CISUTAC

Circular and Sustainable Textiles and Clothing

CISUTAC's Final Results for a Circular European Textile Sector

Four years of innovation, consumer engagement, policy work and cross-European collaboration

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Co-funded by the European Union

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Circular and Sustainable Textiles and Clothing

CISUTAC is a four-year project funded by the European Union's Horizon Europe research and innovation programme (grant agreement No. 101060375), coordinated by Centexbel and bringing together 24 partners from across the textile value chain and the European Union: brands, recyclers, social enterprises, technology providers, research organisations and policymakers.

Its core objective is to remove the bottlenecks currently preventing circularity in the textile value chain, and to minimise the sector's environmental impact by developing sustainable and inclusive European textile value chains. CISUTAC set out to do this on three fronts at once: piloting semi-automated repair and dismantling technologies, developing sorting technologies for reuse and recycling, and advancing novel recycling processes, while working just as hard on the human side of the equation, studying and shifting the behaviours of both consumers and the sector itself. Its work spans three types of products in particular: fashion, workwear and active/outdoor goods.

As the project concludes, this document brings together CISUTAC's final results in one place, one page at a time, organised around three themes: the **innovations developed to make textiles more sustainable**, the work done to **foster circular behaviours** among consumers and citizens, and the **forward-looking guidance CISUTAC leaves behind** for the sector and its policymakers in thinking ahead.

INNOVATIONS FOR MORE SUSTAINABILITY

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Ten Minutes to a Second Life

Zippers are a small component but a big reason why garments get discarded rather than repaired: replacing one can take over 40 minutes with standard sewing machines, which makes it uneconomical at scale. CISUTAC partners **Gentle Systems**, working with **Decathlon**, **Kringwinkel**, and **STAM**, developed a modular, semi-automated zipper repair workstation that guides operators through inspection, spare-part selection and repair using digital interfaces and automated guiding systems (built to handle three levels of intervention, from realigning a slider, to replacing broken components, to a full zipper replacement using an ultrasonic cutter for clean removal). Piloted first at Kringwinkel in Antwerp on jackets (chosen for their flat surfaces and accessible zipper seams), **the station has now handled more than 120 customer repairs on top of internal repairs of donated jackets, cutting the average full zipper replacement time from around 45 minutes to just 10**, while staying simple enough for staff without a sewing background to operate. Many of the repaired jackets have since been resold under a dedicated **"CISUTAC x Kringwinkel" label**, and the team is now working to extend the system to closed-end zippers and bags.

Taking Firefighter Gear Apart

Firefighter suits combine aramid fibres (a high-performance, costly material) with high-visibility stripes, contaminants and complex layering. Today's disassembly is almost entirely manual, expensive, and slow, and it results in recycled fibres that are often more costly than virgin ones. **Gentle Systems**, **SIOEN**, **STAM** and **Kringwinkel** developed a dedicated **workstation to automate the process, pairing a stationary aramid cutter with a machine that identifies and removes high-visibility stripes using computer vision and a high-speed knife** . The team explored two concepts for removing the reflective stripes before settling on a four-step workflow: retrieve the garment, cut it, remove the high-visibility application, and sort the pieces into bins. The ambition was a step-change in output: 10 kilograms of pure aramid cloth per hour, three to five times more than current manual methods.

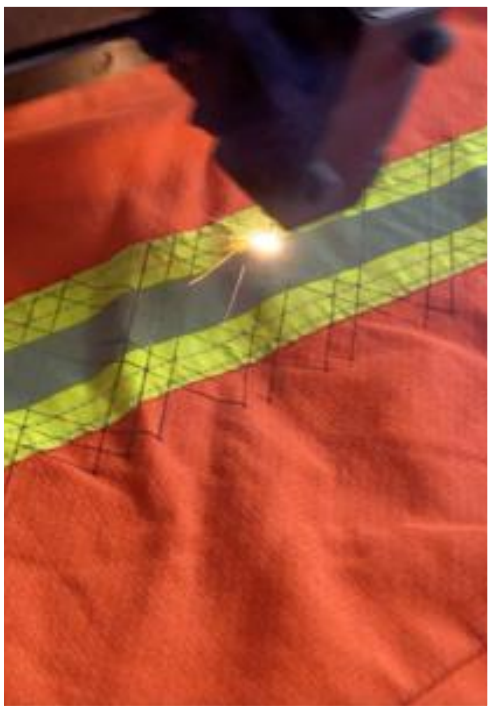
The zipper and firefighter-suit workstations formed one of three pilots CISUTAC ran to validate its circular textile solutions under realistic operating conditions.

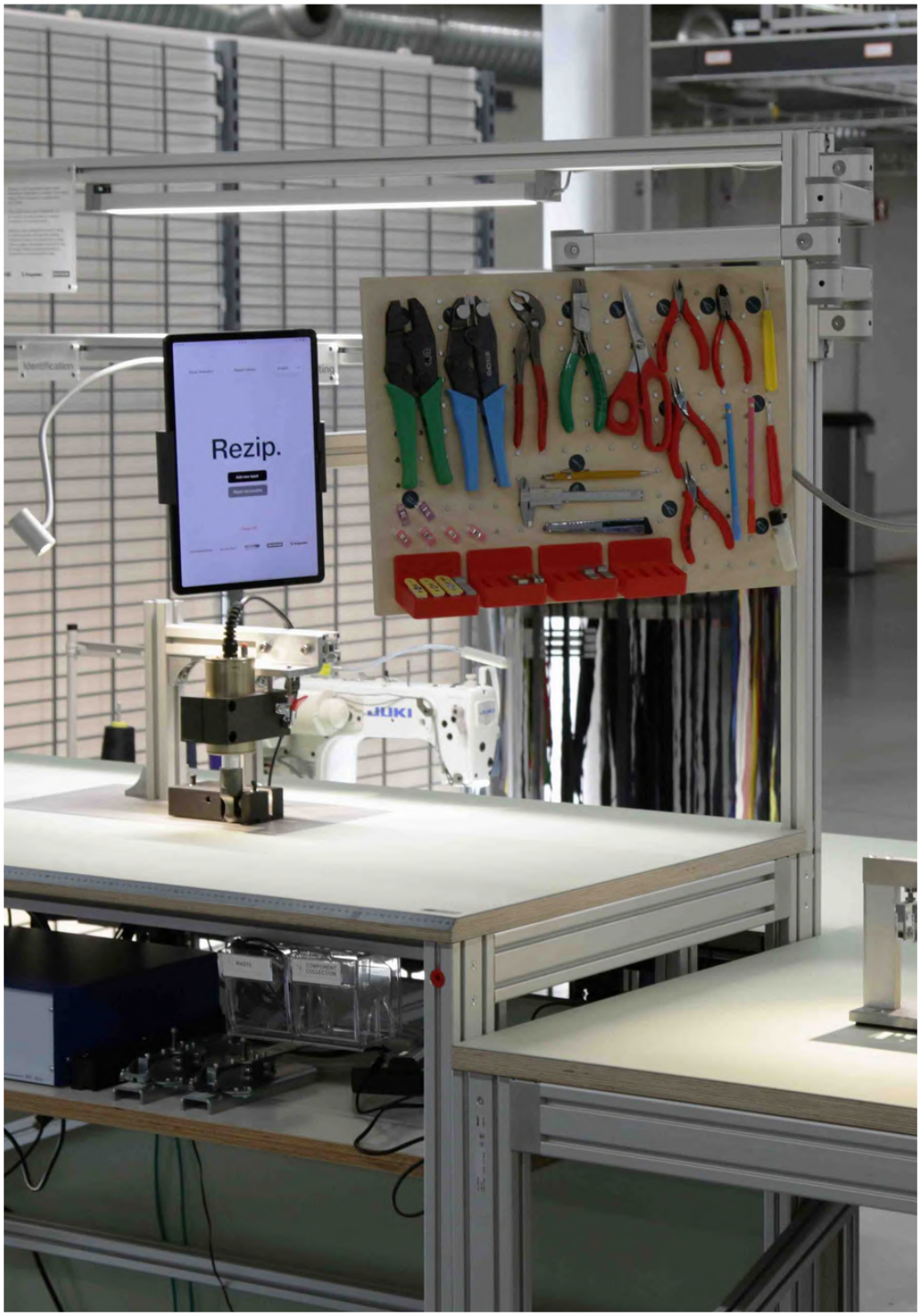
The repair pilot exceeded expectations, reducing repair times and revealing an unexpected market opportunity: consumers' willingness to buy pre-repaired or upcycled garments. The customer repair service didn't quite break even in its first year (time-intensive consultations proved hard to bill for) so the team pivoted, shifting focus to repairing donated items for resale and relocating to Kringwinkel's central warehouse. That move let the model scale from a single shop to all of Kringwinkel's outlets, pointing towards new business models built around repairing donated items rather than customer walk-ins.

The dismantling pilot proved harder. It successfully processed end-of-life firefighter suits, but ran into two obstacles: the suits' own design (extra non-aramid components and items left in pockets) slowed manual removal and limited how much aramid fibre could be recovered, and by the time the pilot was running, identifying partners interested in the recycled aramid was challenging.


9
2
4
1
6
7
5
8


Krimpwinkel
De rits van dit item werd gerepareerd. Het is deel van een speciale collectie die voortkomt uit project
CISUTAC
Funded by the European Union




Rezip.
JUKI

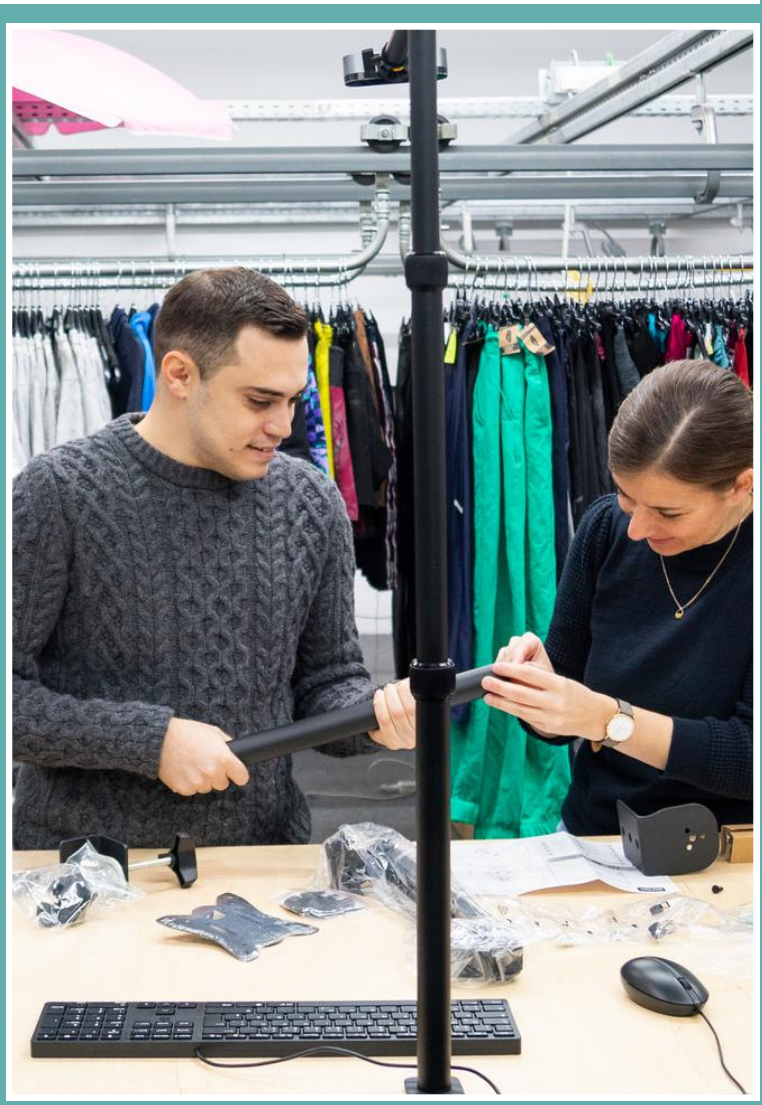
Inside the Sorting Room: Human Eyes Meet AI

The second pilot took the same combination of human expertise and smart technology into sorting. Hosted by **TEXAID** at its Darmstadt site (in a setting where pre-sorted garments are inspected, classified and prepared for online resale), the **pilot brought RFID-based product identification, Digital Product Passport data, near-infrared spectroscopy and image-based AI together in a single digitally supported workstation, guiding sorters (rather than replacing them) towards one of seven possible routes for a garment**.

STAM developed the interface connecting these different data sources, **RISE** built the AI model and the decision tree translating garment data into sorting recommendations, and **Wargön Innovation**, **Global Textile Scheme** and **Decathlon** contributed sorting expertise, product-data infrastructure and test garments respectively. Across six test batches of 20 garments each, sorted by three operators (180 data sets in total), the results were mixed but instructive: NIR material recognition reached around 89% accuracy on single-material garments but dropped sharply for blends; the AI's price-suggestion accuracy landed at 29%, far below its 80% target, reflecting how much a garment's price depends on things a photo alone can't show, like brand or fabric quality; and average throughput was 32 seconds per garment against a 10-second target, with manual condition-assessment the main bottleneck.

Every sorter who tested the station answered “maybe” when asked if it would help their everyday work: a sign of real promise alongside a clear need for further integration. The findings directly shaped what came next: the decision logic and datasets were updated after the test, and the gap in AI accuracy fed straight into the development of the “Holes” and “Spots” condition-detection datasets.


CONDITION ASSESSMENT
INFORMATION
Outfit Classic NKD
Production year
Price
Type
T-shirt
Fiber Composition DPP
100% Cotton
Fiber Composition NIR
100% Cotton
CONDITION
Premium
High
Medium
Low
Very low



Giving Recycled Fibres Their Strength Back

The third pilot, on **fibre-to-fibre recycling**, tackled **the problem of turning old polyester and cotton textiles back into yarn from several angles at once**. Recycled polyester often carries the ghost of its former life (old dyes and finishes that dull its colour and quality) so **AIMPLAS** scaled up a solvent-based de-inking process (using DMSO) to a 200-litre reactor, successfully producing purified PET pellets, while also exploring a more sustainable CO_2-assisted alternative as a promising future direction.

That cleaner material fed into a dedicated recycling line built by technology provider **EREMA** and hosted at **Centexbel**: a pilot-scale "Vacurema" line adapting EREMA's bottle-to-bottle PET recycling know-how to textiles for the first time. It successfully converted recycled polyester into new textile-grade yarn: working well on cleaner, single-source waste, while confirming that genuine post-consumer textile waste, with its mix of materials and contamination, remains the harder challenge.

Running alongside this was a fix for a different problem: every time textile waste is shredded back into fibre, the fibres get shorter (cotton fibres decrease from around 28mm down to 10-15mm), and short fibres spin into weaker yarn, prone to pilling and shedding. CISUTAC partners **Earth Protex** and **Lenzing** addressed this with a modified rotor-spinning process, developed by Earth Protex in 2018, that feeds a fine reinforcing filament (usually recycled polyester, or Lenzing man-made cellulosics) in alongside the short recycled fibres as the yarn is spun, holding them together and restoring the yarn's strength.

With engineering support from technical partner **VUB**, the project took the technology from lab trials to concrete results. The resulting yarns contain up to 80% recycled fibre content. The retrofit needed to run the technology has also been proven compatible with more than 90% of the world's existing rotor-spinning machines, so mills wouldn't need to buy entirely new equipment to adopt it. The team already built a small working spinning unit with two spinning positions from scratch, and Earth Protex now plans to scale this up fast with a full production-scale machine with 500 positions within the year.


EREMA

CISUTAC

A Smarter Way to Sort Clothes

a Decision-support tool for sorting post-consumer textiles

No single available technology can tell a sorter everything they need to know about a garment. Manual operators are best placed to judge condition and reuse potential; but near-infrared (NIR) scanners give more objective fibre-composition data than the eye, Digital Product Passports can supply information no sensor can detect, and AI can help recognise visually observable defects. CISUTAC's decision-support tool for post-consumer textile waste management was built not trying to replace the sorter with one perfect sensor, but combining what all these sources already know.

The tool identifies and prioritises the data points that matter most for routing a garment (condition, fibre composition, multilayer construction, chemical content, colour, trims and disruptors, among others), and maps how ready today's sorting technologies actually are to detect each one. It can point sorters towards any of seven possible routes, from reuse and repair through to mechanical, thermo-mechanical or chemical recycling.

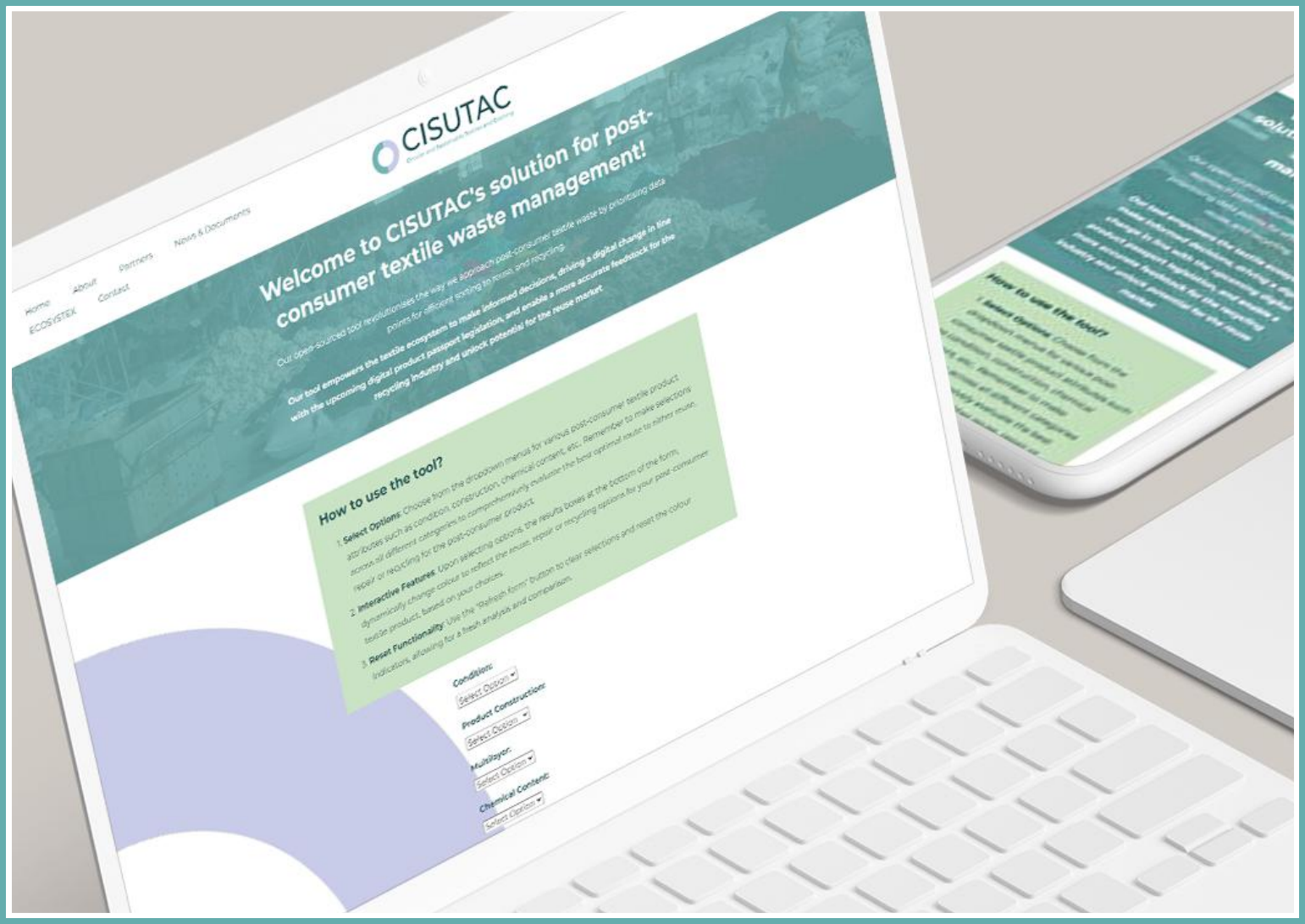
Getting there required first agreeing a common language: extensive internal discussion was needed just to align on shared definitions for concepts like “multilayer construction” or “product classification” across organisations. Built on that shared vocabulary (ISO 5157) and open to all, the tool is available both as an interactive web tool and as an open-access Excel workbook, so sorters, recyclers and technology developers can keep adapting it as sorting and recycling technologies evolve.

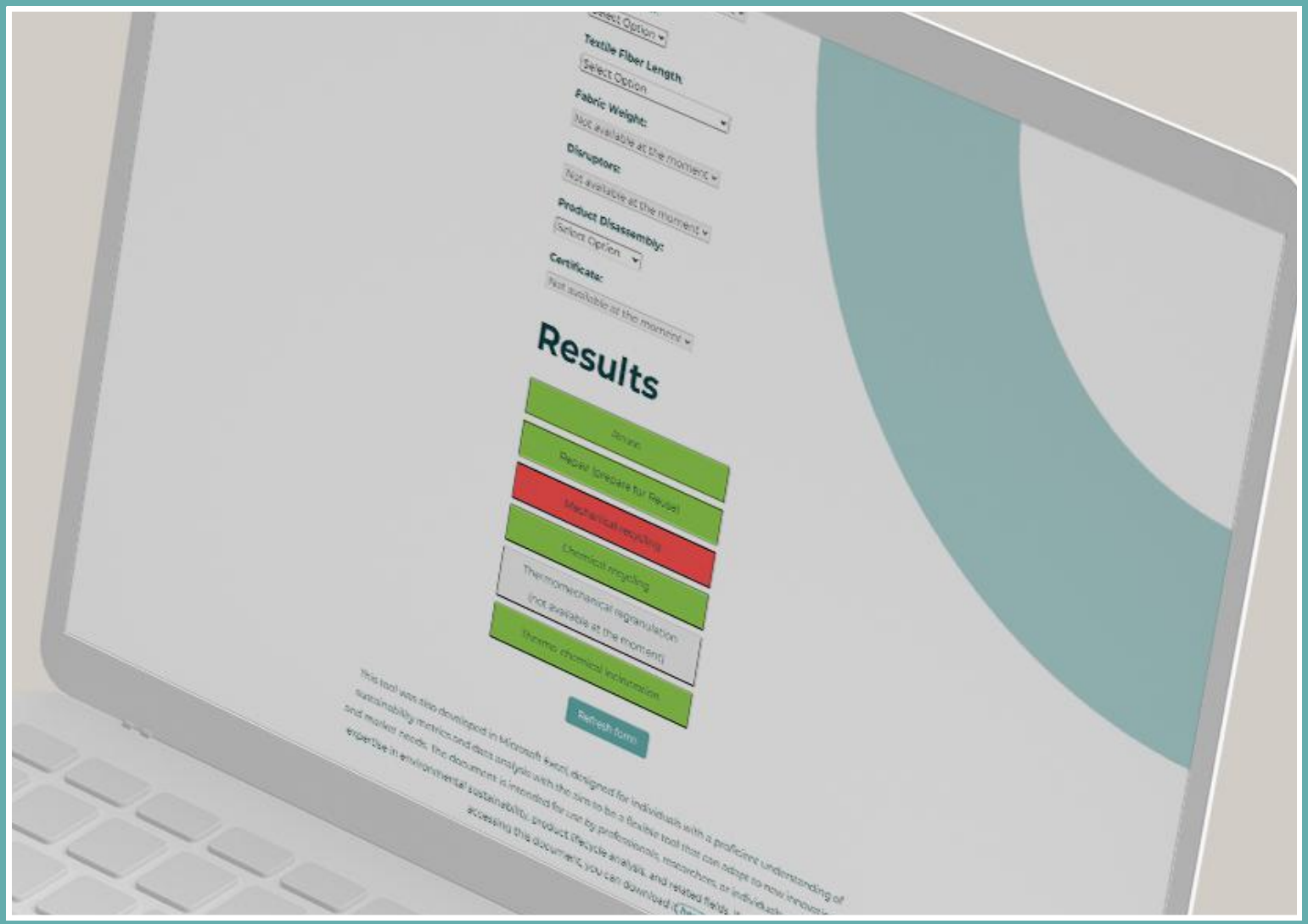
Teaching AI to Spot a Hole or a Stain

Most computer vision models for fashion are trained almost entirely on first-hand, new clothing, leaving them blind to the damage and wear that actually determines whether a used garment should be reused, repaired or recycled. That gap showed up directly during CISUTAC's own sorting pilot: an early AI model asked to judge a garment's condition and likely resale price came nowhere near its accuracy target, largely because it had nothing comparable to learn from.

To help close that gap, CISUTAC has published two open datasets of annotated second-hand garments, focused on the two defects sorters encounter most often: Holes and Spots. Collected and annotated by expert sorters, the underlying models go a step further than a simple pass/fail label: they localise the affected area at pixel level, rather than judging the whole garment at once, and were successfully tested for exactly this purpose in a follow-up run of CISUTAC's sorting pilot.

They're freely available so researchers and technology developers across Europe can build and train better condition-detection models.


CISUTAC
Welcome to CISUTAC's solution for post-consumer textile waste management!
How to use the tool?
Condition:
Product Construction:
Multilayer:
Chemical Content:


Textile Fiber Length
Fabric Weight:
Disruptors:
Product Disassembly:
Certificate:
Results
Refresh form


Kringwinkel

FOSTERING CIRCULAR BEHAVIOURS

What Really Makes Us Repair, Reuse or Toss?

CISUTAC's consumer research combined a large-scale survey (validated with 965 Flemish adults) with interviews, co-creation sessions, and real-world interventions, including an in-store repair pilot with Kringwinkel that saw 46 people bring in 71 items for repair, and an AI-supported wardrobe-assessment study that threw up a striking mismatch: the AI estimated a mean of 50 items per wardrobe, against a self-reported average of 222, suggesting the technology still needs real refinement before it can reliably measure what people actually own.

The findings (from the emotional value people attach to mending a favourite item, to the very practical barriers of cost, time and access to a tailor or sewing facility) are gathered in CISUTAC's consumer circular-behaviour report and accompanying behaviour-change guidelines. A recurring theme is that motivation is the single strongest driver of behaviour, and that no one-size-fits-all intervention works: strategies need to be tailored by consumer segment, product type and the specific point in the textile system, giving brands, retailers and local actors a firmer evidence base for designing their own circular interventions.

23 Million Impressions, One Simple Message

Three CISUTAC partners (**Oxfam Ireland**, **Oxfam Belgium** and **Decathlon Italy**) designed and ran national awareness campaigns tailored to their own context: Oxfam Ireland's “Do Good, Donate” intervention and its Second Hand September push, Oxfam Belgium's fashion-forward “Infinity Collection” campaign encouraging both donation and second-hand buying, and Decathlon Italy's two-year push from repair (2024) to reuse (2025). Together they combined digital content, influencer partnerships, in-store activations, repair workshops and styling sessions.

The results comfortably cleared the campaigns' combined KPI of 2 million impressions, reaching over 23 million impressions across all three campaigns, set out in the consumer awareness campaign report. While behavioural change itself is hard to measure over such a short window, the report is clear on what worked: awareness lands best when it's paired with an easy, low-effort action (a home collection service, a repair workshop on the doorstep, a styling session in-store), rather than a message alone.


ÉÉN ITEM,
ENDLESS LOOKS.


CHECK OUT
OUR NEW
CLOTHING
CARE HUB


OXFAM
FILLS CLASSROOMS
DRILLS WELLS
EMPOWERS WOMEN
FIGHTS POVERTY
OXFAM
Ireland
/ OXFAMLIMERICK
/ OXFAMLIMERICK
WWW.OXFAMIRELAND.ORG
DO GOOD.
LET'S NOT WEAR OUT THE WORLD
DONATE
DON'T
KEEP YOUR
UNWANTED GIFTS
DONATE THEM
TO US
OUR
OPENING
HOURS
SMILE!
YOU ARE
ON CCTV
GIVE HOPE
GIVE NOW


RTÉ ONE


OXFAM
INFINITY
COLLECTION
OXFAM

The Local Rulebook for Circular Textiles

Cities and regions are often the closest link between citizens and circular textile systems, which is why CISUTAC also produced dedicated guidelines for local embedding and a link with the Circular Cities and Regions Initiative.

Developed by **ACR+** in dialogue with the CCRI's Thematic Working Group on Circular Resource Management, the guidelines bring together good practices and concrete recommendations for local and regional authorities across three areas: designing effective textile collection systems (location, density, signage, guidelines for citizens), managing professional and public-sector textiles such as uniforms and workwear, and using local levers (incentives, communication, procurement) to encourage more sustainable consumption in their communities.

The Business Case for Fixing, not Replacing

Developed with project partner **RREUSE**, "Unlocking Opportunities for Circular Business Models in Textiles: Phasing out Linearity" maps the operational and financial challenges facing repair, reuse and recycling businesses across Europe. It draws on extensive desk research plus a stakeholder survey (responses spanning private sorters, social enterprises, municipalities, brands, research centres, recyclers and repair platforms) and in-depth case-study interviews covering one business model each: repair, reuse and recycling.

Reuse and recycling activities can create 20 to 35 jobs for every 1,000 tonnes of textiles collected and sorted, yet a large share of donated textiles today are still incinerated or landfilled rather than reused or recycled, in part because Europe's downstream sorting and recycling capacity hasn't kept pace with the volume of textiles entering the system.

The report identifies policy and financial support, cross-value-chain collaboration, skills development and consumer engagement as the priorities for scaling circular business models, alongside concrete policy recommendations: tackling overproduction through the waste hierarchy, directing EU funding towards sorting and recycling infrastructure, using green public procurement to create stable demand, and reducing or removing VAT on repair services to make circular options more affordable.

Recommendations for textile waste collection

1 Develop a diverse range of collection methods taking into account the local context

Textile containers can be deployed as a primary method but implement further collection efforts establish a network of collection points.

2 Continuously evaluate and adapt strategies deployed based on performance metrics and local feedback

Identify underperforming areas through data analysis and stakeholder feedback. Based on these findings, alternative collection methods should be developed and implemented.

3 Actively engage local actors, including citizens, in a collaborative governance model

Establish a system of multi-stakeholder agreements between local authorities, collection, and sorting operators including potentially other key stakeholders.

Good practices from Europe

Gothenburg's pilots in vertical houses gather data on the quantity and quality of textile collected and on the residents' behaviour with 31 collection points.

Antwerp's De Collectie consortium, formed under a public tender, gathers the main social enterprises already active in textile collection, and implement a mix of integrated collection methods.

Recommendations for enhancing circularity of professional textiles through procurement

1 Engage in market and multistakeholder dialogues

By leading a dialogue, cities can share their vision and goals, discuss, and define respective responsibilities.

2 Do not overlook the importance of repair systems

Public procurement strategies should incentivise suppliers to prioritise repairs.

3 Dedicate enough support to R&D and education

Long-term contracts with suppliers provide the stability and incentive needed for companies to invest in innovative solutions, ultimately driving progress in sustainable and circular procurement practices.

4 Keep end-users in mind

Involving end-users in the design of reuse systems, also considering their needs, could be made a contractual requirement for suppliers.

5 Encourage flexible size management.

Set up systems for regular size exchanges between different departments or organisations.

6 Cost considerations are crucial

Consider "total cost of ownership", as opposed to the cost of purchase, including for instance the cost of maintenance and of increase need for renewal if maintenance is not done correctly.

Good practices from Europe

Veneto's Strategy for Green Public Procurement guides public procurement decisions, promotes sustainable practices in the textile industry, and celebrate initiatives in sustainable procurement with an award.

Recommendations for facilitating sustainable textile consumption patterns

1 Optimise the existing systems rather than creating new ones

Prioritise fostering a local culture of reuse, by offering space and funding, and integrate textile reuse into existing social spaces.

2 Develop new reuse indicators, not only based on weight

Since a product lifetime is central to circular reuse, some components of a reuse indicator may focus on the quality of inflow.

3 Promote and give visibility to local reuse initiatives

Produce a repair calendar or mention the reuse network on city waste calendar.

4 Incentivise the digital transition of second-hand retailers

Offer grants or low-interest loans for investment in digital tools.

Good practices from Europe

France's new reparation fund system allows individuals to benefit from discounts to have their damaged clothes and shoes repaired by certified repairers: six months after the launch, 250 000 repair services had been carried out by more than 600 partner stores.


ETP Fibres Textiles Clothing
ECOSYSTEX
The European Community of Practice for a
Promoting Research & Innovation in Fibres, Textiles & Clothing in Europe


DONATE BY POST FOR FREE
It's easy to donate items by post to Oxfam, extend the life of your pre-loved items, and help support life-changing projects for people living in poverty.
A PARCEL WITH A PURPOSE
Donate By Post. Keep Clothes in Use. Combat Climate Change.
an post

THINKING AHEAD

Four Futures for European Textiles

Rather than betting on a single prediction, CISUTAC used foresight methodology to build four explorative scenarios for the European textile system in 2035 : from a global slow-fashion shift, to a fast-fashion world underpinned by mass recycling, a “quality exclusives” model built on regional repair infrastructure, and a subscription-based “stream your wardrobe” economy. Each scenario deliberately stress-tests a different combination of consumer behaviour, business models and policy ambition, rather than assuming today's trends simply continue in a straight line.

Alongside the scenarios sits a roadmap to 2030, structured around three priority areas, shifting business models, steering consumption patterns, and building infrastructure and data management capacity, with concrete recommendations split between the short term (2024-2027) and medium term (2027-2030), so that today's decisions can be judged against where the sector actually needs to be a decade from now.

Getting Ready for the Digital Product Passport

CISUTAC's Open Data Guide, written by **RISE** and **Global Textile Scheme**, helps brands, retailers and supply chains make the most of the incoming Digital Product Passport, at a moment when most companies are still working out exactly what data they'll need to expose and how.

It offers practical guidance connecting product-level information with what sorters, recyclers and reuse operators actually need on the ground, drawing directly on CISUTAC’s decision-support tool and semi-automated sorting pilot, so that the guidance and the sorting technology it is meant to serve were developed hand in hand rather than in isolation

Its central, somewhat counter-intuitive message: the Digital Product Passport is a powerful enabler, but on its own it can't replace the physical, at-collection assessment of a garment's actual condition.

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Scenario A

Slowing Down: A New Paradigm of Sustainable Fashion Goes Global

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Scenario B

The Fast Fashion Paradox: Material Recycling Becomes Big Business

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Scenario C

Quality Exclusives: The Cornerstone of European Circular Value Chains

CISUTAC

Scenario D

Stream Your Wardrobe: Subscription Models Disrupt Fast Fashion

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CISUTAC's Shared Visions for a Circular Textile Europe

Much of CISUTAC's forward-looking work is captured in a series of shared visions: concise policy positions built directly on the project's evidence and its own pilot findings, aimed at shaping the EU's circular textile framework:

- **Raising consumer awareness and supporting behavioural change**
  Awareness alone isn't enough; circular practices need to be made easy, trustworthy and socially normal, backed by accessible services and sustained, multi-channel communication.

- **Textile waste management and circular material flows**
  Waste management should become a value-retention system, prioritising prevention, reuse and repair ahead of recycling, and creating the market conditions for fibre-to-fibre recycling to scale.

- **Public procurement**, paired with **Public Procurement Guidelines for Textiles**
  Public authorities, who purchase around 14% of EU GDP, should move beyond lowest price and reward long-term value, with practical criteria for workwear, uniforms and PPE.

- **Ecodesign, repairability and recyclability**
  Durability and repairability should be built in from the design stage, as CISUTAC's own pilots showed when suit design made disassembly harder than it needed to be.

- **Waste prevention and reduction**
  Tackling overproduction, which drives around 80% of a textile product's lifecycle emissions, by disincentivising the destruction of unsold goods and scaling up reuse and repair first.

- **An EU-wide Extended Producer Responsibility scheme**
  Harmonised rules, science-based eco-modulation, transparent governance, and dedicated funding for reuse and repair operators.

- **Standardisation**
  Standards as a practical bridge rather than a hurdle, with a seven-step pathway to help businesses build compliance in from the start.

Watch and Learn:
The CISUTAC Sustainability Forum

Throughout the project, CISUTAC ran a series of Sustainability Forum webinars, opening up its pilots, research and policy work to live discussion with practitioners, local authorities and policymakers. All five sessions are recorded and freely available:

- **Citizen engagement and the role of local and regional authorities**
  Local and regional authorities and city networks on collection systems, professional textiles and local policy levers, linked to CISUTAC's CCRI guidelines.

- **Understanding consumer behaviour in a circular economy**
  Unpacking CISUTAC's consumer research with practitioners: what really drives repair, reuse and second-hand purchasing.

- **EU policy developments impacting textile circularity**
  Policymakers and industry on the Ecodesign Regulation, EPR and the Waste Framework Directive's separate-collection requirement.

- **Circular business models in textiles**
  The findings of the circular business models report, discussed with practitioners across the reuse, repair and recycling value chain.

- **Digital Product Passport and digitalisation in textile sorting**
  How the DPP and digital sorting technologies can work together, grounded in CISUTAC's own Texaid sorting pilot.

Bigger than One Project: Building ECOSYSTEX

CISUTAC played a founding role in the wider research landscape by creating **ECOSYSTEX**, the European Community of Practice for a Sustainable Textile Ecosystem, supported by the European Commission's Horizon Europe programme and the Circular Bio-based Europe Joint Undertaking, and facilitated by **Textile ETP**.

This network of textile circularity projects builds a long-term community of practice, ensuring collaboration across project consortia that lasts well beyond the duration of any single project: a reminder that no single project can solve textile circularity alone, and that the sector's progress depends on sharing evidence, tools and lessons learned as widely as possible. What started as a CISUTAC-led effort has since grown into a network of over 100 projects as of Summer 2026.

CISUTAC presented its work in 6 ECOSYSTEX Insight Series webinars, at the first ECOSYSTEX Conference in Barcelona in October 2023, and brought the project full circle by hosting its final event at the fourth ECOSYSTEX Conference in Antwerp on 22–23 September 2026, helping to align research efforts across Europe and amplify collective impact on EU textile policy.

ECOSYSTEX


From EU Research
to Sustainable
Textile Business
Barcelona 18-20
SPAIN OCTOBER


32 months
77 member projects
3 working groups
3 publications
ECOSYSTEX


New Technologies
& Business Models
for Textile Circularity


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