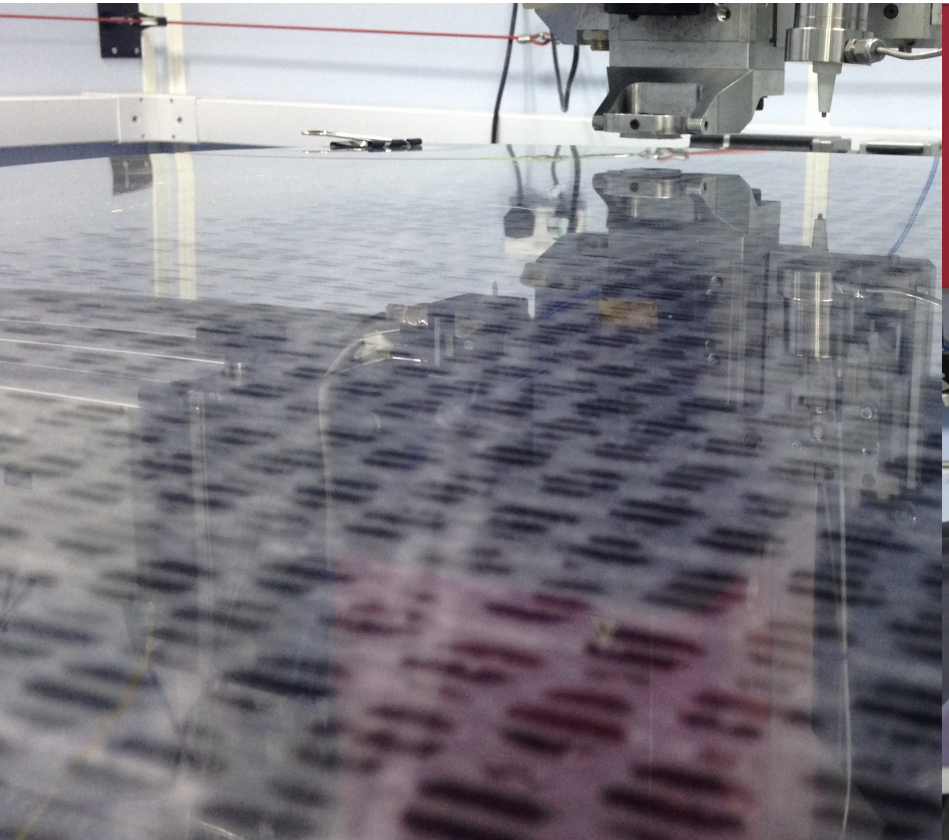
Designing Circular Systems;
the value of design in interdisciplinary research

Dr Kate Goldsworthy
Centre for Circular Design

PhD: Laser Finishing for Retaining Recyclability in Polyester Textiles (2005-2012)



Emmeline Child

PhD researcher Emmeline studied fashion design, then went on to complete a KTP with the Salvation Army Trading Company where she developed ... read on →

Laetitia Forst

PhD Researcher Laetitia studied textile design at the Ecole Nationale Suprérieure des Arts Décoratifs in Paris. Her master's thesis on "High ... read on →

Dr Dawn Ellams

Research Assistant Post-Doctoral Researcher: Trash-to-Cash Dawn is a researcher and designer whose interdisciplinary research focusses on the relationship between science and ... read on

Cathryn Hall

PhD Researcher Cathryn Is interested in how design for mechanical recycling can provide new solutions... readon

Miriam Ribul

PhD researcher Miriam is a designer and researcher exploring new models for design interventions at the intersection of collaborative and trans-disciplinary practice ... read on →

Dr Helen Paine

LDOCPost Doctoral Researcher: Helen works in conjunction with the Mistra project, bringing expertise in digital tech for fashion and automotive sectors ..readon

Dr Marion Real

LDOCPost Doctoral Researcher: Marion works in conjunction with the Mistra project, focusing on local, circular business models and convivial engagement... readon

Circular Design

Materials AND People….

https://www.thersa.org/discover/publications-and-articles/reports/the-great-recovery

Circular Design

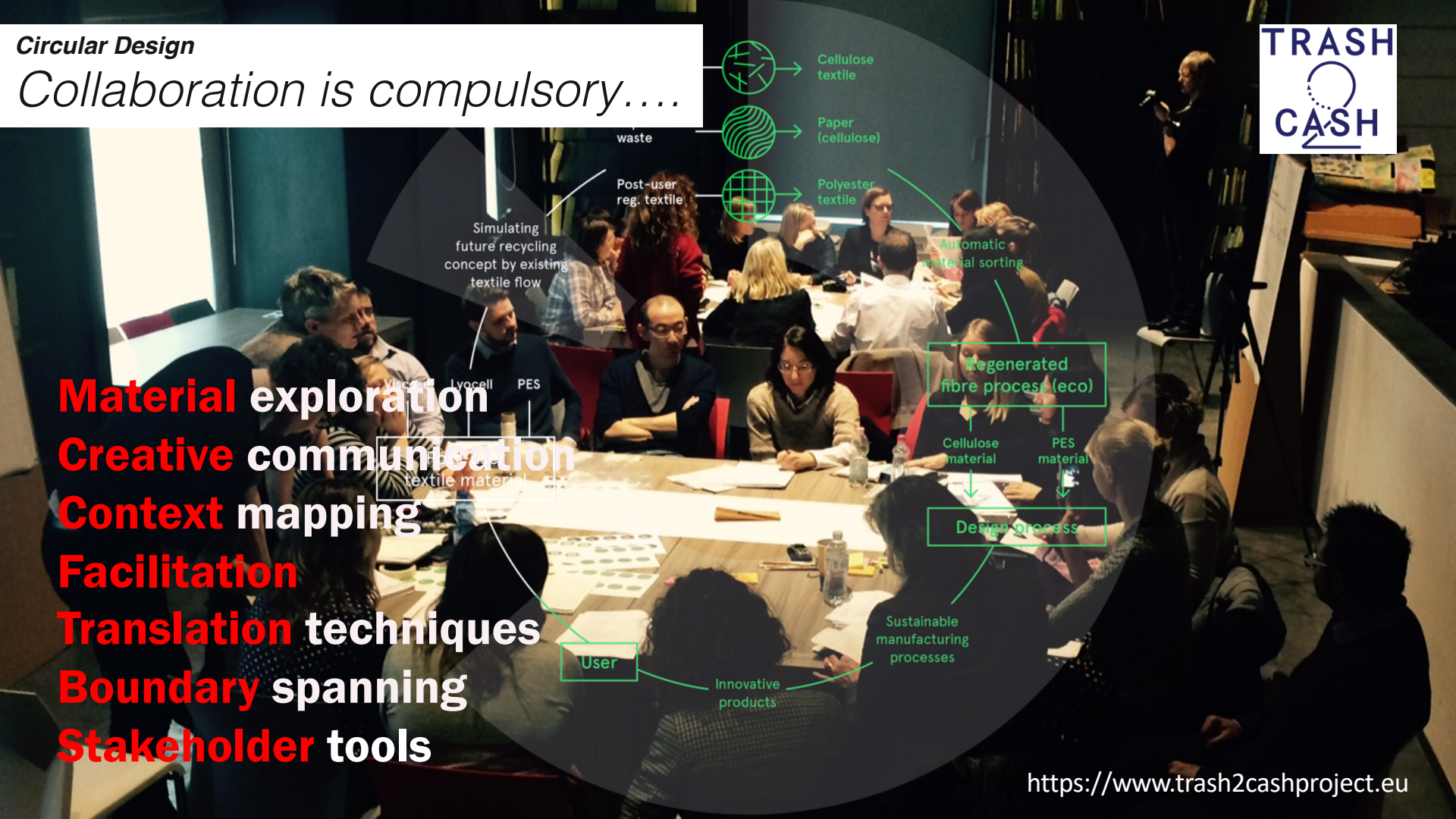
Products as systems

Viewing sustainability through a lens of circularity & transformation. The materials and production choices we make as designers have impacts beyond the objects we design.

http://1granary.com/interviews/yesenia-thibault-picazo/
http://yeseniatp.com/

Circular Design

Collaboration is compulsory….



Material exploration
Creative communication
Context mapping
Facilitation
Translation techniques
Boundary spanning
Stakeholder tools

https://www.trash2cashproject.eu

mistra future fashion

how to design for circular fashion systems (2011-2019)

mistrafuturefashion.com

8 years, 15 research partners, 14 disciplines, 40 industry partners

- **textile** material science
- strategic **design** thinking
- **waste** management
- **system** analysis
- **behavioural** science
- **policy** assessment
- **chemical engineering**
- **biological** engineering
- **consumer** communication
- **cellulosic** fibre processing
- **environmental science**
- **business model innovation**
- textile **recycling science**
- **artisan craft making**

swerea|IVF

Stockholms universitet

CBS COPENHAGEN BUSINESS SCHOOL

CHALMERS

BOKU

STOCKHOLM SCHOOL OF ECONOMICS

iiiee

KTH

THE SWEDISH SCHOOL OF TEXTILES UNIVERSITY OF BORÅS

ivl SVENSKA MILJÖINSTITUTET

ual: university of the arts london

PlanMiljø

re:newcell

MoRe Research

RI. SE

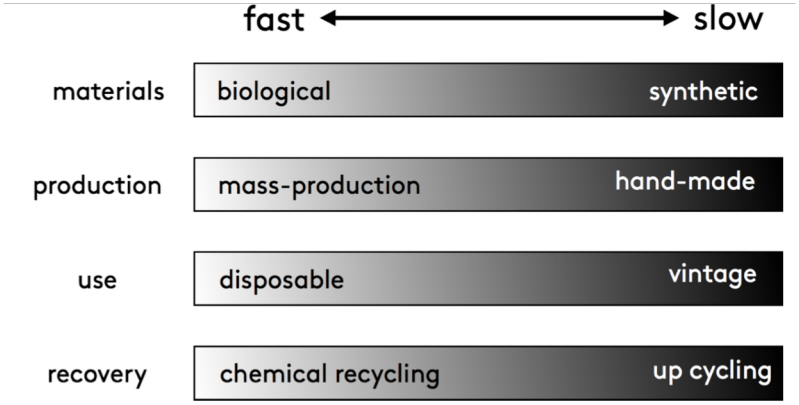
FUNDED BY

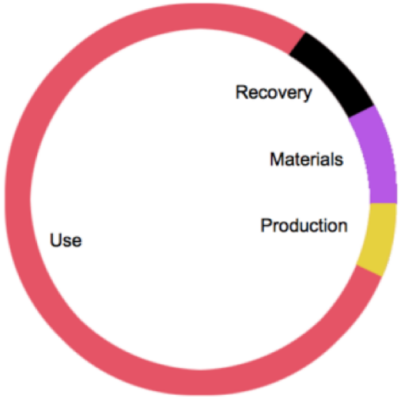
MISTRA

The Swedish Foundation for Strategic Environmental Research

circular design speeds

design strategies for circular fashion production





Extending
the Use Phase:
Reduces the environmental 'cost-per-wear'

Reducing
the Use Phase:
Increases the environmental 'cost-per-wear'

prolonging the lifetime of a garment by two will decrease its climate impact by 49%

Sandin, et al (2019)

access to material resources is critical to the needs of an increasing world population and to the future of production

Politowicz (2018)

Fast Forward:

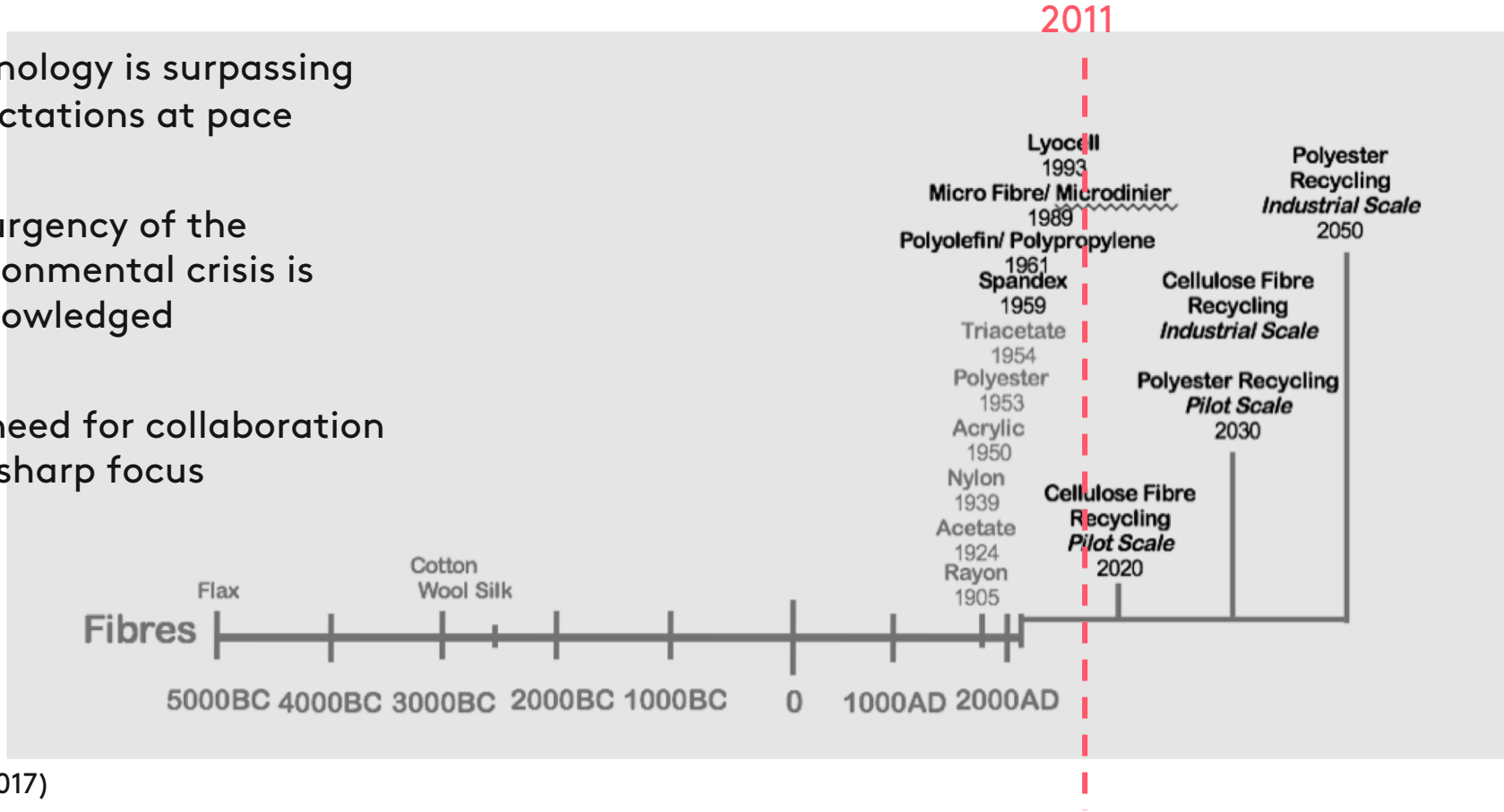
Remodelling Circular Fashion for Material Longevity

Professor Kay Politowicz & Dr Kate Goldsworthy

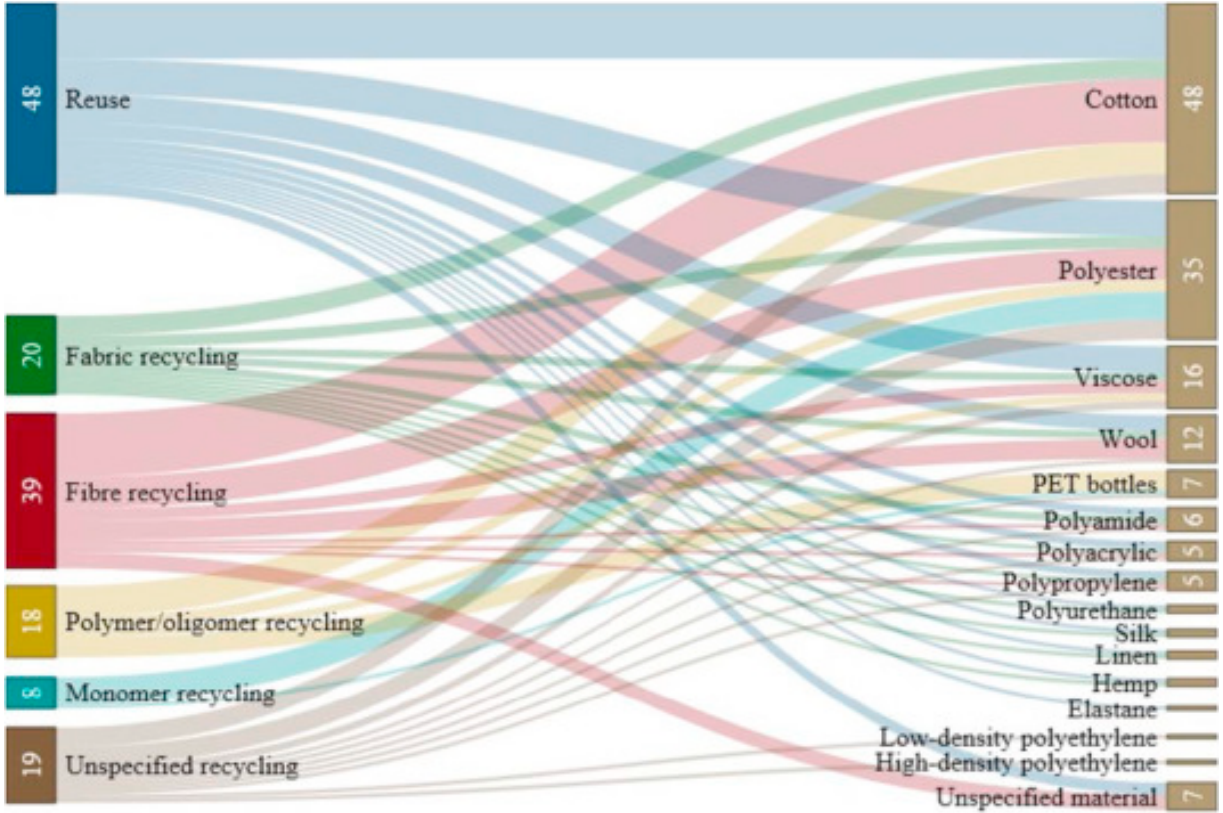
ual: centre for circular design
RISE
ff mistra future fashion

the next material revolution

- technology is surpassing expectations at pace
- the urgency of the environmental crisis is acknowledged
- the need for collaboration is in sharp focus



Landalv (2017)



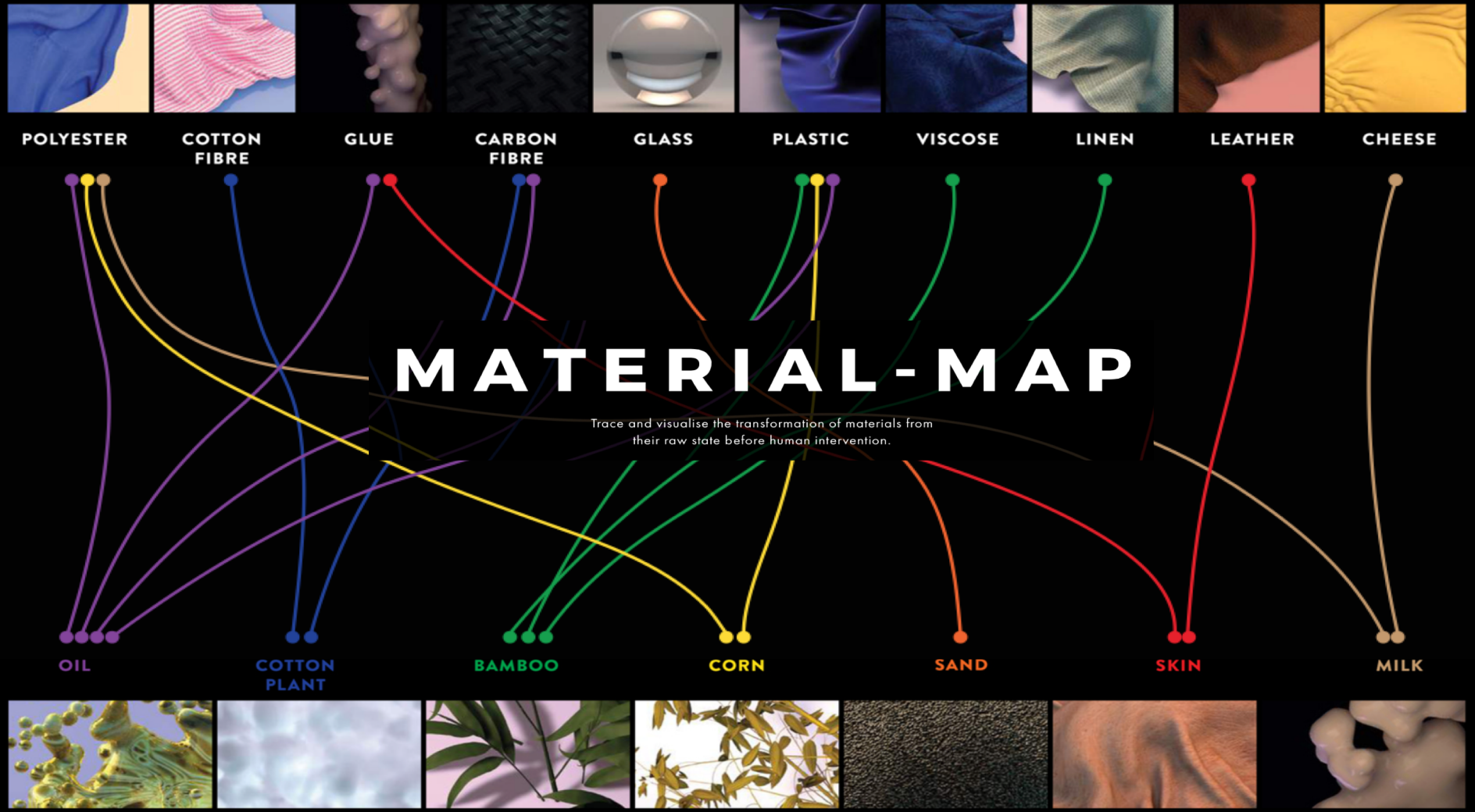
Environmental Impact of Textile Reuse and Recycling: a review (2018) Sandin & Peters

73% sent to landfill or incinerated

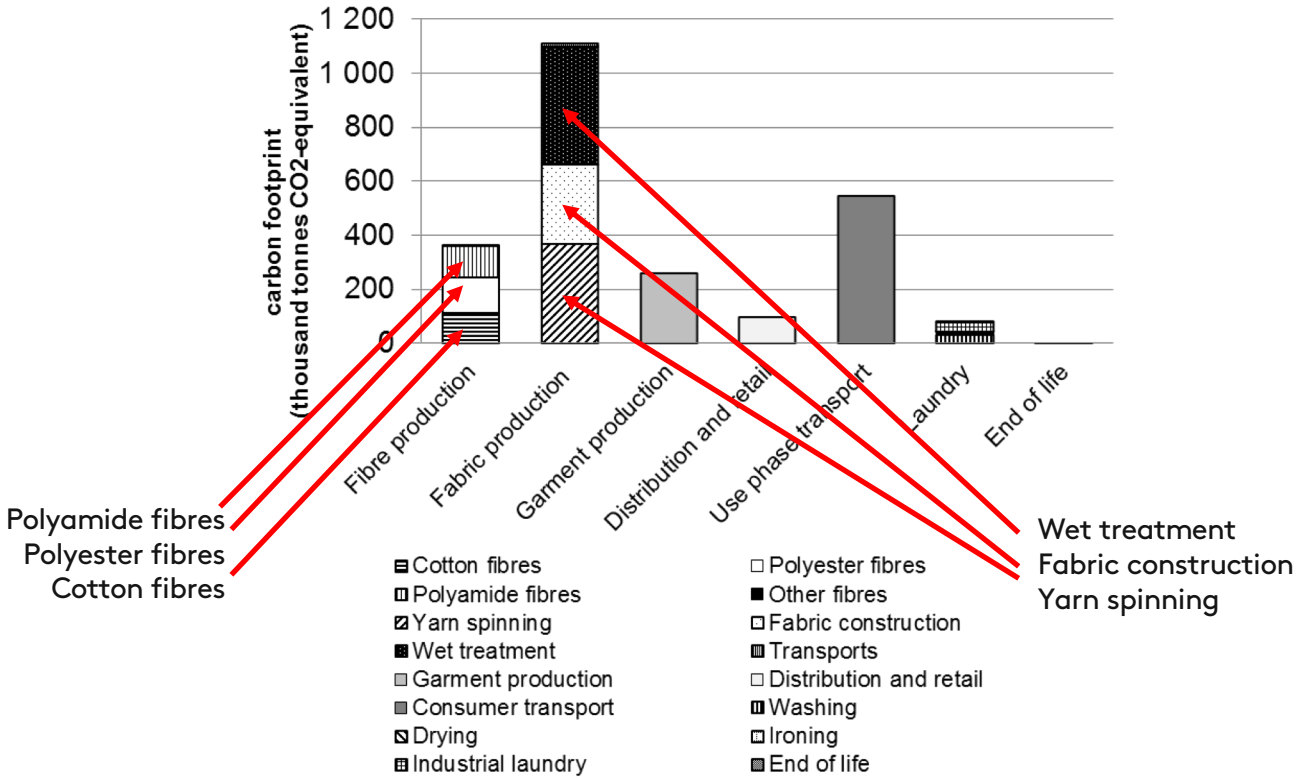
12% is mechanically recycled

Less than 1% is chemically recycled

Circular Fibre Initiative analysis (2017)


POLYESTER
COTTON FIBRE
GLUE
CARBON FIBRE
GLASS
PLASTIC
VISCOSE
LINEN
LEATHER
CHEESE
MATERIAL-MAP
Trace and visualise the transformation of materials from their raw state before human intervention.
OIL
COTTON PLANT
BAMBOO
CORN
SAND
SKIN
MILK

Climate impact from the Swedish apparel sector over one year



"wet treatment is likely to create 20 times more damage than cotton cultivation. In total 92% of the toxicity impact stems from the production phase alone"

Roos (2016)

3 concepts, 3 recovery briefs

PAPER LEATHER JACKET:

PAPER RECIPE NO 9

PULP-IT STRIPED-T:

PAPER RECIPE NO 7

LASERLINE MONO-T:

RECYCLED POLYESTER

commercial nonwovens production

Raw materials
Commercially available 100% recycled polyester (rPET)

Production
Industrially available non-woven process

Finishing
Traditional polyester dye methods and fabric finishing with digital laser technology

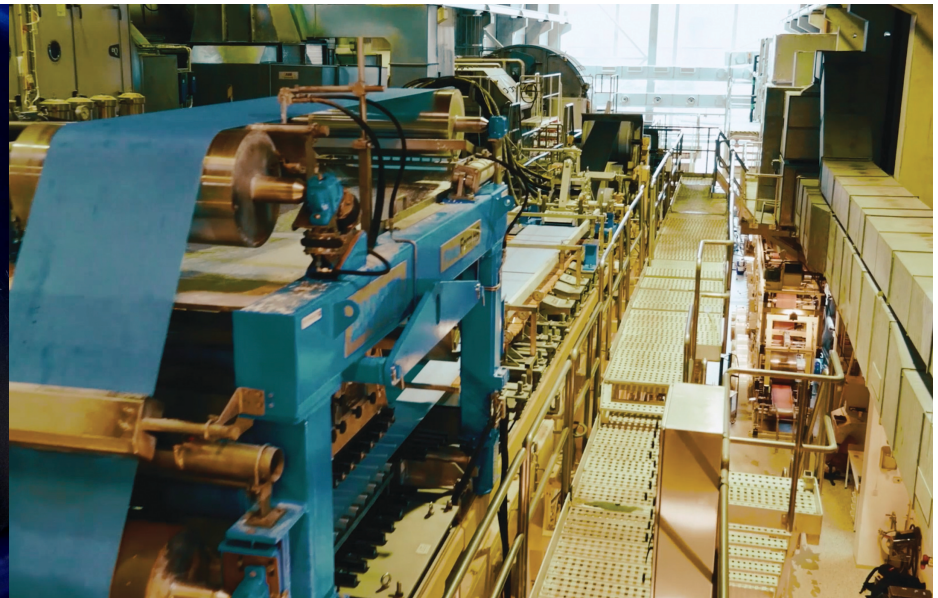
Construction
Zero-waste garment seamed with ultrasonic welding

Use
Designed to be worn 30 times over 1 year (washed 10 times)

End of Life
Recovered through in-store collections and chemically recycled back to virgin material. The whole cycle from raw material, through use and recovery is 15 months

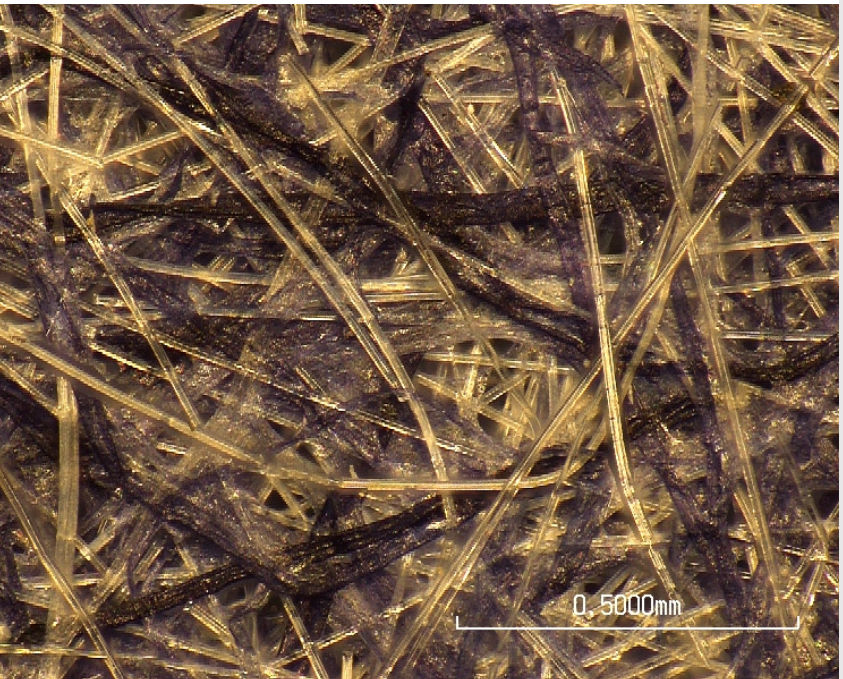
developing a new paper textile

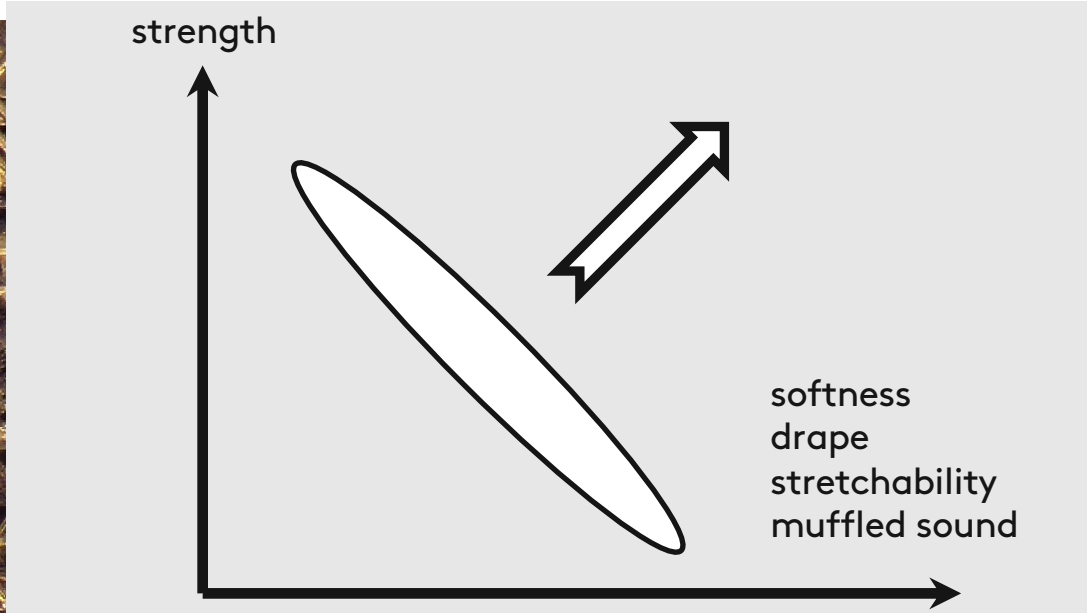
- to produce a ‘paper’ base material suitable for clothing use which ‘feels like cashmere’



combining soft and strong

- the recipe; wood pulp, PLA & NFC





two experimental papers

Paper 1 ‘paper leather’

High wood-pulp content

Strong but paper-like

softening techniques

Paper 2 ‘pulpit’

High PLA content

soft but fragile

Strengthening techniques

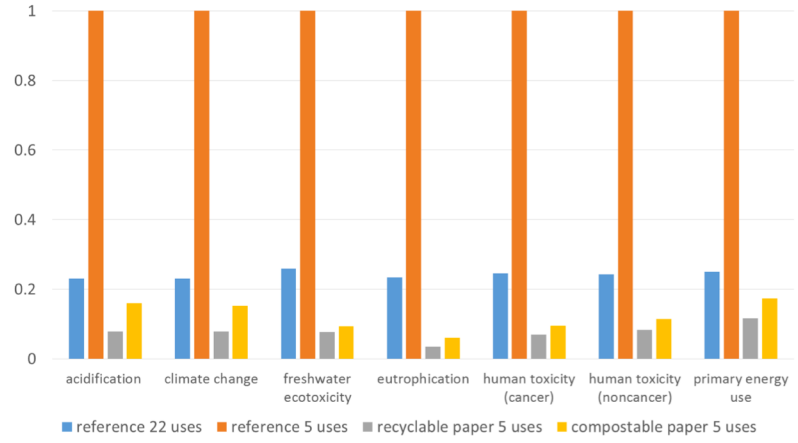
finishing experiments

- over 200 finishing experiments were conducted to transform a mass produced material.
- innovative finishing processes could be used to cost effectively transform a single generic material.
- this can be used to convert it into a multitude of products fitting the needs of the many.

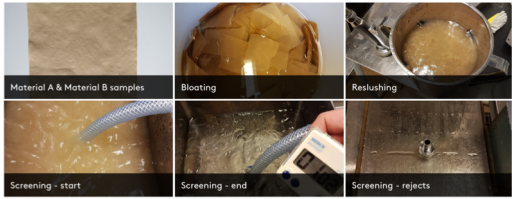
results

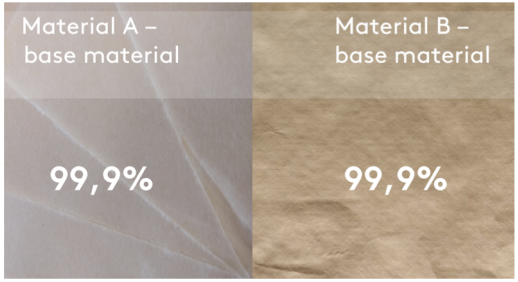
Tailored finishing processes to cost effectively produce large quantities of a single generic material in a paper machine, that later can be converted or tailored into a multitude of products fitting the needs of the many.

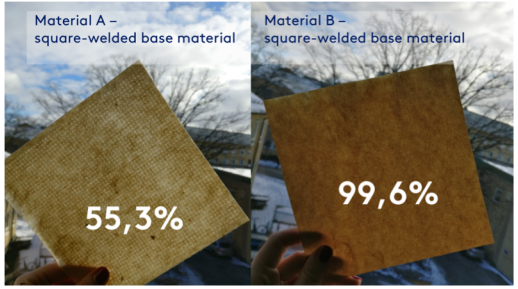
Paper-based vs reference LCA scenarios



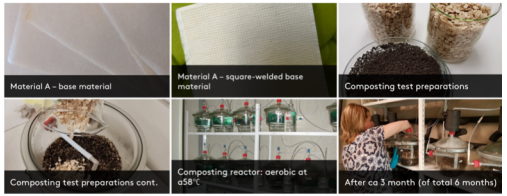
Material recycling test



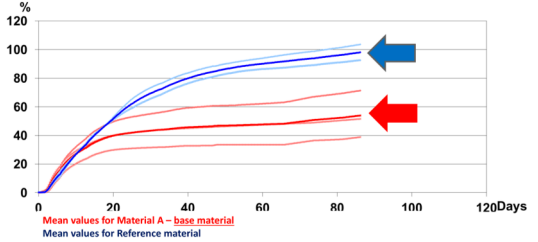




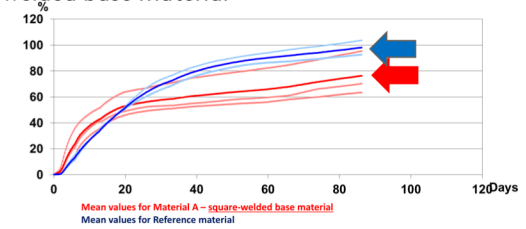
Industrial composting test according to EN 13432



Biological degradation of material A – base material

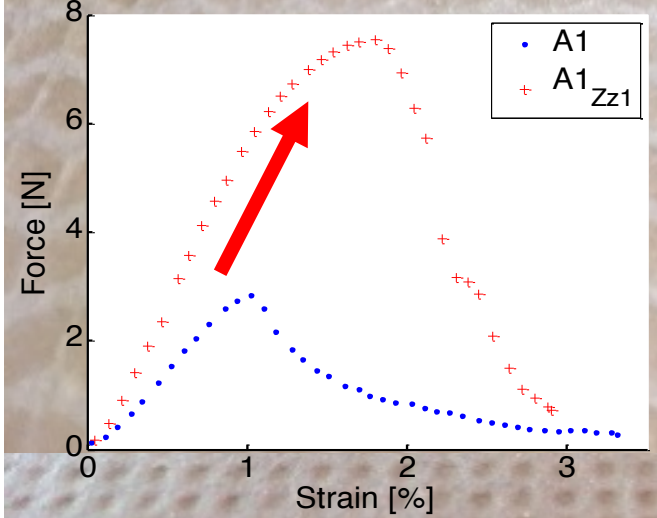


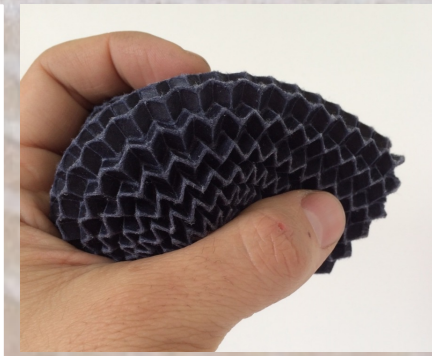
Biological degradation of material A – square-welded base material



welding patterns

- application of a spot welding pattern increased the sample strength by up to 100%
- it increased the strain at break by up to 60%
- square-welded material biodegrades faster than the base material (wood fibres accelerate hydrolysis of PLA)





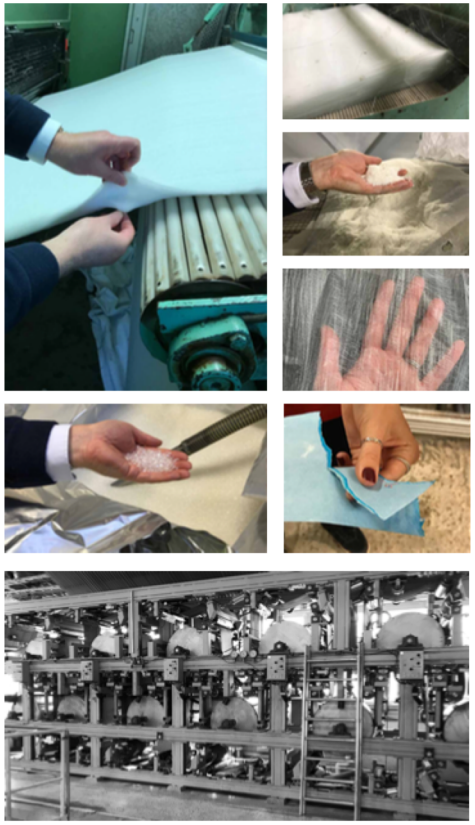
Miura

1 cm

Square

Fashioned from Nature, Exhibition

scaling up



SCALING UP:

There is potential for all of these fast-forward concepts to be scaled up for a mass-market, yet sustainable, industrial context. Local networks of manufacturers will be essential for this vision, from large scale mass-manufacturing plants through to smaller entrepreneurial start-ups. Through developing an extended technical understanding of opportunities and barriers within an existing manufacturing landscape it is hoped than an outcome of this research will be to enable future development of local fast and circular material and fashion systems.

Post Doc research by Dr Helen Paine, UAL

sustainable production at micro & macro scales

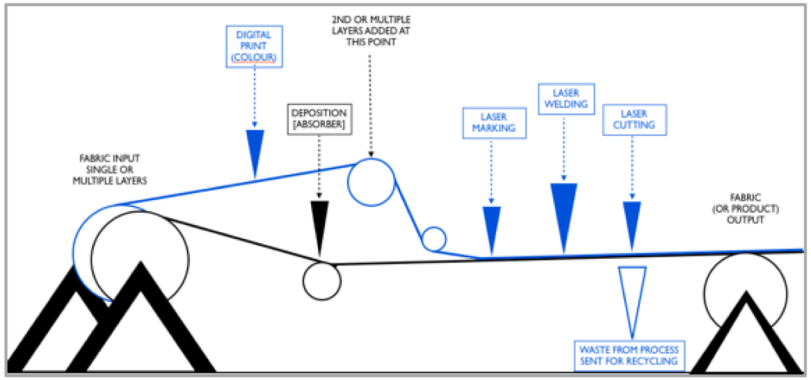
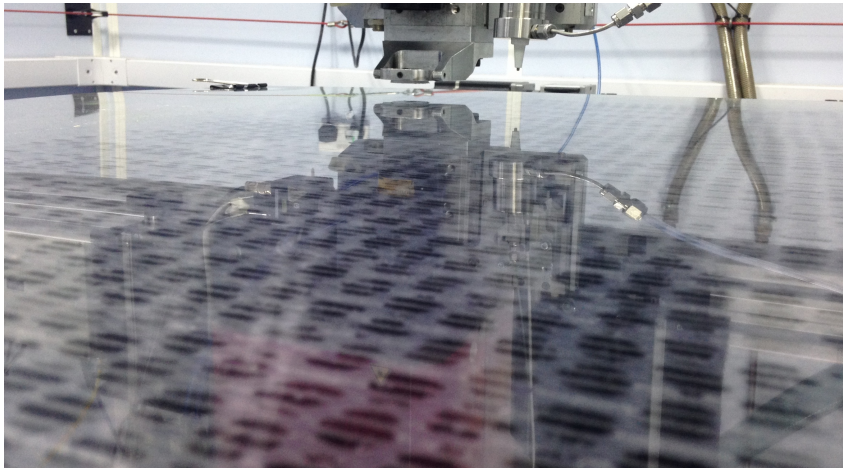


Figure 1 Blueprint of the automated LASERLINE process; an integrated and transformational production system.



the DESIGN THEME

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Thank you

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