

TRACE

Legislation Promoting the Circular Economy

BARRIERS FOR CIRCULAR SOLUTIONS



Legislation Promoting the Circular Economy

Executive summary

This ongoing working white paper, produced by TRACE — Denmark's national Innomission for Circular Economy — synthesizes findings from multiple real-world circular economy projects spanning plastics, textiles, electronics, healthcare, and construction.

Each project has encountered regulatory and legislative barriers that hinder the transition from linear to circular business models. While many of these regulations were originally enacted to protect people and the environment, they were designed in the context of a linear economy where waste collection for incineration was the default.

This paper identifies these barriers and presents concrete, actionable recommendations to update legislative frameworks, so they actively promote — rather than obstruct — the circular economy.

The projects collectively demonstrate that circular solutions are technically feasible and environmentally beneficial, but they are consistently blocked or disadvantaged by outdated waste definitions, procurement structures, absent standards, and fragmented regulatory frameworks.

The overarching finding is that legislation must shift from a linear-by-default logic to one that recognizes and rewards circularity by design.

Main recommendations from the project cases presented:

1. **Reform Waste Classification and Cross-Border Shipment Rules:** Adopt a destination-based waste definition in the EU Waste Framework Directive, so that products destined for reuse, repair, refurbishment, remanufacturing, or recycling are classified as resources, not waste
2. **Reform Public Procurement to Drive Circularity:** Integrate circular economy and sustainability parameters into public procurement, develop regulatory frameworks enabling value chain partnerships and introduce pilot procurement mechanisms that allow smaller-scale testing of circular solutions alongside conventional large-scale tenders.
3. **Develop Fit-for-Purpose Standards for Circular Products:** Create new testing standards and analytical frameworks specifically designed for recycled materials, establish standards and guidelines for reusable product categories and introduce graduated regulatory targets allowing companies to build capabilities progressively.
4. **Adapt Safety and Product Regulation to Enable Repair and Reuse:** to make it simpler for manufacturers to advise end users on repair operations without legal risk, promoting repair as a preferred option over replacement.
5. **Create a "Circular Sandbox" Framework for Innovation:** enabling controlled, supervised testing of circular products, services, and business models that fall outside existing standards, regulation and procurement structures.



Introduction to TRACE

TRACE is Denmark's national Innovation Commission for Circular Economy. TRACE exists to accelerate the transition towards a regenerative circular society by 2050, where resources circulate in closed loops, waste is minimized, and natural systems are restored rather than depleted.

TRACE's vision is to leave a positive trace on people and planet through a circular economy, and its mission is to drive collaboration and knowledge creation across actors in order to make systemic circular transition possible.

TRACE brings together research institutions, companies, public actors and civil society in a mission-driven partnership focused on plastics and textiles. Its role is not simply to support isolated projects, but to create shared direction, cumulative learning and stronger alignment across initiatives, so that insights from practice can be translated into broader system change.

Through its roadmap, impact framework and collaborative infrastructure, TRACE supports the development of scalable circular solutions and the generation of policy-relevant knowledge grounded in real-world experimentation.

TRACE operates through three complementary roles. As Builder, TRACE develops and demonstrates scalable Proof-of-Concept Circular Economy Systems across value chains. As Harmonizer, TRACE brings together actors across sectors to create shared direction, collaboration and legitimacy. As Pathfinder, TRACE helps identify the knowledge, data and impact logic needed to move circular solutions from experimentation to broader adoption, institutionalization and policy relevance.

Together, these roles enable TRACE to work from pilots to policy by linking applied research, practice-based learning and systemic transition.

This white paper is part of that broader context, but it should be read first and foremost as a research-based contribution. Written by expert researchers, it synthesizes insights from TRACE-related projects and translates them into policy-relevant analysis and recommendations.

Its purpose is not only to identify where current legislation creates barriers to circularity, but also to show how future framework conditions can better support viable, credible and scalable circular solutions in practice.

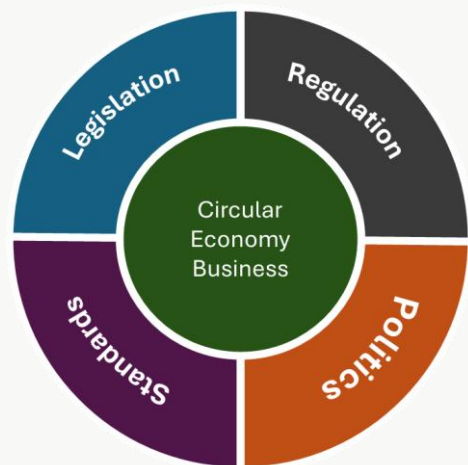
Background of legislation regarding circular economy

The transition to a circular economy is undeniably intertwined with legislation where policy makers administer a selected dosage of carrot and stick to drive change.

In the TRACE supported projects, each project has also come across regulations that hinder circularity – these cases are described below. The legislation was adopted to protect the environment and people and changes should not relax on these noble goals.

Many regulations were ratified in a time of linear economy where waste collection for incineration was the preferred option, thus amendments with a circular mindset are warranted.

Multiple new Danish and EU initiatives are already being implemented to promote circular economy – PPWR, EcoDesign, DPP, EPR, EU Green Deal and EU Circular Economy Act. Standards are being developed and implemented to document sustainability and circularity.



Despite these initiatives, changes to a circular economy still face challenges that must be addressed. For some cases standards, legislation and industry ambitions are “out of sync” with each other and does not jointly promote the transition to a circular economy. This needs to change.

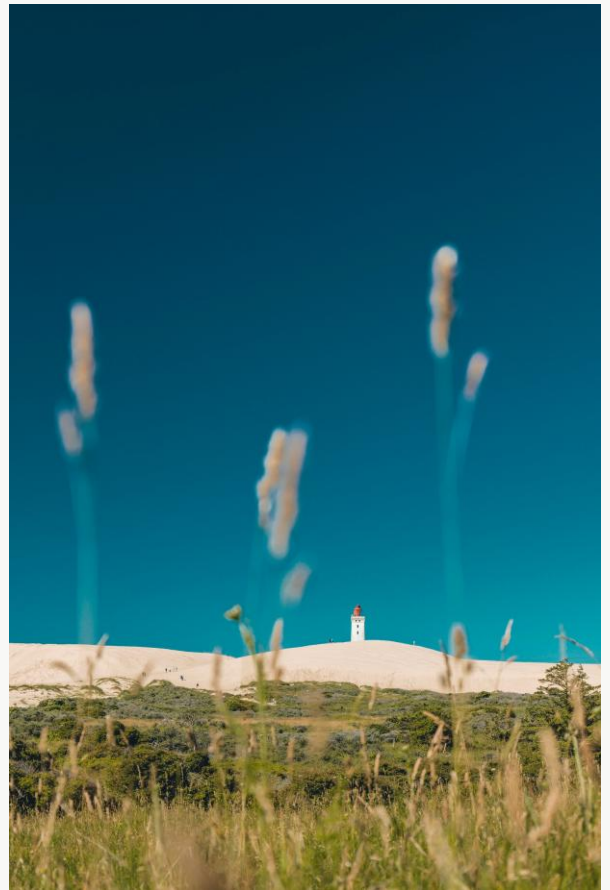
The aim of this white paper is to further accelerate legislative changes promoting circularity by pointing out the barrier identified in our cases and recommend concrete changes. We see legislative incentives as a cornerstone in the continued transition towards circularity.

Accelerating Circular Economy

Converting your business from a linear business to a circular business is complex enough both identifying and describing your business model but also requiring closer collaboration with your value chain with increased trust and knowledge sharing.

Besides facing this complexity companies early on - or too late - identify that outdated legislation, regulations and standards also works against their new circular business model. This is wrong – it should be the opposite!

Politicians – both nationally and internationally – should set clear, long-term guidance promoting and accelerating companies transition to circular economy.



**Our North Star is a
regenerative circular
society by 2050, where
resources circulate in closed
loops, waste is eliminated,
and natural systems are
restored**



HoliMed: Recycling of medical devices – from clinical risk waste to second resources

Purpose

HoliMed represents the full value-chain from medical device manufactures, hospitals, waste broker, recycler, and manufactures utilizing recycled plastic. The project is establishing the infrastructure required for recycling medical devices to enable a circular flow in an otherwise conventional linear value chain.

Recycling complex multi-component items (e.g. medical devices) is a highly specialized process, and the volume of material is lower than everyday commodities.

Obstacles

An economically viable circular model requires a high volume of products. To enable scalability, devices from multiple countries must be pooled at specialized recycling hubs. Obtaining the permits for cross-border waste transport is a bureaucratic and slow process, and even more so when waste is classified as clinical risk waste. The current regulations (e.g. EU waste shipment regulation EU No. 2024/1157), Basel convention 1989, & OECD Decision C(2001)107/Final) are made to prevent dumping of waste in other countries.

The current challenge is not the safety requirements themselves, but the fact that the legal classification ignores the intended circular use.

Innovative circular economy solutions face heavier bureaucratic burdens compared to linear disposal routes. For instance, shipments of plastics for recycling often require notification under the OECD Decision C(2001)107/Final (Amber List), while sending the same plastics for incineration or landfill can proceed faster with fewer controls. This discourages investment and scaling.

Potential circular solution

From a circular economy perspective, these medical plastics are not destined for disposal but for high-value recycling. Once they reach the recycling hub, they are decontaminated, processed, and converted into secondary raw materials. By early recognition of a recycling purpose, the shipments could follow a streamlined regime (closer to Green List), while still fully complying with ADR transport safety rules for potentially contaminated materials.

The HoliMed consortium has provided recommendations to the EU Circular Economy Act that is finalized Q4 2026.

Recommendations

1. Fair and proportional rules so recycling is not disadvantaged against disposal.
2. Introduce a fast-track Prior Informed Consent (PIC) procedure for shipments destined for certified recycling hubs, so materials for recycling are not unnecessarily delayed by regulations designed for disposal.
3. Recognize the circular economy purpose of these shipments in national and EU permit procedures to reduce administrative burden while maintaining full safety compliance.
4. Ensure harmonization of national waste shipment regulations within the EU.

About HoliMed:

Duration: 2 years, start April 2025

Partners: Danish Technological Institute, Central Region Denmark – Center for Sustainable Hospitals, NG Nordic Medical Recycling, Ambu, J&J MedTech, Resourcify, Letbek, Roskilde University, Copenhagen Business School.

Funding: TRACE

Back2Back: Take-back solution for technical products – ensuring best possible end-use scenario

Purpose

Back2Back is an industry consortium spanning manufacturers, logistics providers, technology companies, and academic institutions.

The project is developing a scalable framework for take-back solutions that unlock circular business models such as reuse, repair, refurbishment, remanufacturing and closed loop recycling across multiple industrial sectors.

Take-back schemes represent a significant economic and environmental opportunity: by collecting used products from customers and routing them to facilities for cleaning, repair, refurbishment, or remanufacturing, companies can retain the value embedded in products and materials while reducing resource consumption.

Scaling these models across European markets has the potential to make circular business models highly competitive and economically attractive.

Obstacles

The current EU Waste Framework Directive (2008/98/EC) defines waste based on the holder's "intention, decision, or requirement to discard," which means that used products entering take-back schemes are classified as waste even when they are fully functional or readily repairable.

The waste definition of products at end-used results in a series of obstacles in the logistic chain regarding administration, transportation with other goods, cross-borders complications and more. It also requires that the functional products or re-used components need to be re-classified as end-of-waste at repair / refurbish destination.

All this destroys the business in a take-back solution and hinders companies joining forces to create a common solution.

Potential circular solution

By shifting to a destination-based definition, where products are only classified as waste when they are genuinely destined for disposal, the EU can enable used products in take-back schemes to move through standard logistics networks.

This would allow companies to use standard freight rates, combine used and new products on the same transport, and apply standard shipping documentation, dramatically improving the efficiency and economics of circular operations.

By recognizing that products destined for reuse, repair, refurbishment, or remanufacturing are resources, not waste, the EU can turn its regulatory framework into a catalyst for circular innovation rather than an impediment.

The Back2Back consortium has provided a recommendation to the EU Circular Economy Act.

Recommendation:

1. **Adopt a destination-based waste definition** in the EU Waste Framework Directive, recognizing products destined for reuse, repair, refurbishment, or remanufacturing as resources rather than waste.
2. **This approach aligns with international best practices** (US, China, India, Brazil, Australia) to position EU companies competitively in the growing global circular economy market.

About Back2Back

Duration: 2 years, starts May 2025

Partners: Danish Technological Institute, Grundfos, Danfoss, Schneider Electric, Kvadrat, DSV, DXC, Stena Circular Consulting, Linköping University, Aalborg University

Funding: TRACE

ReGlove: Reusable nitril gloves for the healthcare sector – converting single-use product to reusable solution

Purpose

The healthcare sector accounts for approximately 6% of Denmark's consumption-based climate footprint, with hospitals as the primary contributors. The majority of this impact stems from procurement, and single-use nitrile gloves are by far the most widely used product across departments.

The ReGlove project has developed a reusable nitrile examination glove and an associated washing process that ensures the glove meets nitrile glove standards even after 15 cycles.

ReGlove has demonstrated and validated in clinical settings that it is both technically feasible to develop and implement reusable nitrile gloves for the healthcare sector, and, with user involvement and minimal behavior change, practical for use and collection in clinical settings.

A third party evaluated LCA (life cycle assessment) shows that for the climate change category, the carbon footprint (CO₂-eq) of the ReGlove glove is already lower than that of the disposable version from the second use onward. The more times a ReGlove glove is re-turned for washing and reused, the greater the climate benefits compared to disposables

Obstacles

Current standards for a product like nitril gloves do not support a reusable solution but only single use solution. They cannot answer all the questions for a reusable glove, for instance regarding washing and hygiene quality control of gloves after wash.

Supporting authorities do therefore not have any guidelines to support companies searching developing a new, circular reusable solution. Especially regarding hygiene questions, hospital personnel refer to the same authorities when in doubt in the clinic. When they can't get clear answers, they consider the risk too high and work too big to try new products and solutions compared to what they know.

Recommendation:

1. **Create a framework** allowing start-up companies to scale new solutions in close collaboration with the public healthcare securing a viable business for the company also through scaling.
2. **A one-point-of-contact collaboration model** with authorities supporting the industry when converting a product from single-use to reusable.
3. **Private public collaboration** when developing new products to e.g., the health care sector without tender regulation barriers

About ReGlove

Duration: 2 years, finalized 2025

Partners: Textilia, Bait, Danish Technological Institute

Funding: Danish EPA, MUDP Lighthouse



One Textile

Direction: Addressing barriers to textile circularity in Denmark

Purpose

One Textile Direction (OTD) brought together actors across the Danish textile value chain. The project worked across collection infrastructure, market demand, recycling technologies, and mapping of the current textile system.

The project demonstrated that textiles with recycled content can meet the same technical and user requirements as conventional textiles, developed recommendations for improving textile waste collection, developed and matured advanced recycling technologies, and created a stronger knowledge base on textile production, recovery, and waste flows in Denmark.

The project shows that circular textile solutions are technically feasible and increasingly market-ready. However, it also highlights that regulation and policy uncertainty remain major barriers to implementation and scale.



Obstacles

A central barrier identified in One Textile Direction is the lack of long-term regulatory clarity and system-wide coordination for textile waste management and circular textile systems.

Although technological solutions, collection models, and market interest are developing, the current framework remains too fragmented and uncertain to support large-scale investment and implementation.

From 2023, household textile waste has been collected as a separate fraction. The implementation has been handled differently by waste handlers of different municipalities.

This initiative has raised a challenge relating to how textile waste collection is understood by citizens. When textiles can be discarded through household waste schemes, consumers may assume that all discarded items belong in the recycling stream.

In practice, this leads to reusable textiles being discarded as waste rather than kept in reuse systems, reducing the environmental and economic value retained in the system.

The issue is therefore not only technical, but also linked to communication, guidance, and public understanding of the purpose of textile waste collection schemes.

At the same time, the textile value chain is highly international. Production, machinery, and processing know-how are often concentrated in Türkiye and East Asia, while Denmark has limited domestic textile manufacturing infrastructure.

This heightens the barrier for establishing a Danish recycling capacity and to create local circular loops, even when collection and sorting systems improve.

Without stronger domestic capabilities and more predictable framework conditions, collected textile waste risk continuing to flow out of the country rather than supporting local recycling and value creation.

Together, these challenges create a “wait-and-see” situation across the value chain. Collection operators, recyclers, manufacturers, and procurers face uncertainty about future requirements, future material streams, and whether sufficient domestic capacity and market demand will emerge to justify investment.

Potential circular solution

The main need is a clearer and more coordinated framework for textile circularity that supports both better system performance and stronger market confidence.

A more harmonized national approach to household textile collection would allow municipalities and waste actors to build on common learning and best practices.

Greater alignment in collection and sorting methods would improve material quality, make textile flows more predictable, and create better conditions for scaling both reuse and recycling.

In parallel, clearer public guidance is needed to ensure that citizens understand the distinction between textiles suitable for reuse and textiles that should enter waste-based collection systems.

Better information would help preserve high-value reuse opportunities and improve the overall quality of materials entering recycling processes.

At the same time, textile circularity should be addressed not only as a waste management issue, but also as an industrial and market development issue.

If Denmark wants to establish stronger domestic recycling infrastructure, policy must support the development of local competences, partnerships, and investment conditions for textile processing and manufacturing.

Clear long-term policy direction — including on collection responsibilities, sorting requirements, treatment standards, and market incentives — would make it easier for companies and municipalities to invest in the infrastructure and collaborations needed to close textile loops more effectively.

About One Textile Direction:

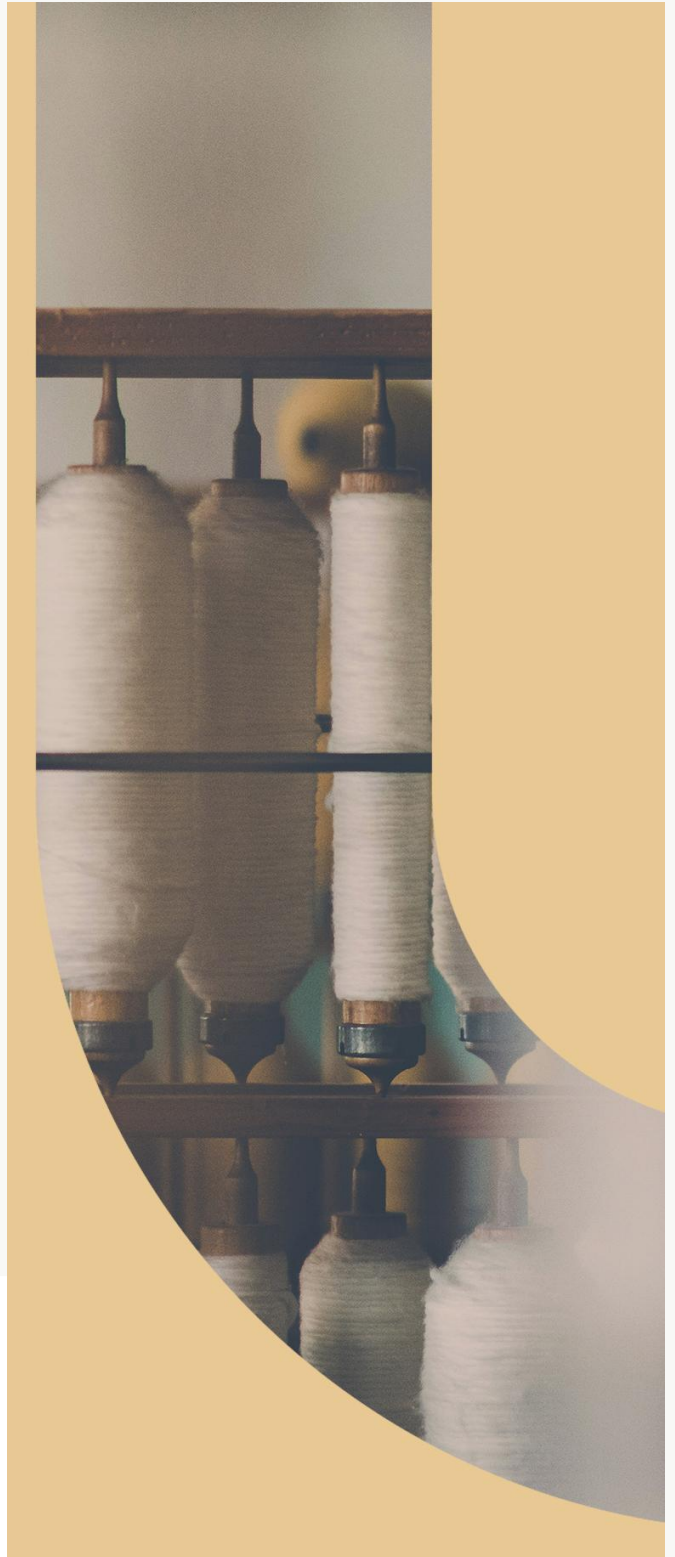
Duration: 3 years, finalized 2025

Partners: Danish Technological Institute, Bornholms Affaldsbehandling, AffaldPlus, Eldan, Kentaur, Copenhagen Airports, Køge Kommune, Aalborg University, Aarhus Kommune, Gate 21, Bestseller, Ganni, Kolding School of Design, Lifestyle & Design Cluster, DT Solutions, New Retex, Textile

Funding: TRACE

Recommendations

1. **Establish clear, long-term policy frameworks** for textile waste management at national and EU level, giving actors across the value chain a predictable basis for investment in collection, sorting, reuse, and recycling infrastructure.
2. **Promote greater harmonization** across municipalities in the handling of household textile waste, including consolidation of learning, national guidance, and dissemination of best practices for collection and sorting.
3. **Strengthen citizen guidance and communication** so reusable textiles are not unnecessarily discarded, and so household collection systems better support the waste hierarchy.



CircleHealth: Circularity of plastics and textiles in the healthcare sector

Purpose

CircleHealth is an interregional project focusing on plastics and textiles, aiming to implement circular economy principles in the Danish hospital sector over four years.

In the project, we work across the value chain and have a broad range of partners, including three out of five regions, four knowledge institutions, two suppliers, and one waste handler.

We specifically work with three products in the project: Non-sterile single-use examination gloves, the white textile uniform, and EPS (expanded polystyrene) packaging, throughout their life cycle. The

Danish healthcare sector account for 6% of the total Danish CO2 emissions, and recently it has become an overarching goal for all regional hospitals to actively work on reducing the hospitals' total CO2 emissions - specifically by 50% by 2035 (compared to 2022). The circular economy is highlighted as a way to achieve this.

The project aims to map and analyze product flows within the healthcare value chain, to propose initiatives across the value chains for minimizing CO2 emissions.

Focal areas include design, consumption patterns and behaviors, public procurement as a driver for innovation, and better utilization of end-of-life products.



Obstacles

The most significant regulatory barriers identified throughout the project primarily concern existing public procurement legislation, which has demonstrably impeded the advancement of initiatives oriented towards a circular economy transition.

With respect to textile uniforms, a notable absence of provisions addressing durability testing and longevity considerations at the product design phase was observed.

Moreover, prevailing tender frameworks within current procurement legislation constrain the adequate valuation of sustainability parameters, total cost of ownership, and circular innovation potential. In the context of plastics, persistently low market prices systematically favour single-use products, undermining efforts to promote more sustainable alternatives.

About CircleHealth

Duration: 4 years, ultimo 2026

Partners: *Roskilde University, Aarhus University, Design School Kolding, Technical University of Denmark, MidtVask, Abena, Gate21, BEWI, Region Zealand, Central Region Denmark, and Capital Region.*

Funding: TRACE

Recommendation:

1. **Development of a regulatory framework** that facilitates value chain partnerships in the advancement of more circular products, either as a supplement to or substitution for existing short-term contracts.
2. **Greater integration of circular economy** and sustainability parameters in the evaluation criteria for bids and products.

Tekstilbroen: Textile-to-textile recycling

Purpose

Tekstilbroen is a cross-border collaboration that has established a new value chain for textile-to-textile recycling, demonstrating that discarded hospital textiles can be collected, processed, and returned as new textile products with high recycled content.

The project has produced 1,000 pairs of hospital socks consisting of 80% recycled textile content. The socks are being tested by patients at Bispebjerg Hospital. The value chain runs from hospital and industrial laundry in Denmark through mechanical recycling and yarn spinning in Türkiye, then return to Denmark to produce the finished products.

The project demonstrates that textile-to-textile recycling at meaningful scale is technically feasible, and that discarded textiles can be kept in the material cycle as new textiles rather than being incinerated or downcycled.

Obstacles

The project has encountered barriers in three areas:

Trade and waste classification

barriers: Türkiye has import restrictions on textiles, meaning that used textiles cannot simply be shipped as goods. To enable the material flow, the textiles had to be classified as textile waste, which required legislative clarifications and extensive dialogue involving the Danish Ministry of Foreign Affairs and the Consulate General in Istanbul. In practice, trade-regulatory barriers rather than circular economy considerations determined whether and how the collaboration could proceed. This experience shows that waste definitions and import rules in key partner countries can directly block circular value chains from being established.

Procurement practices: Hospital textiles are purchased through large public tenders where price, standard compliance, and theoretical durability dominate the evaluation criteria. Requirements rarely address whether a product can enter a circular value chain at end-of-life, whether it contains recycled content, or whether documented return streams are in place.

This means that procurement continues to favor linear solutions by default, even where circular alternatives have been demonstrated. If public procurement is to drive circular transition, tenders must reward solutions where materials can be taken back and turned into new textiles.

Unclear responsibility for post-use

textiles: When discarded textiles gain value as a raw material, a new question arises: who is responsible for them after use, and who gets access to bring them back into circulation? Upcoming regulations such as Extended Producer Responsibility (EPR) have not yet clarified how responsibilities, access, and incentives will be distributed in practice.

This uncertainty risks creating a grey zone where valuable materials are neither effectively collected nor returned to new textile products.

Recommendations

- 1. Adapt waste classification and trade regulation** to enable cross-border movement of textiles destined for recycling, ensuring that circular value chains are not blocked by rules designed for linear waste disposal or trade protection.
- 2. Reform public procurement criteria** for textiles to reward recycled content, documented return streams, and end-of-life recyclability alongside traditional requirements for price and durability.
- 3. Clarify responsibility for post-use textile flows** under upcoming EPR and waste regulation, so that roles, access, and incentives support effective collection, sorting, and return of textiles to new products.

About Tekstilbroen: Duration: 2025-2026

Partners: Danish Technological Institute, Bispebjerg Hospital, Centralvaskeriet, Hansen Textile, WHITEWEAR, The Danish Ministry of Foreign Affairs, and the Consulate General in Istanbul.

Funding: Co-financed by the European Union and Denmark's Business Promotion Board (Danmarks Erhvervsfremmebestyrelse). It is a part of the Closing Loops program

CFIT: Circularity of Industrial Thermoplastic for high quality recycling

Purpose

The project aims to accelerate the transition toward true plastic circularity by addressing the full spectrum of challenges across four interconnected areas.

It seeks to enable closed-loop recycling that maintains plastic materials at their highest possible value through multiple use cycles — moving beyond conventional downcycling.

This involves developing a deep, science-based understanding of how different polymers degrade during use and recycling and leveraging these insights to inform “design-for-recycling” strategies covering polymer selection, additives, and product construction.

To support informed decision-making, the project develops accessible, dynamic LCA tools and evaluation frameworks that enable companies to assess the environmental and business impact of circular scenarios in real time, grounded in both data and practical pilot experience.

Finally, the project addresses the practical infrastructure and value-chain collaboration needed to implement circular systems at scale — including take-back schemes, sorting technologies, regulatory alignment, and consumer engagement — recognizing that viable plastic circularity requires a systemic approach that aligns technology, material science, business models, policy, and cross-industry partnerships.

Obstacles

Absence of standards

One main obstacle identified in the project was the actual absence of legislation and standards when introducing recycled content into high-quality products like medical devices. This leaves the companies on their own identifying and developing roadmaps for custom-made screening and test procedures for both the recycled material and of the final products after production.

This is extremely knowledge and time-consuming and might be possible for very big companies with own regulatory teams and skilled material specialists, but for smaller companies this is an immense task to face, and the risk might be too high and thereby it is much safer to keep using virgin feedstock in its production.

Unrealistic requirements

When and where legislation does exist, it can be set at levels that are operationally impossible to meet, effectively stopping companies from acting.

And many of the tests and specifications are based on what is feasible for virgin materials, for instance existing food-contact and safety regulations require full characterization of all substances in a material – including all high-molecular-weight compounds.

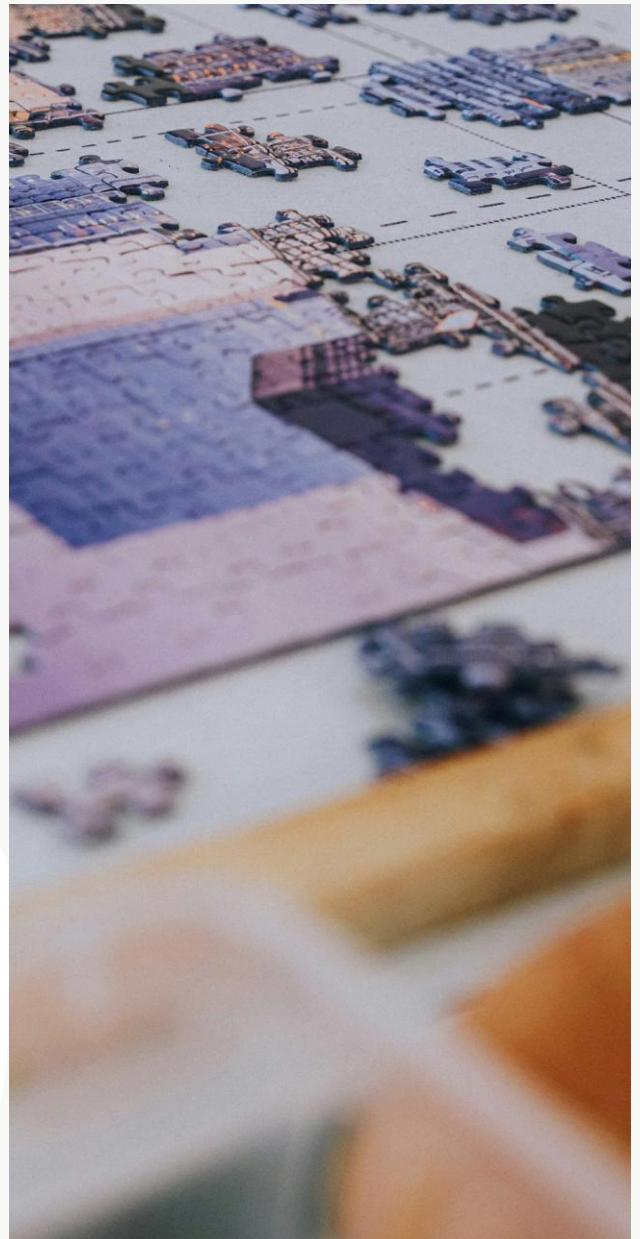
For standardized virgin materials or simple streams like PET bottles, this is feasible. For complex recycled streams, it is not.

Even where requirements are formally described, the analytical methods to fulfil them simply do not exist for mixed recycled plastics.

Building a full substance library for a variable recycled input would require enormous resources with no guarantee of success.

The core issue is that existing regulatory frameworks were built around standardized, well-characterized virgin materials.

They work for simple, uniform streams but break down when applied to complex, variable recycled inputs.



Potential circular solution

Providing standards and legislation enabling easier implementation of recycled plastic will increase the number of companies introducing recycled content into their products and productions thereby increasing the demand for recycled plastic and strengthening the market.

This will not only be an environmental benefit for the companies lowering the carbon footprint of their products but in the long run, with new upcoming regulations from EU on circularity, give the companies a competitive advantage in the market with already established supply chains for recycled materials.

Recommendations

- 1. Graduated Regulatory Targets:**
Introduce phased/stepwise legislation rather than single high-bar requirements. For example, start with 20% recycling targets in year one, scaling to 50% after three years. This allows companies to build capabilities progressively rather than being blocked from the outset.
- 2. Develop Fit-for-Purpose Testing Standards:** Create new analytical methods and tests frameworks specifically designed for recycled materials, rather than forcing compliance with standards built for virgin material. Current requirements (e.g., full identification of all high-molecular-weight substances) are unachievable for complex recycled streams and effectively act as a ban on recycled content.
- 3. Accept Production Variability:**
Companies need to widen production specifications and tolerances to accommodate the inherent variability of recycled feedstock by developing production methods that can handle varying input quality rather than requiring perfectly uniform material.



About CFIT:
Duration: 2022-2025

Partners: University of Copenhagen, Aarhus University, Aalborg University, Nopa Nordic, Trebo ApS, LEGO Systems, Matas, Novo Nordisk Denmark A/S, Danish Technological Institute, Technical University of Denmark.

Funding: TRACE

Mattresses – Reuse and Recycle Systems, a pilot to scale

Purpose

The project develops new approaches for reuse and recycling of mattresses, according to the quality and recyclability of the mattresses and based on intensive stakeholder insights.

The project provides essential elements enabling implementation of the reuse/recycling value-chain involving criteria for the collection system and reuse/recycling options, and quantification of environmental emissions and impacts.

Municipalities are obliged to increase recycling and, in particular, reuse, but mattresses represent a problematic waste fraction that must be solved to save CO2 emissions.

While advances have been made outside DK, no value-chain, no consistent quality tests or reuse/recycling criteria, and no collection/management system exists in DK.

The environmental consequences are unclear. Currently, mattresses are poorly utilized.

Obstacles

Lack of EPR legislation

There is currently no EPR legislation on mattresses supporting mechanism to force or fund systematic collection and recycling.

Attempts were made to establish a voluntary industry scheme, but it collapses if it is not supported by the entire industry and especially the larger players in the market.

The missing EPR legislation also results in the mattresses currently ending up at recycling stations, where they get contaminated and dirty, reducing their recycling potential.

A separate collection system is needed but is expensive and difficult to organize, and nobody takes the lead in funding it - Voluntary Schemes Don't Drive Action!

Product and material standards

Mattresses are highly diverse in design and composition. Some contain laminated/glued layers that cannot be separated or recycled, and different types of PUR foam may have different chemical compositions that cannot be mixed in the same recycling process.

The sheer variety of mattress designs makes standardized recycling processing very difficult.

Potential Circular Solution

The critical volume of discarded mattresses is there for justifying investments in dedicated recycling facilities. Currently most discarded mattresses go to incineration in Denmark.

A recycling system would divert significant material streams from burning, recovering embedded value instead. Besides PUR foam, mattresses might also contain other recyclable materials such as metal (springs), textiles and wood from frames.

Another sustainable solution such as cleaning and reuse of discarded mattresses are not yet being explored.

Recommendations

1. **Establish Mandatory EPR Legislation for Mattresses:** this is needed since voluntary industry agreements have proven insufficient. A EPR would fund the collection infrastructure, create a level playing field for all producers, ensure consistent, long-term financing and enable a dedicated collection system

2. **Minimum required recycled content:** Through EU regulation mandate minimum recycled content in new mattresses (potentially up to 30%) coming from discarded mattresses promoting establishing a recycling infrastructure and creating a new circular solution for PUR mattresses.
3. **Develop Reuse Pathways:** A critical recommendation is to not focus exclusively on material recycling but to build parallel reuse systems. Sort near-new mattresses for direct reuse (shelters, hostels, schools), engage social economy enterprises to refurbish mattresses (new covers, cleaning) and recognize that reuse is higher on the waste hierarchy and delivers more value.

About Mattresses:

Duration: 2022-2025

Partners: Technical University of Denmark, Vejle Municipality, Odsherred Municipality, Capitol Region, Copenhagen Municipality, Amager Ressource Center (ARC), ARGO (Affald, Ressourcer, Genbrug og Overskud), Vestforbrænding, Danfoam/Tempo-Sealy, Bramming Plast Industry.

Funding: TRACE

Circular Electronics

- CirkEL

Purpose

CirkEL aims to advance the electronics industry towards a more circular and sustainable future.

The overall purpose of the project has been to introduce a platform where the electronics industry can be converted from a linear to a more circular industry.

Key stakeholders from across the value chain were brought together to develop innovative demonstrations that could increase the reuse, repair, refurbishment, and recycling of electronic products.

Obstacle

Safety regulation prevents repair of electronics: For consumer electronics products, a promising route for prolonging the lifetime of products is for end users to repair their own products.

With this purpose in mind, Nilfisk has developed three repair kits for a specific vacuum cleaner.

After a review of the EU Machinery Directive 2006/42/EC, a challenge has been observed. Although the Directive does not contain a

single article that expressly forbids consumers from servicing machines, several clauses make it clear that all maintenance and repair work must be carried out “in a safe manner,” which implicitly requires qualified personnel.

For machinery connected to the 220 V mains, Danish electrical regulations further stipulate that only certified electricians may work on the high-voltage circuit.

Consequently, Nilfisk cannot continue with two of the three repair kits, as they would allow unqualified users to intervene in the 220 V section of the machine.

Potential circular solution

Many electronic products are of a high value and normally it is only one part failing to make the entire product not functional anymore.

Creating both economic incentives, easy-to-repair guidelines and simple spare-part infrastructure will create a new repair/spare part business for the manufactures and at the same time prolonging the lifetime of the products.

Recommendation

Adapt regulations to make it simpler for companies to advise end users on more complex repair operations without legal risk.

By providing safety instructions, manufacturing companies can thus increase the number of possible repair activities dramatically.

This legislative change would promote repair as a preferred option over buying new products.

About CirkEL:

Duration: 2023-2025

Partners: Danish Technological Institute, Ragn-Sells Denmark A/S, Trebo ApS, Eldan Recycling A/S, Techsave A/S, European Recycling Platform Denmark A/S, Bang & Olufsen A/S, KK Wind Solutions A/S, Schneider Electric Denmark A/S, Nilfisk A/S

Funding: Danish EPA, MUDP



Circular Sandbox: Test environments for innovation

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Obstacles

Circular innovations that challenge established product paradigms often face barriers - not because they are unsafe or unproven, but because the systems around them are designed for linear products on a scale.

To accelerate the transition to a circular economy it is required that some solutions go beyond incremental improvements to existing linear systems.

To enable such shifts, there is a need for controlled environments where innovative circular solutions and business models can be tested outside the constraints of frameworks designed for established markets.

The EU has introduced regulatory sandboxes in areas such as AI and finance, allowing new technologies to be tested under supervised conditions before full regulatory compliance is required.

A similar concept — “a circular sandbox” — could accelerate the development and market introduction of circular products, services, and business models that do not yet fit within existing structures.

The ReGlove project is a concrete example. ReGlove has developed a reusable nitrile examination glove with an associated washing process for the healthcare sector presenting a paradigm shift from traditional single-use product to reusable solution.

The solution is technically validated and shows clear environmental benefits from the second use cycle onward.

However, public procurement processes for hospital gloves are structured around purchasing large, defined volumes of single-use products, often covering entire regions over multiple years.

A start-up company offering a circular product-as-service model cannot realistically compete under these conditions. The tender structure itself becomes the barrier — not the product, and not the regulation.

This pattern is not unique to ReGlove. Across sectors, circular solutions that introduce new product categories, service models, or material flows risk being excluded from the market simply because existing procurement and regulatory frameworks do not accommodate them.

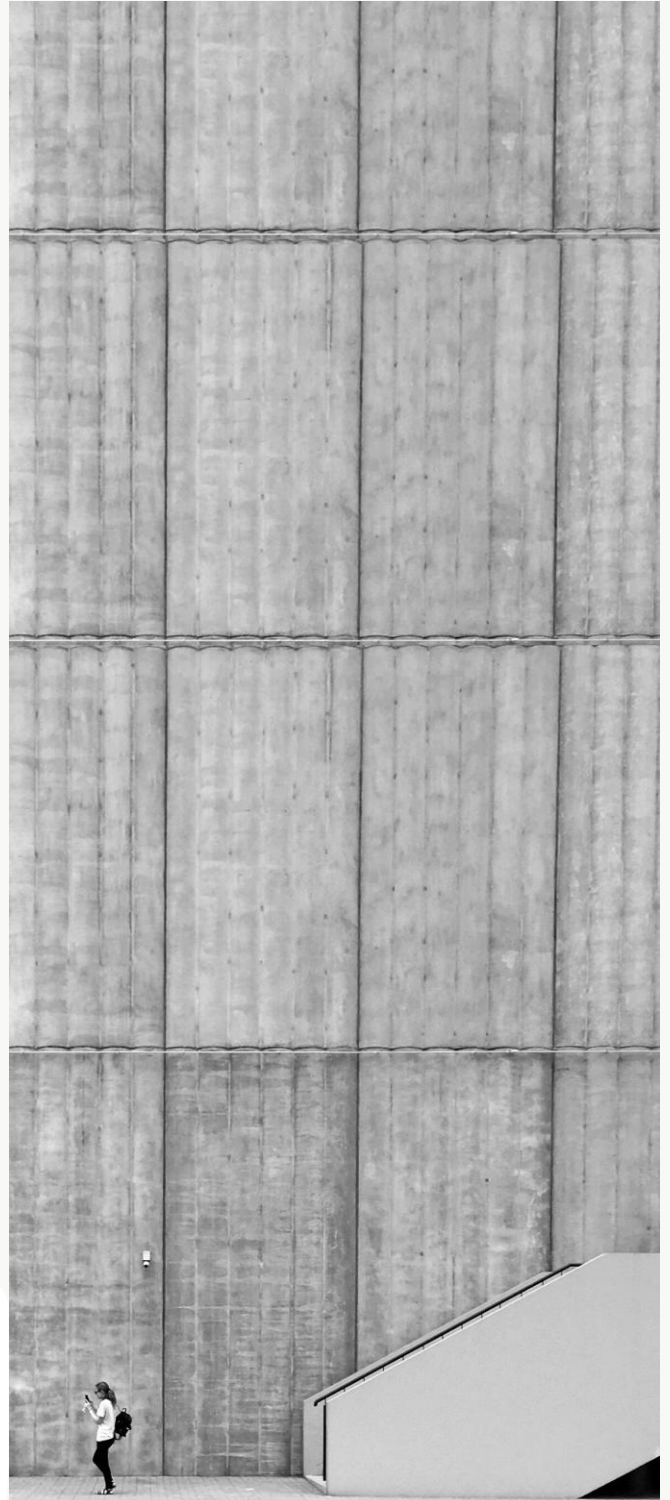
The project “Tekstilbroen” demonstrates that regulatory exceptions for circular purposes can work in practice.

Türkiye has import restrictions on textiles that would normally prevent used textiles from being shipped into the country. Through sustained dialogue involving the Danish Ministry of Foreign Affairs and the Consulate General in Istanbul, the project managed to obtain permission to import Danish hospital textiles for recycling – effectively creating a de facto sandbox situation where an exception was granted to test a circular value chain within a restrictive regulatory framework.

The experience shows that targeted, supervised exceptions can unlock circular solutions without compromising the intent of existing regulations.

However, achieving this requires extensive time and diplomatic effort that most projects and companies cannot mobilize.

A formalized circular sandbox framework would make such pathways more accessible and replicable, rather than dependent on ad hoc negotiations.



Potential circular solution

A circular sandbox would allow authorities and companies to test new circular solutions at limited scale under defined and monitored conditions.

For public procurement, this could mean introducing smaller, dedicated test tenders alongside conventional large-scale bidding processes.

For regulation and standards, it could mean allowing temporary, supervised deviations where existing rules are not yet adapted to circular models. In both cases, the sandbox serves a dual purpose: it gives innovators access to real-world conditions, and it gives authorities and procurers practical experience with circular solutions before adapting broader frameworks.

This is not about lowering the bar. It is about creating structured pathways for solutions that have the potential to deliver significant environmental impact but need a different entry point.

Recommendations

1. **Establish a "circular sandbox" framework** at national and EU level, enabling controlled testing of circular products, services, and business models that fall outside existing standards and procurement structures.
2. **Introduce pilot procurement mechanisms** in public tenders that allow smaller-scale testing of new circular solutions alongside conventional procurement processes.
3. **Use sandbox outcomes** as a basis for adapting regulation, standards, and procurement criteria to better accommodate circular innovation.

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