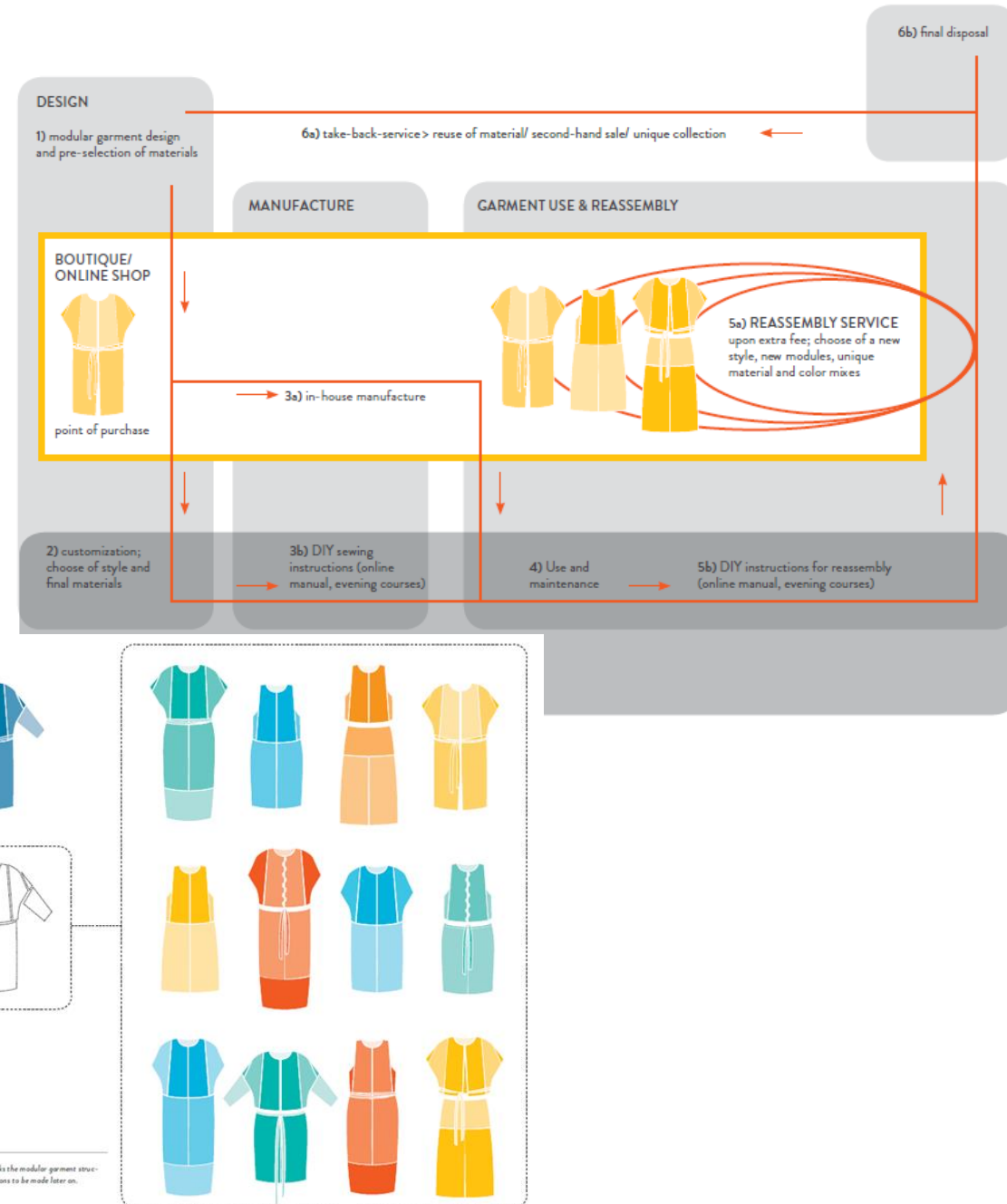
Modular structure

Armstrong, C., Niinimäki, K., Kujala, S., Karell, E. & Lang, C. (2015) **Sustainable Product-Service Systems for Clothing: Exploring Consumer Perceptions of Consumption Alternatives in Finland.**



Essi Karell 2014

Four different looks were sewn during the concept development process in order to illustrate how the concept could work in practice. (Photo: Kerttu Malinen)



In addition to four basic looks the modular garment structure enables multiple variations to be made later on.

Reverse logistics

- Using pre consumer waste back to production
- Cutting waste 15-30%

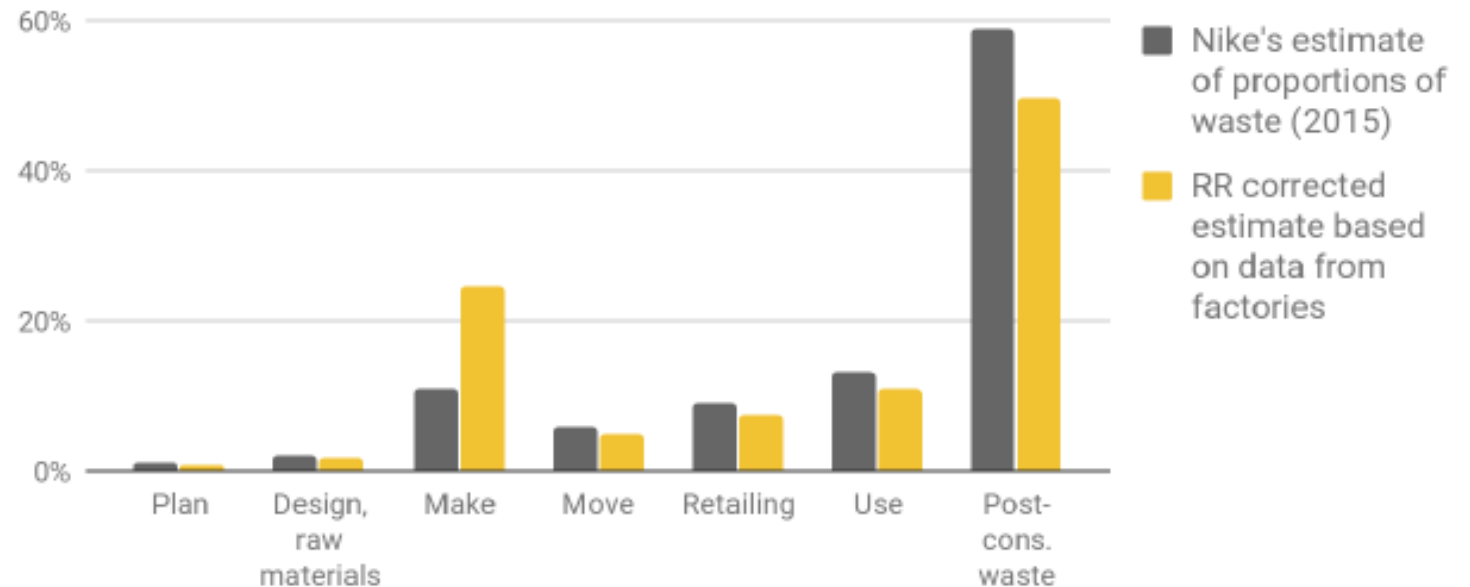


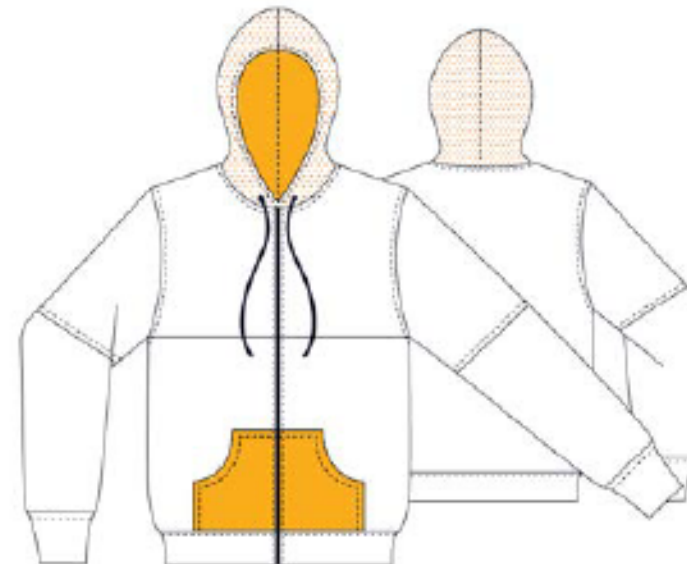
Figure 3. The proportion of waste in different phases of value chain: comparison between Nike's and RR research. Fashion industry has been underestimating the production leftover volumes and thus the potential of reusing these materials.

Reverse Resources has developed 3 methods of remanufacturing that are applicable in mass-production:

1. Invisible remanufacturing – Using production leftovers invisibly on internal sections of a garment (e.g. pocket, cuff and fly facings, collar stands, back yoke). The exterior of the garment remains completely standardised. By only using a small % of leftovers invisibly within a garment, the potential for reuse of fabrics within mass production is created.



2. Visible remanufacturing - Using left-over fabrics for small details on the outside of a garment. This could be done in the same or contrast colour. The leftover fabric is visible, but does not significantly affect the design. (The product planning follows the usual design-buying-purchasing pattern).

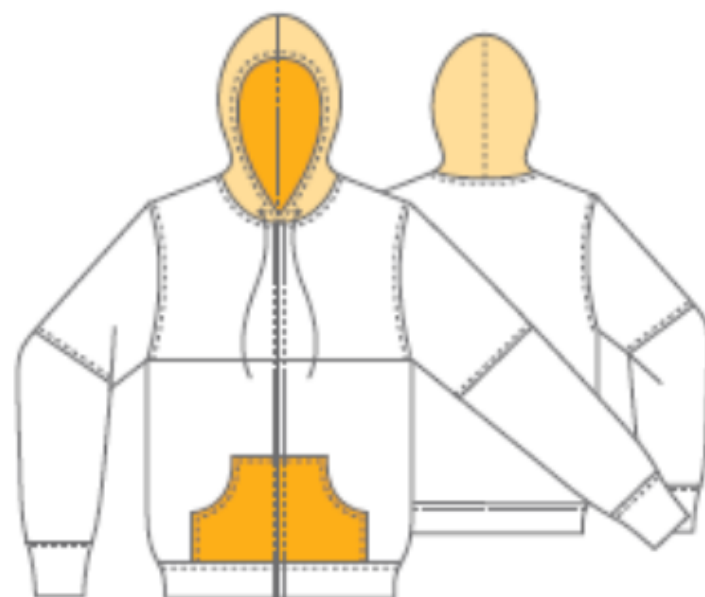


- 3. Design-led remanufacturing** - Designing a garment with a specific waste-stream in mind. It is similar to the concept of upcycling fashion design, except that it does not demand producing a full garment out of 100% leftovers. Mixing a small % of leftover fabrics with new fabrics increases the application of remanufacturing in mass production and reduces design limitations.



VISIBLE REMANUFACTURING





– using leftover fabrics on external sections of a garment



PRODUCTION OF 10 000 OF THESE HOODIES WOULD:

- Save 2843 yards (17%) of virgin fabrics
- Avoid 0.88 tonnes of fabrics from being spilled
- Saved 7827 kg CO₂

Hoodie specification drawing & marker plan

-  Visible remanufactured fabric pieces
-  Invisible remanufactured fabric pieces
-  Virgin fabric
-  Amount of saved virgin fabric

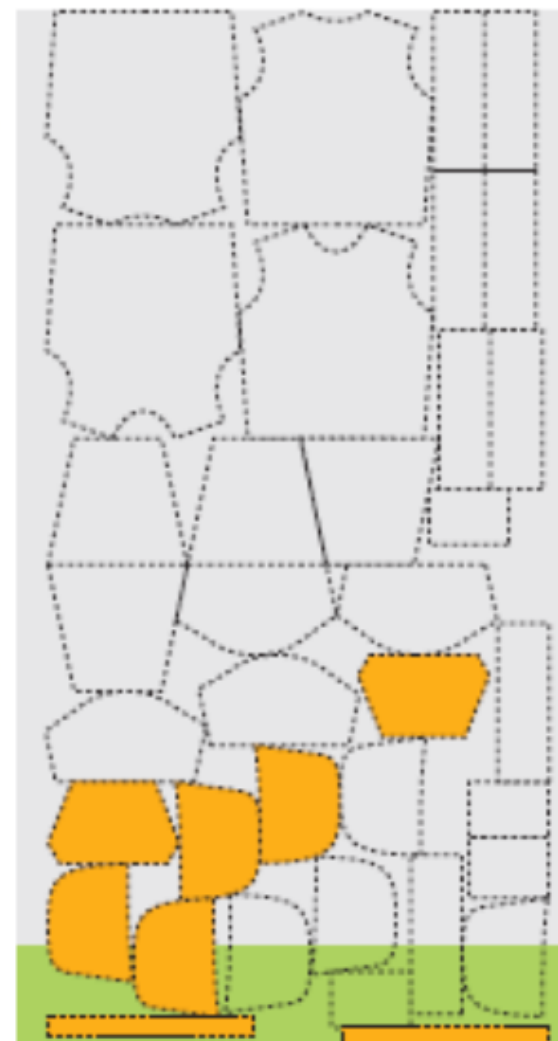


Figure 3. Visible remanufacturing by Reverse Resources (Runnel et al. 2017, 15).



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)

- Finlayson collected over 12,000 kg of jeans material in 2017 alone, which is estimated to be around 8,000 pairs of jeans.
- It is estimated that 80 % of the jeans material can be used for towels.
- The material is sorted based on cleanliness and fiber content. Only jeans that are clean and do not contain elastane can be used in the towel-making process, as elastane is a flexible fiber and thus problematic when material is being mechanically opened back into fiber.
- It is calculated that the jeans towels save hundreds of litres of water compared to towels made from virgin cotton. More precisely, 1 kg of jeans towels saves 5999 liters of water.
- The hand towel saves 850 liters and the bath towel over 2500 liters.

Crowed sourcing

- Consumer orders a garment, and waits
- When enough amount of orders are collected, production starts
- Each garment have a user already, when the production starts so no extra production to storage



Anna Ruohonen

Recovery



Figure 5. A LED spot light (top left) and three redesigns employing different materials and connections to improve the recycling result. The images at the bottom show typical fragments resulting from a shredding test. Recovered fractions are given in weight-%.

(Balkenende, Bakken, 2018)

Consumption practices



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Sustainable consumption

- Products configure consumer needs and use patterns; hence, design can be said to be “practice-oriented”, creating certain everyday practices and consumption behaviour

(Shove et al. 2007, 134–136).

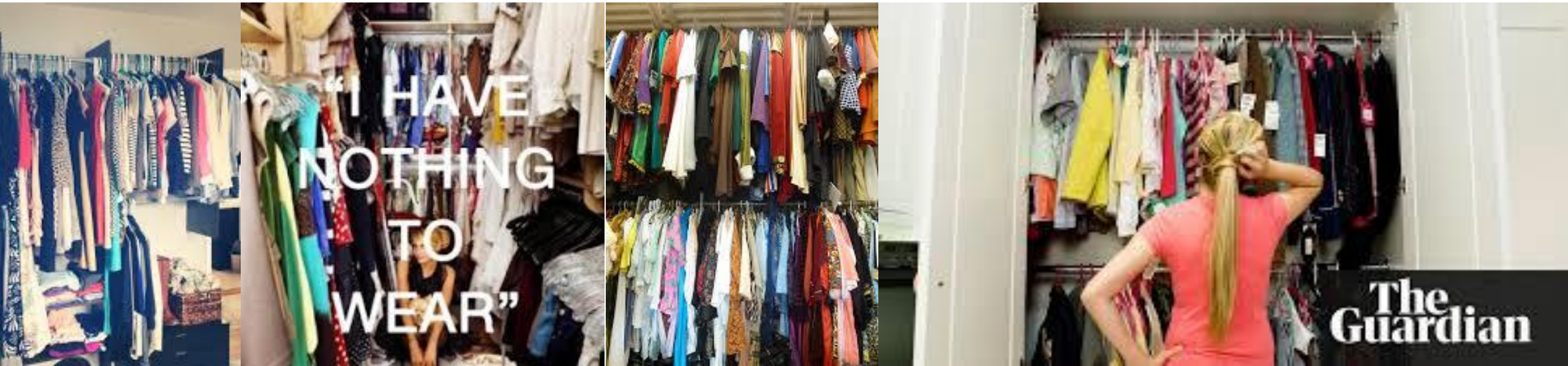
- Current industrial design and mass-manufacturing systems stimulate consumerism and the production of disposable products

(Walker 2007, 51).

- To create a new, sustainable balance between design, manufacturing and consumption, **alternative ways** to create products and doing business are required to drive **more sustainable consumption behaviour**.

Clothing use

- Average owning time 3 years 5 months (or 2,2/UK)
- In active use 44 days = 1,5 month
- Laundry after 2,4 -3,1 days' use
- The reality of fast fashion, garment lasts 10 laundry times
- We have a lot of garments and only view of them are in active use



Respondents' estimation of the shortest use time of their garments

	Men	Women
Less than 1 month	10.3	21.8
1-2 months	12.1	9.2
3-6 months	25.9	30.3
7months-1 year	25.9	28.2
1-2 years	22.4	13.4
2-3 years	3.4	4.9
3-4 years	0	1.4

25 % of female respondents reported that their latest garment purchasing was based on impulse

What is behind of fashion consumption

- Where we need fashion for
- Tempting Fast fashion
- Constant and fast changes
- Fashion consumption as a hobby
- "Shopping offers excitement, experiences and happiness"
Fashion as a hunt, emotional side of fashion consumption
- Identity building through external symbols
- Need for beauty, need for social acceptance

Extending the lifetime

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%

Challenges in Sustainable Fashion Consumption

- The use time of clothing
- High technical quality, functionality
- Emotional side; How to create person-product attachment
- Attributes for product satisfaction, which are a possibility to extend the use time of the product
- Find alternatives ways to fulfill consumers vanity needs in appearance in a more sustainable and less materialistic ways.
- Designing for sustainable consumption

Satisfaction attributes	
Quality aspects Good fit (size and cut) Durable materials Durability A) in use B) while laundering (stability in fit, material, colour) High quality in manufacturing (sewing work)	Functional aspects Suitability in use Use experience Easy maintenance
Aesthetic aspects Beauty Style Colour Fit Tactile feeling (material and fit)	Values Local production Ethicality Ecological Long life span

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

Services to extend the garment lifetime or to intensify the garment use

Leasing Fashion
Can Be Fun!
Vaatepuu

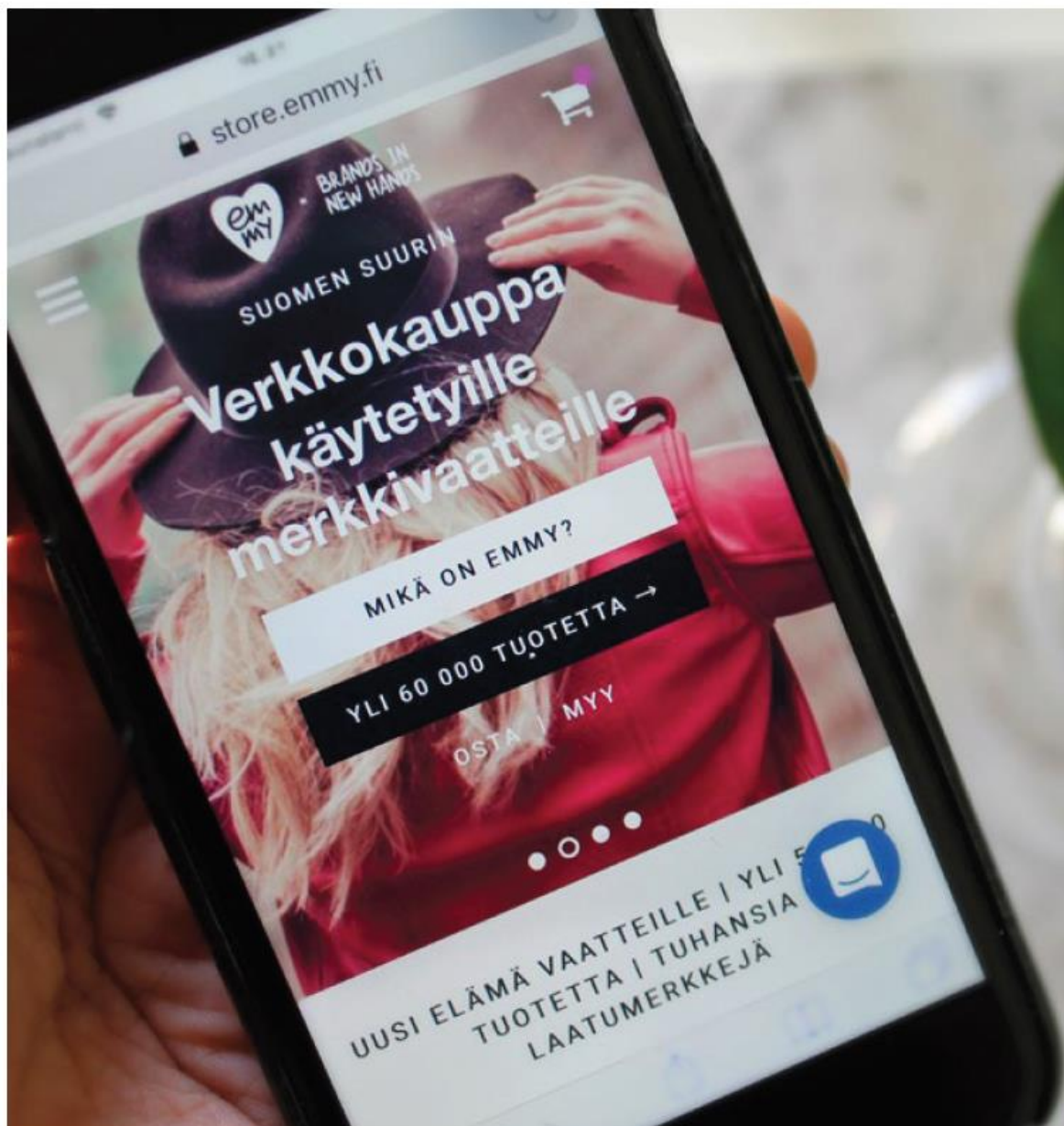


Vaatepuu

- The mission behind Vaatepuu is to get consumers to give more thought to the number of garments they are buying, and to consider the factor of quality over quantity.
- We are also concerned with increasing accessibility to the experience of how high-quality materials feel on your skin, how it feels to wear well-designed garments, and, in general to show how it is possible to be well dressed everyday of your life.

(Vaatepuu In
Niinimäki, 2018)

Sharing economy, Platform business and consumers' new roles



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



Time

Tempo in use

Tempo in design, in manufacturing

Slowing down the system



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New aesthetics



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New system understanding New business models



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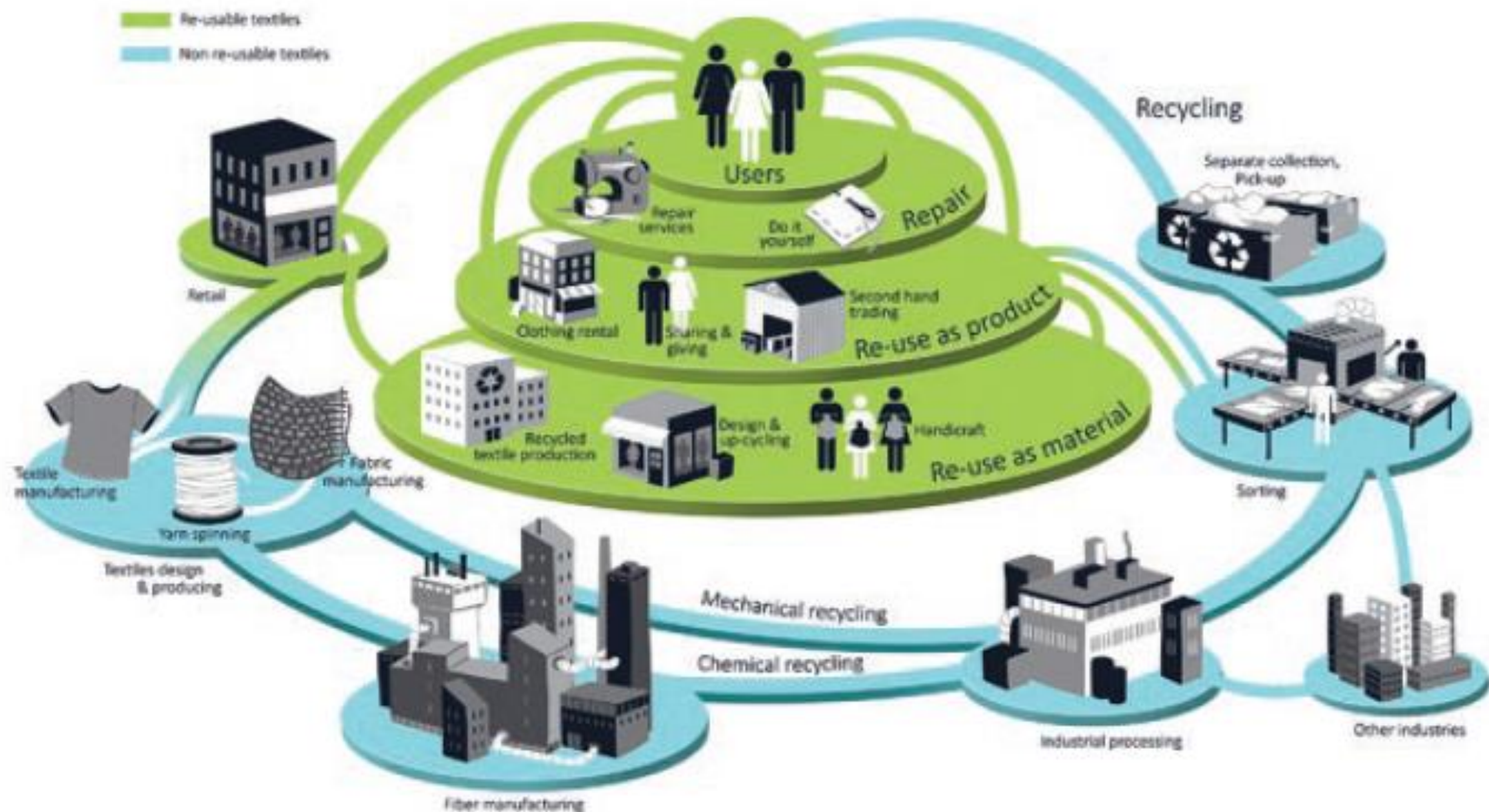
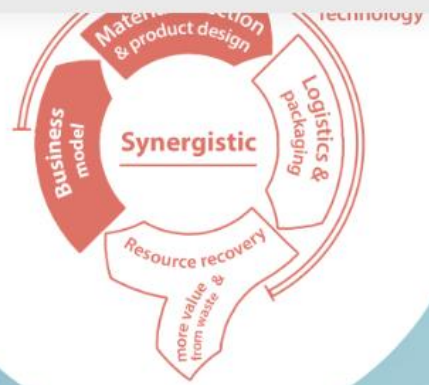


Figure 1. Model of a circular business ecosystem for textiles (Fontell & Heikkilä 2017).

Renting/Vigga

#13 Organic maternity and baby clothes on subscription



Vigga 

Renting the otherwise short-lived items of maternity and baby clothing makes sense from a resource perspective and offers cost-savings for the customer.



= 80 % Waste



Read more about this and other Nordic cases of circular economy at circitnord.com

FRENN:

- Alterations
- Repair
- Made to order
- Repair
- Lifetime guarantee
- Recycling
- Home delivery and fitting
- Sustainable materials, transparency, Carbon footprint



Get Repair Kit

Please fill in the form below and receive the Nudie Jeans Repair Kit for free by post. The Repair Kit includes all you need to mend your jeans.

In Repair Kit:

- 2 Denim Patches 100% cotton
- 1 Black Denim Patch 100% cotton
- 1 Iron Patch
- 1 Needle
- 1 Belt Loop
- 1 Spool of Orange Thread
- 1 Spool of Dark Blue Thread
- 1 Repair Kit Booklet

NAME*

LAST NAME*





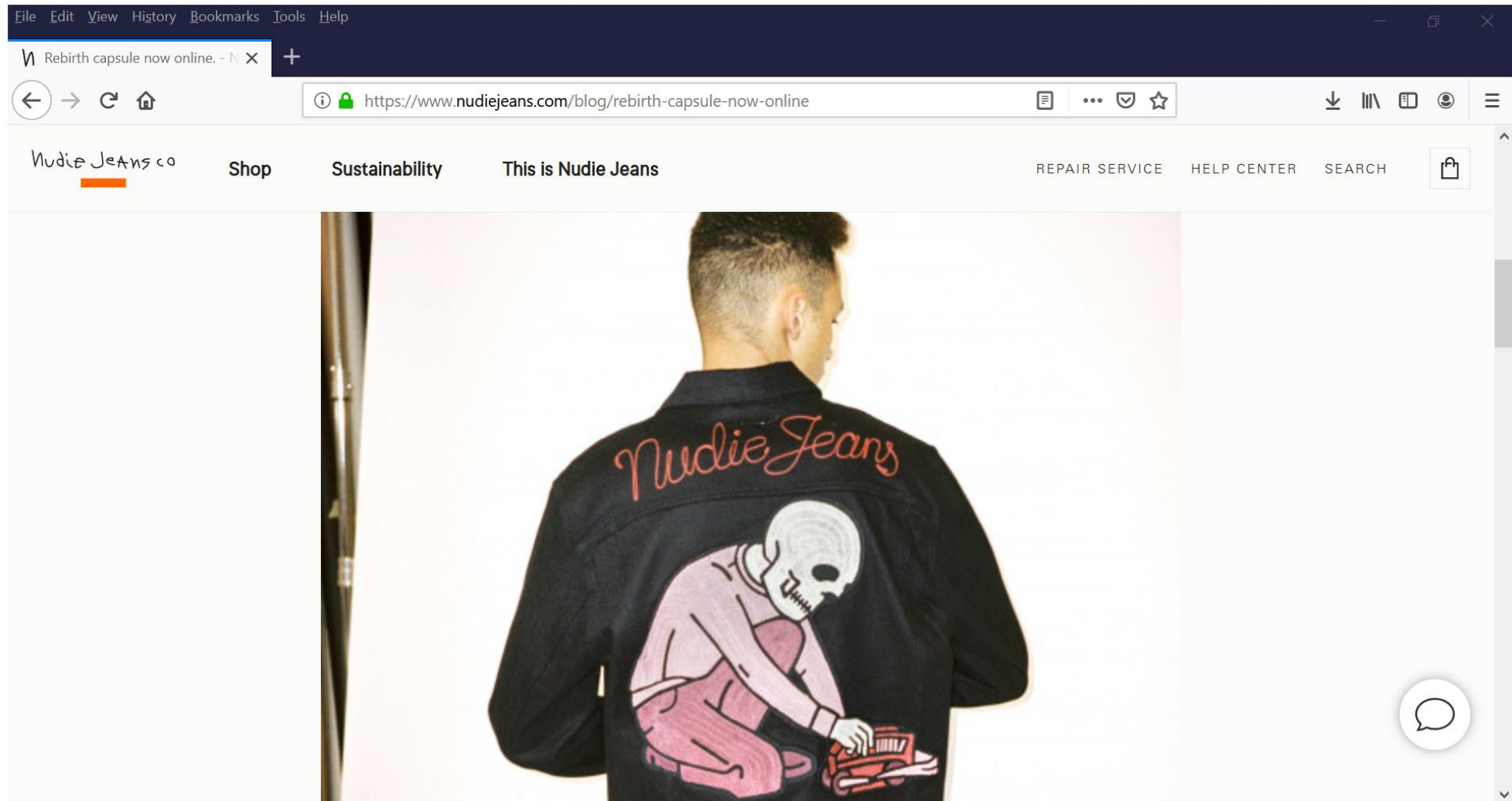
/ MATERIALS PART 3

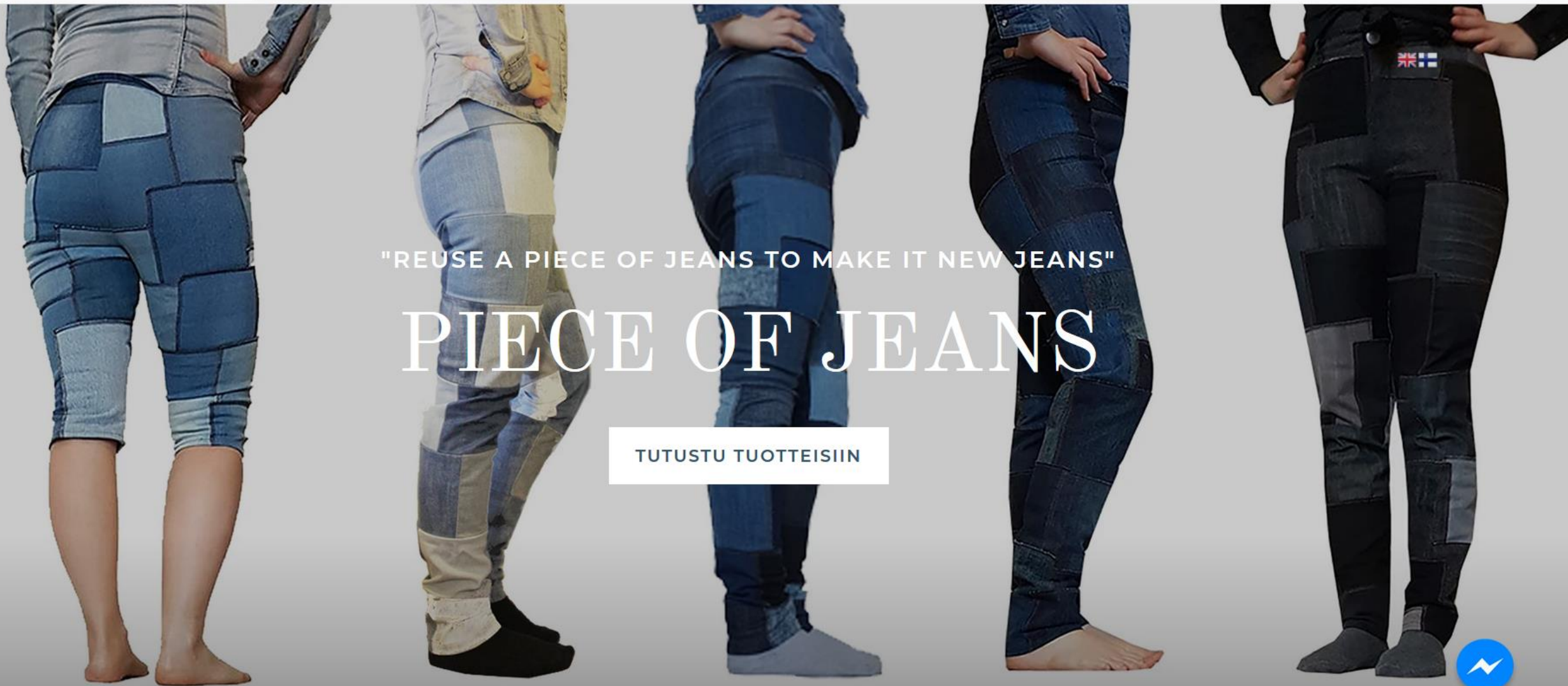
Reused Denim

We are using old Nudie Jeans brought in by customers, in different ways.



Redesign/added value through design





"REUSE A PIECE OF JEANS TO MAKE IT NEW JEANS"

PIECE OF JEANS

TUTUSTU TUOTTEISIIN



Mechanical recycling

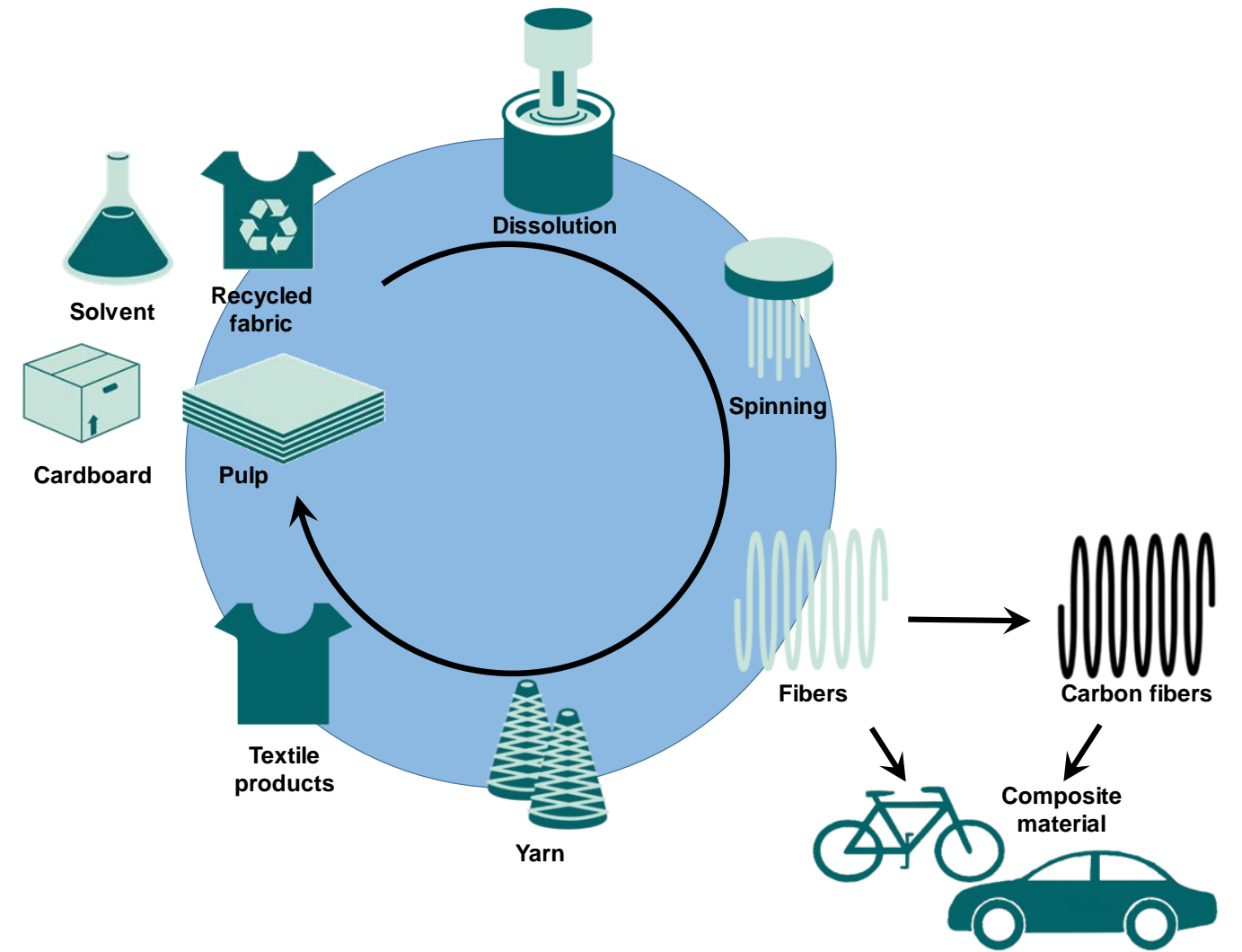


Responsibility
in Business
through Textile
Recycling:
Pure Waste



Circular process enabling circular economy

IONCELL

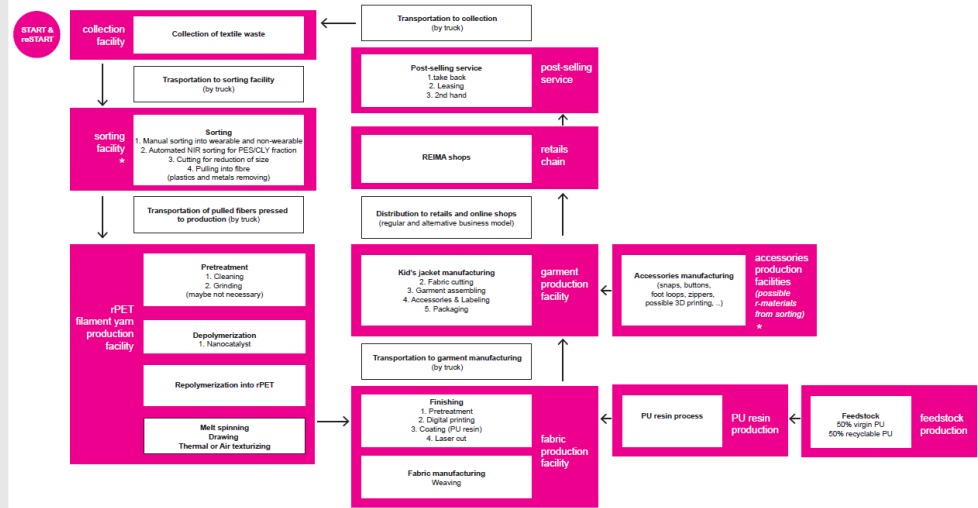


Hoodie



Reima

haberdashery that you can get off when the jacket will be recycled.



With a raincoat comes a service

iLast can be bought in various pop up stores, and even comes with its own take back system to retain its valuable material. Using this material, products such as huts, backpacks, table cloths and many more items can be made. Your raincoat keeps existing, but just in another form.

Recycling your iLast is easy and beneficial as well - you simply turn your raincoat in and get discount for a new one in return. As your kid keeps growing, so does his raincoat. But if your kiddo isn't ready for a new raincoat just yet, feel free to drop iLast off at a store for a dry and cleaning treatment.

iLast also offers a leasing service for institutions or private use.



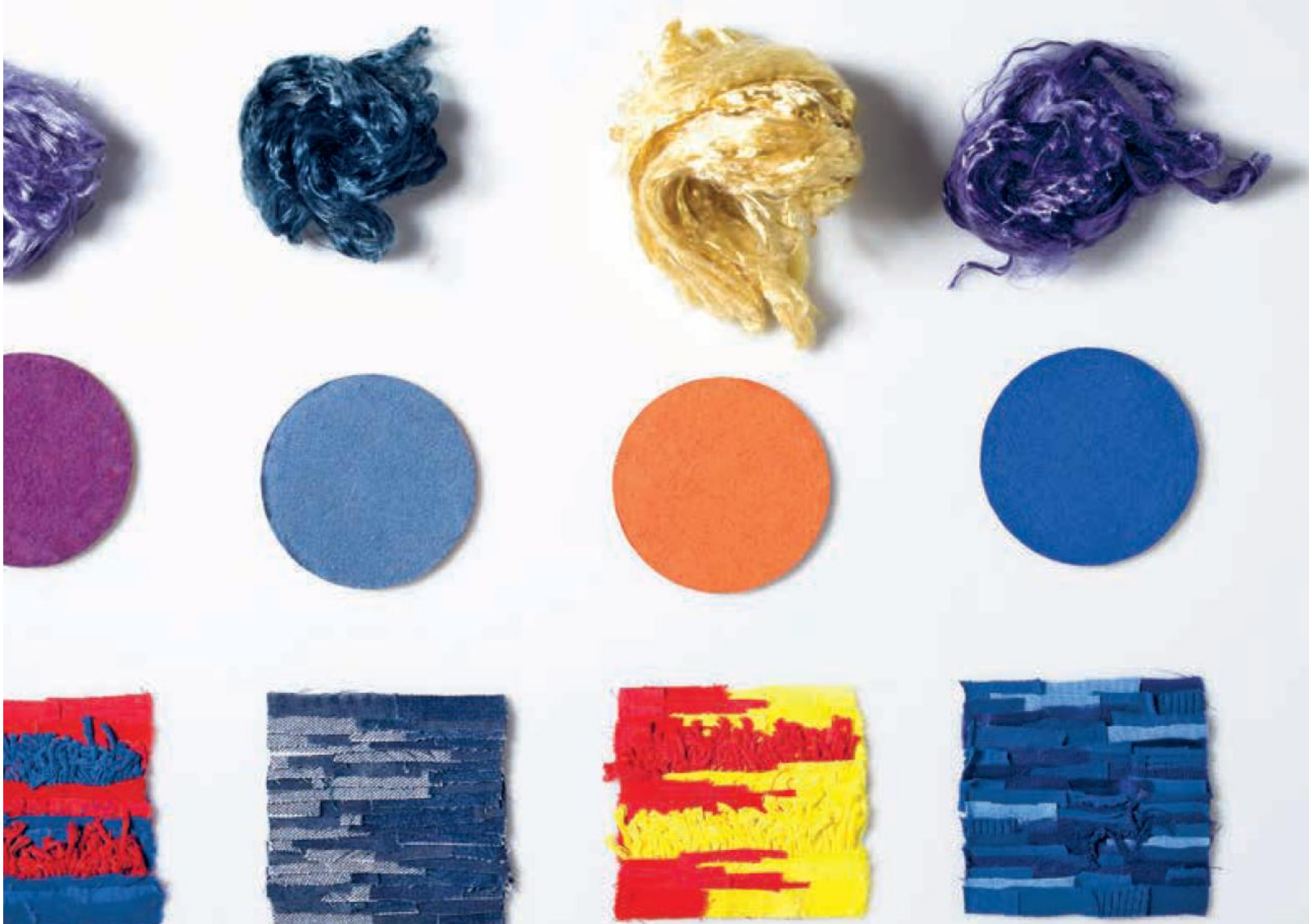
A kids best buddy

This innovative material is new on the market: 100% Polyester textile with Cidetec Epoxy recyclable resin coating on the outer side of the fabric to create water proof finish, and will replace conventional rubber/PVC rainwear that is not currently recyclable.

COLORS IN CIRCULAR ECONOMY

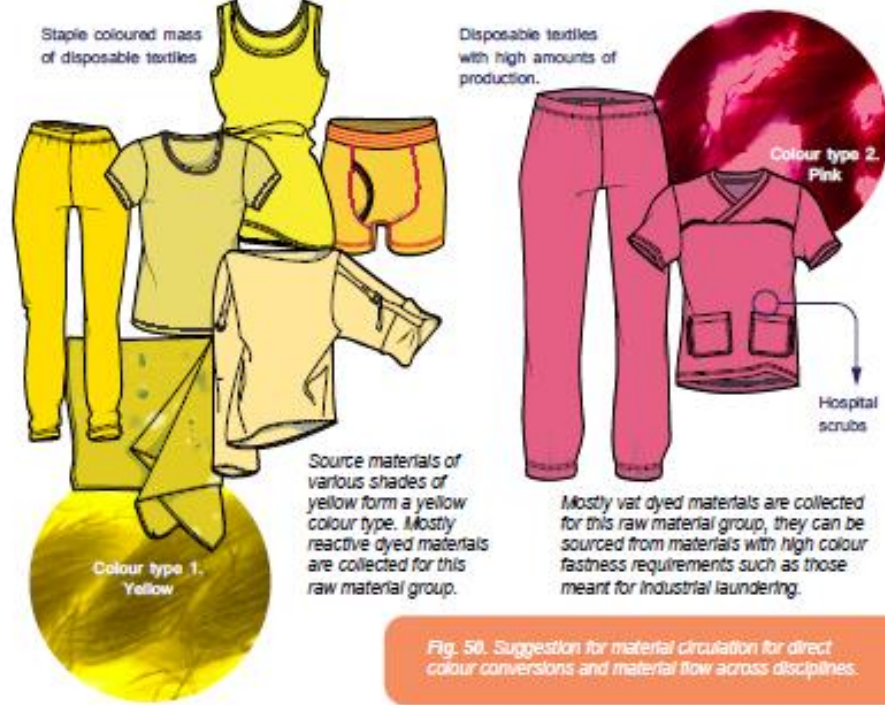
(EUGENIA SMIRNOVA 2017)





(Eugenia Smirnova 2017/T2C)

Designing Lifecycles



Smirnova 2017 /T2C



Case: Adidas and the *FUTURECRAFT.LOOP*

- 100% recyclable performance running shoe.
- The shoe design is based on the 'closed loop' and circular manufacturing model. It is made from recycled material and at the end of its life, can be disassembled.
- All its parts can be upcycled into a new shoe. Adidas calls this approach: ***made to be remade***.
- *FUTURECRAFT.LOOP* is a transformative approach to designing performance shoes that are made to be remade from the outset, by using one material type and no glue. (adidas., 17.4.2019)
- Avoiding glue in shoe manufacture enables **easy disassembly** of

each part and upcycling these to obtain the **best recycling value**.

When plastic parts cannot be separated, in most cases this means downcycling the material mix and taking the lower-value recycling path.





TouchPoint
workwear
Material is possible
to recycle 8 times =
40 years

(Photo by TouchPoint)

Partnering, collaboration

- New life for old workwear as outdoor furniture



<http://www.touchpoint.fi/>

Outdoor furnitures made from textile waste transformed into composite material (photo by TouchPoint).



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Product obsolescence

Table 2.2 How to handle product obsolescence through design approaches (adapted from den Holland, 2018, 31)

Long use	Extended use	Recovery
Resisting	Postponing	Recovery
Emotional durability Physical/Technical durability	Maintenance Repair Upgrading	Recontextualising Refurbishment Remanufacturing

Table 2.3 Business strategy, approach for sustainability and design principle

Sustainability strategy	Approach	Design principles
Reduce	Avoiding overproduction More accurate production Resource efficiency No waste Less environmental impact Less risks in the business	Smaller collections More focused design Made-to-measure Made-to-order Zero waste design No dead stocks Local design and production Using recycled materials High design-quality warranties
Rewear	Extending garment lifetime through multiple users	High quality Timeless design
Repair	Extending garment lifetime	Repairable product Easy construction Offering repair kits Offering repair services
Resell	Second-hand fashion	High garment quality High brand value Uniqueness through redesign Upcycling
Recycle	Closing the material loop	Design suitable for recycling Multiple lifecycles

(Henninger et al., 2022)

Transformation

- Extending product lifetimes
- Designing for several lifetimes
- Controlling lifetimes and time
- Intentional design for CE (designing for recycling)
- Using recycled materials in new products
- Aesthetics; variations in qualities, fibres and colours, styles, time and patina
- Designing products suitable for new business models in CE
- Collaboration (multidisciplinary approach)

Good stuff is durable, made from locally sourced, sustainable materials, is repairable, fit for purpose and dismantle-able (thus easily up-cycled or recycled). It has a valued purpose (not just a fantasy-advertising-based, flash-fashionable appeal). Let's make stuff remarkable again. Meaningful. Special. (Fletcher 2017, 19)



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How to manage time?

How to design product lifecycles?



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Kiitos/Thank You

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