Interreg
CENTRAL EUROPE

European Union
European Regional
Development Fund

ENTeR

ENTeR
Expert Network on Textile Recycling

E-REPORT
"PILOT CASES"

PARTNERS

Textile Cotton and Clothing Centre

Industrial Unione of the Province of Varese

Pannon Business Network Association

INNOVATEXT Textile Engineering and Testing Institute Co.

Saxon Textile Research Insitute

SACHSEN!TEXTIL e V.

INOTEX LTD

CTPT - Czech Technology Platform for Textile

LUKASIEWICZ Institute of Aviation

PIOT - Federation of Appareal & Textiles Industry Employers

CONTENT

1. THE PROJECT

The **ENTER – Expert Network on Textile Recycling** – project is a partnership of research centres, company associations and clusters in the textile sector, from five countries in Central Europe: **Italy (Lombardy), Germany (Saxony), Czech Republic, Hungary and Poland**. It focuses on cutting wastes to prevent consuming non-renewable resources in the textile and clothing industry.

The **project strategy** aims at creating sustainable connections between the stakeholders of textile innovation in Central Europe: companies, associations and specialized research centres, to strengthen the industrial innovative power. Cooperation aims at enhancing the management of industrial wastes and at fostering **a common approach to the Circular Economy** by developing the offer of common innovative services by the concerned research centres and associations.

Working in a Circular Economy means cutting wastes by leveraging on design, the ability to redefine wastes (by re-thinking them in terms of new raw and secondary materials and products) and on the duration of the average useful life for the goods (extending their useful life cycle means reducing the consumption of raw materials).

2. PILOTE CASES APPROCH

In the recent report "1**0 Circular investment opportunities**" by Ellen Mac Arthur Foundation it emerges that 87% of the fibers used to produce clothing are destined for incineration or landfill and only 1% is recycled into new garments. clothing. Before the global pandemic, more than $ 500 billion was lost due to underutilization of clothing and a lack of recycling. The European Union has identified the textile sector as one of the priority sectors on which to work for a zero-emission and circular future, laying the foundations for a sustainable recovery of the fashion sector which in 2019 moved 162 billion euros in the old continent alone. The transition to the circular economy is in fact one of the focal points of the entire European strategy which also aims to give a boost to the secondary raw materials market. The European strategy on sustainable textile products is also accompanied by the eco-design directive, the so-called Ecodesign directive which draws attention to harmful chemicals in textile products.

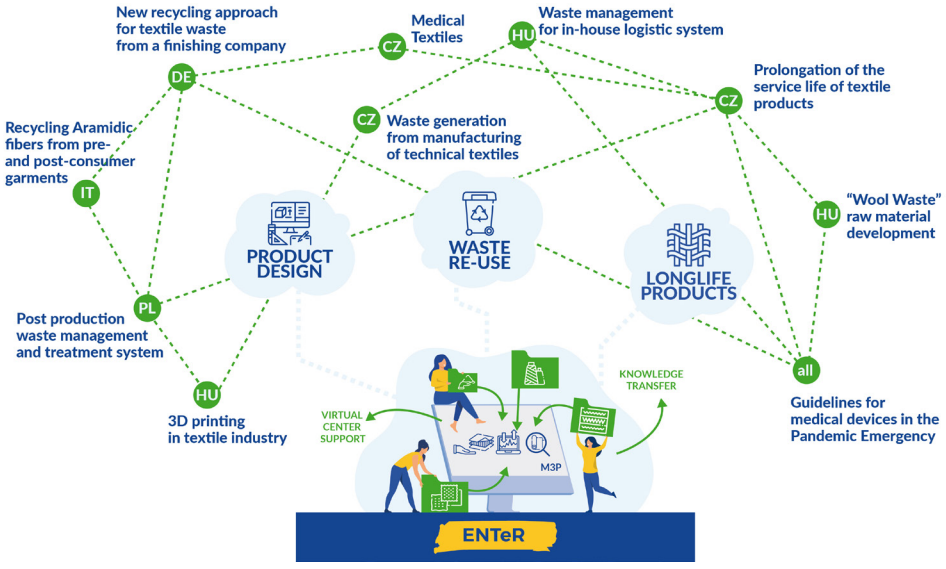
In this context, the partners promoted the ENTeR project in order to strengthen the innovative capacity of the textile sector and spread the principles of the Circular Economy within it. The partnership is made up of research centers and business associations / clusters in the textile sector belonging to five Central European countries: Italy, Germany, the Czech Republic, Hungary and Poland.

ENTeR, a co-funded project under the Interreg Central Europe program, used a cross-sectoral matchmaking platform developed within the **European Life M3P** project, to create a system capable of enhancing the reuse of industrial textile waste, based on the characterization and classification of their properties, as well as on the technologies capable of transforming these wastes into other materials / semi-finished products / products.
In fact, the **M3P platform** favors the meeting between the demand and supply of waste materials from various production sectors and which are often destined for landfill or waste-to-energy and which can instead represent an important resource for other companies interested in reusing them and recycle them.

Through the platform it was therefore possible to develop a "**digital ecosystem**" that facilitates cooperation both between companies belonging to the same supply chain and between companies operating in different value chains or, in other words, fertile ground for industrial symbiosis has been created. At the same time, starting from individual cases of good practice, the platform can be an important tool for developing a strategy that coordinates the flow of materials of local networks in a circular perspective.

	WASTE CATALOGED	COMPANIES INVOLVED
TOTAL	545	259

In addition, the **ENTeR project** has developed a "Virtual Center" through which all partners have put at the service of companies the knowledge and experience necessary to help them solve problems relating to recycling and reuse, even in a creative way, of waste. textiles.
Thanks to this work of coordination and sharing of various knowledge, **10 pilot cases** have been developed that represent good practices to bring textile companies closer to increasingly sustainable and circular development models.



3. PILOTE CASES LIST

Ten pilot cases have been carried out.

No.	TITLE PILOT CASE	PARTNER
1	New recycling approach for textile waste from a finishing company	STFI (Saxony)
2	Waste generation from manufacturing of technical textiles	INOTEX (Czech Republic)
3	Waste reduction thanks to prolongation of the service life of textile products	INOTEX (Czech Republic)
4	Medical Textile – COVID-19	INOTEX (Czech Republic)
5	Recycling Aramidic fibers from pre- and post-consumer garments	Centrocot, UNIVA (Lombardy)
6	Post production waste management and treatment system	IW (Poland)
7	"Wool Waste" raw material development	INNOVATEXT (Hungary)
8	Waste management for in-house logistic system	PBN (Hungary)
9	3D printing in textile industry	PBN (Hungary)
10	Guidelines for medical devices in the Pandemic Emergency	ALL,

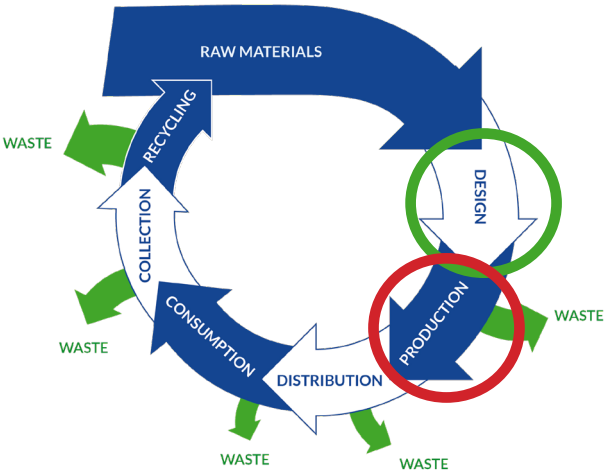
The **ENTeR project** has highlighted that a systemic vision is needed to help a traditional sector such as the textile industry to navigate a more circular world: it is necessary to take into consideration all aspects from the economic, to the social and environmental ones at the same time. **Innovation and good practices developed by European projects**, such as ENTeR, can play a fundamental role in this game, also providing important insights for future technical standardization projects that can facilitate the transfer of innovation to the market

4. DE. PILOT CASE

New recycling approach for textile waste from a finishing company

Positioning of the studied waste:
production waste

Positioning of the solutions found:
Recycling
(scraps are reused for other applications)



Objective
The pilot case aims to recycle PES scraps from textile production waste.

Context
STFI contacted company Textilausrüstung Pfand GmbH, Lengenfeld (DE) as partner for its Pilot case. The company offers contract finishing and functionalization of technical textiles. It generates different kinds of textile waste during the production process.

Operational steps
To help the company with their waste management, STFI and ENTeR-project partner INOTEX (CZ) built up a consortium to work together on solutions on how to recycle this textile waste. Most of the samples from the textile waste produced by Pfand were tested by company Green Way Recycling (Opava/CZ) having a rich experience in processing various waste materials. One kind of waste, namely pure white PES scraps (unfinished and only slightly thermally fixed), has been of great interest. Due to the untreated and smooth structure the material is suitable for a use as underground in horse arenas and for the automotive industry. Transfer activities for the textile waste material took place between the companies Pfand and Green way recycling. The Czech company carried out several testing and feasibility trials and company Pfand provided further waste material.

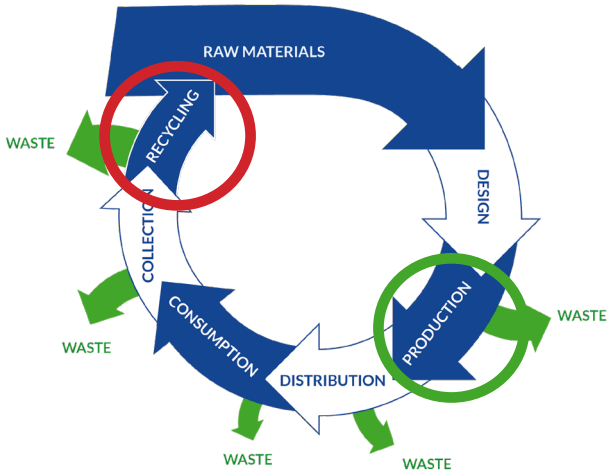
Result obtained
Scraps are reused for other applications

5. CZ. PILOT CASE

Waste generation from manufacturing of technical textiles

Positioning of the studied waste

Positioning of the solutions looked for (waste processing and recycling)



Objective
To find solution for use of waste from production of technical textiles (abrasive cloths, buckrams)

Context
The waste was offered to companies operating the waste processing technologies in Czech Republic; verification tests were provided to assess the processability of the waste.

Operational steps
- characterization of the waste composition
- verification testing of processability of the waste
- use of the waste as material for design products was tested

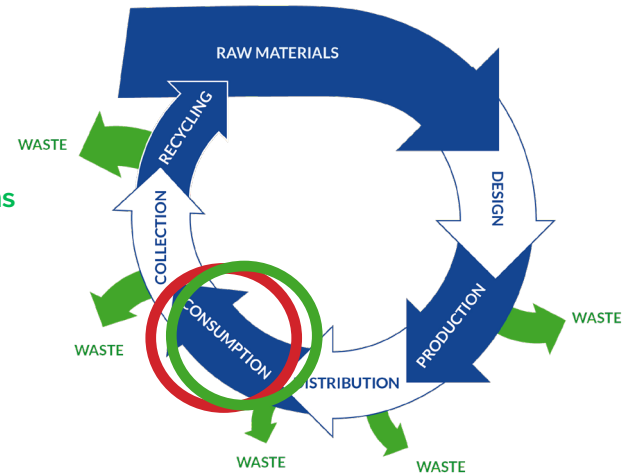
Result obtained
The verification tests of the waste processability by recycling company as well as tests of its´ use as material for design products didn´t bring the positive results. Processing by available mechanical processing technologies was not successful from technical reasons.

6. CZ. PILOT CASE

Waste reduction thanks to prolongation of the service life of textile products

Positioning of the studied waste

Positioning of the solutions found (comparison of the service life length of 100% cotton and blended cotton/PES textiles)



Objective

Study of the influence of a prolongation of the textile products service life thanks to changed material composition on reduction of textile waste and of the raw materials consumption.

Context

Study focusing on material composition used in leasing medical textiles and the lifespan of medical textiles depending on material composition.

Operational steps

Questionnaire survey in laundries with leasing service for medical sector

Processing and evaluation of data from survey

Result obtained

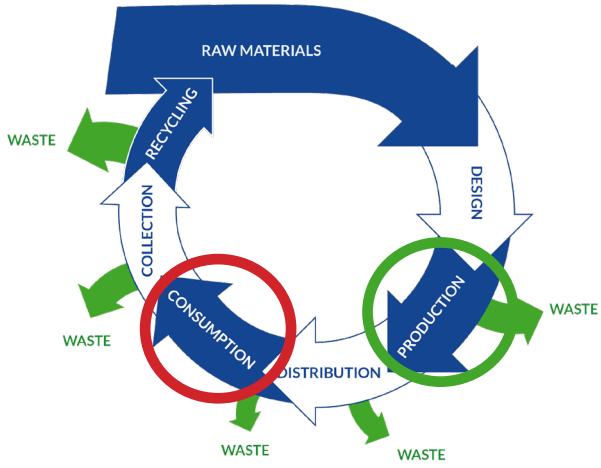
- Study of fabrics at 100% CO and 50% CO / 50% PES.
- Recommendations in tenders. It is recommended to insert not only the cost of renting the products but also an indication on the duration of the product (product life cycles).

7. CZ. PILOT CASE

Medical Textile – COVID-19

Positioning of the studied waste

Positioning of the solutions looked for (waste processing and recycling)



Objective

Within the pilot case "Textile waste coming from medical devices concerning COVID-19 emergency", INOTEX studied reduction of waste from disposable masks thanks to the "self-cleaning" photocatalytic textiles designed for repeated use. It significantly reduces volume of generated waste from face masks.

The study demonstrated the positive effect of the repeatedly usable textile face masks on volume of generated waste. Thanks to the self-cleaning properties and stability of this effect at minimum 50 washing cycles, the "FreshDye" masks significantly contribute to reduction of waste from single-use face masks in Czech Republic, where wearing of face-masks is mandatory almost during the whole pandemic.
This self-cleaning textile may be used also for other types of products as for staff clothing and linen in hospitals or social care homes.

Result obtained

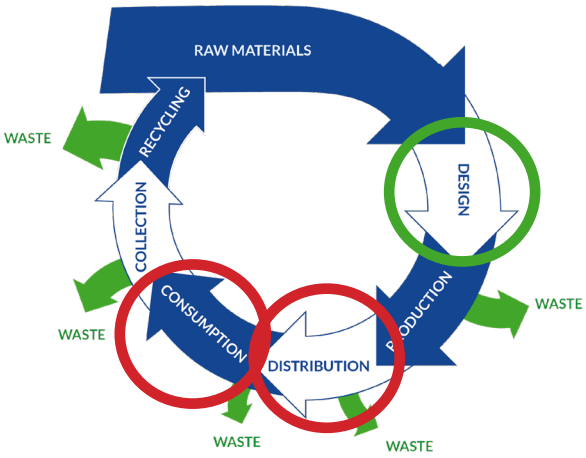
The study demonstrated the positive effect of the repeatedly usable textile face masks on volume of generated waste.

8. IT. PILOT CASE

Recycling Aramidic fibers from pre- and post-consumer garments

Positioning of the studied waste

Positioning of the solutions found (Yarn to be reused in weaving)



Objective
The pilot case aims at recycling the aramidic fibers contained in pre- and post-consumer garments.

Context
A spinning company aims to experiment, with a method of waste management, how to disassembly garments of aramid fibers (coming from another company by M3P).

Operational steps
- Verified how to transport and treat waste in compliance with waste management
- regulations;
- Disassembled test;
- Trimmed parts of the garment with aramidic fibers;
- Carried out laboratory tests to understand the suitability of the yarn for the weaving phase.

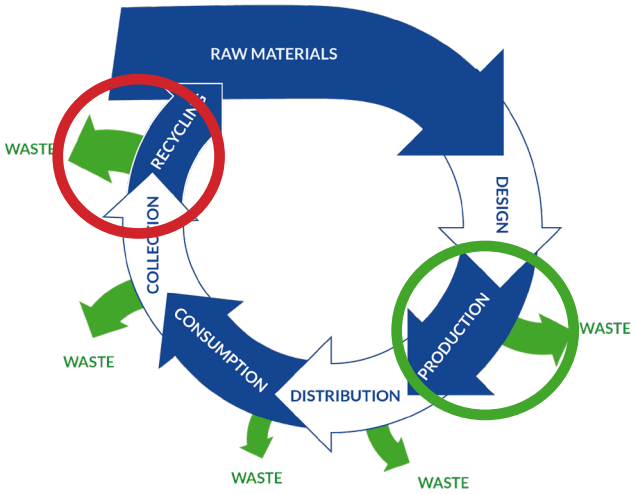
Result obtained
Yarn for the weaving phas

9. PL. PILOT CASE

Post production waste management and treatment system

The studied waste: post-production textile waste

The solution: mechanical recycling



Objective

To find a way of effective post-production textile waste management from production of carpets, woven grass and quilted textile materials. There is an urgent need to find solutions, e.g. recycling possibilities. The costs of waste storage and disposal are very substantial for the companies.

Context

Two textiles companies delivered post-production textile waste. Experts on textile material engineering/processing were invited to cooperate, including textile waste processing plants. The developed solutions were tested in cooperation with processing plant in Tomaszów Mazowiecki and University of Bielsko-Biala.

Operational steps

- Different kinds of post-production textile waste were collected and were assessed in terms of their structure and the raw material composition.
- The potential possibilities of processing or other use of separated waste streams (polyolefins, natural fibers) were assessed and analyzed in cooperation with external experts.
- The possibility of obtaining needled nonwovens from collected post-production textile waste was tested in cooperation with recycling company.
- The possibility of obtaining ropes from selected post-production textile waste, produced according to KEMAFIL technology, was tested in cooperation with University.

The potential application areas for such manufactured products were proposed.

Result obtained

As a result the first ideas of managing and processing of post-production textile waste (mechanical recycling) from production of carpets, woven grass and quilted textile materials were developed (nonwovens and ropes production, according to KEMAFIL technology), including pre-treatment for recycling purposes (waste cutting and then their defibering).

The potential application areas of new products obtained from post-production textile waste result mainly from their structure and the secondary raw material composition and thus they comprise: geotextiles, construction industry, heavy industry (sorbents), forestry, transport, decorations, sealing used for construction of wooden houses.

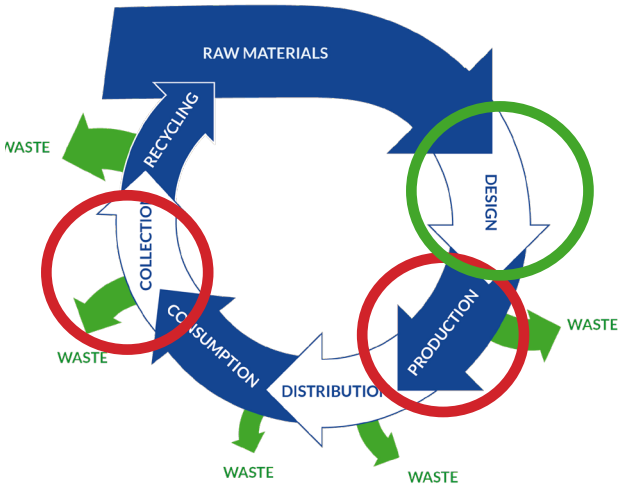
New value chains were created - textile companies with similar waste streams, in terms of their processing possibility, were involved.

10. HU. PILOT CASE

"Wool Waste" raw material development

Positioning of the studied waste

Positioning of the solutions found (wall panels)



Objective
To find potential ways for the recycling of wool felt production waste

Context
Waste is generated in the production of industrial and decorative materials, mainly in the form of cut off material edges. Most of them consist of only 100% wool. The cut edges of the wool felt are too small to sell as felt for decoration and industrial use, so they are out of their business scope. These smaller parts contain the same good quality wool, so they are potential raw materials for another type of usage.

Operational steps
- Catalogue of the waste
- Mapping of the market
- Finding feasible technologies
- Sending the waste to companies for recycling
- Use the waste for designer products and for acoustical wall panels

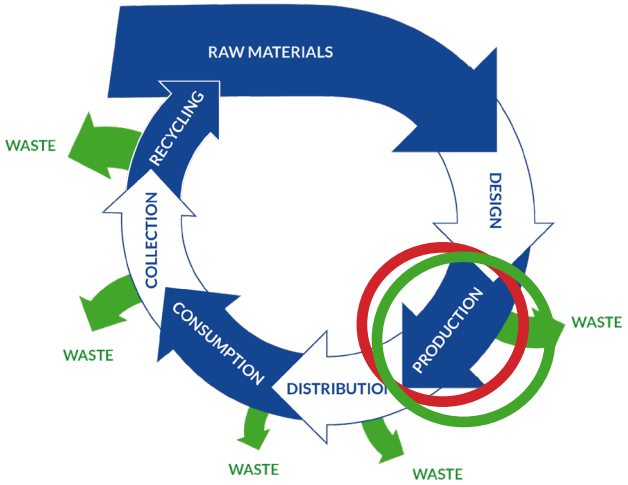
Result obtained
Ways of wool felt recycling in design and interior products, such as acoustical wall panels.

11. HU. PILOT CASE

Waste management for in-house logistic system

Positioning of the studied waste

Positioning of the solutions found (waste management system)



Objective

This pilot case aims to find a solution for the post-production waste generated by manufacture of mattresses, upholstered bedroom furniture and home and household textiles.

Context

Waste consists of cutting waste and textile fabrics, latex, coco-latex or PU foam and of foils and films. The pilot activity shall support the minimalization of the storage cubage of the waste – increasing the storage capacity – and create an easily movable formats of the waste.

Operational steps

The first part of the study is about the current state of the in-house logistic system in the Biotextima company. PBN, the external expert, and the CEO of the Biotextima Kft. had regular meetings in order to find the best possible option for the development. The expert identified the current situation and offered 4 options to Biotextima (1st development framework). The best and most cost-effective solution has been chosen. The expert and PBN analyzed how the company's waste management is developing (2nd development pattern) and carried out laboratory tests to understand the suitability of the yarn for the weaving phase.

Result obtained

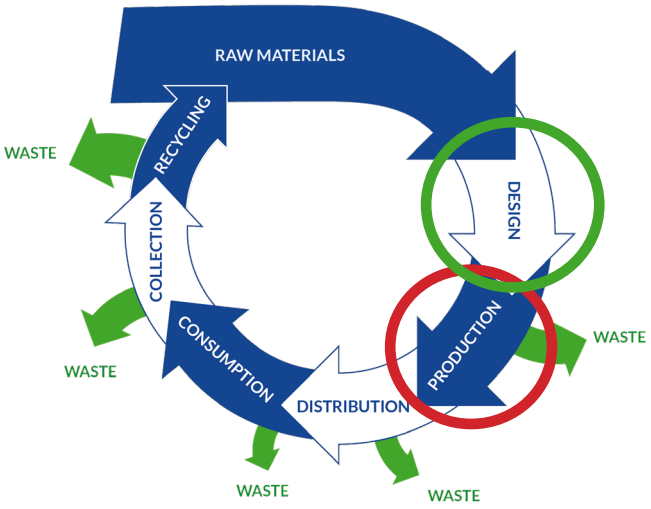
- Solution for recycling and use
- Logistic of the storage cubage and support to handle and move the waste inside / outside company
- Reduction of the company's communal waste quantity

12. HU. PILOT CASE

3D printing in textile industry

Positioning of the studied waste

Positioning of the solutions found (producing 3D print fibres from scrapped plastic granules)



Objective
Producing 3D printing fibers from waste plastic granules.

Context
Another pilot case carried out by PBN is how we could connect 3D printing and textile industry. Meanwhile PBN's spin off company called am-LAB operating as a DIH, unfortunately we didn't have the opportunity to print out full clothes or textiles.

Operational steps
We made several researches how we could integrate the modern technic, when we have found the opportunity: we bought recycled filaments and recycled shirts and combined them with creativity. We cooperated with a local gym and a kindergarden, who were very happy to use the recycled shirts. The applicants sent us their logos, which were scanned. Logos were printed out and the applicants used the shirts and made several stress tests to them (e.g. training, washing machine and dryer).

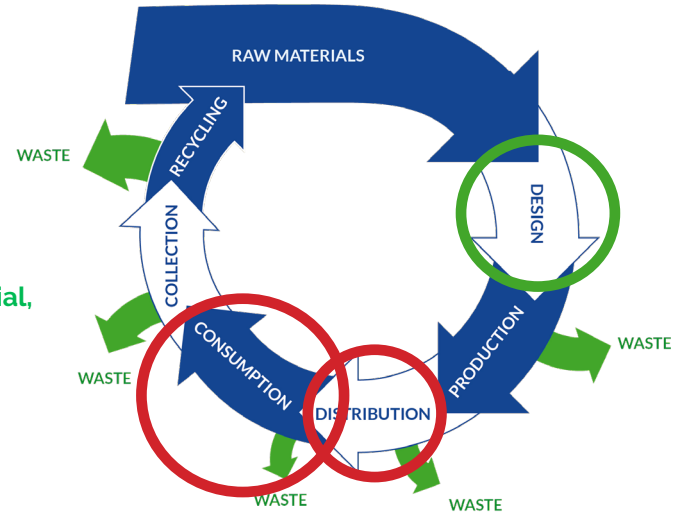
Result obtained
The results were good, and the workers were happy that they could use the recycle method combining with modern technic.
It can be concluded that it is justified to use filaments made of recycled plastic in 3D printing.
This kind of creative but also environmentally conscious creation can play a role not only in the fashion industry, but also in the home space.

13. ALL PILOT CASE

Guidelines for medical devices in the Pandemic Emergency

Positioning of the studied waste

Positioning of the solutions found (positioning of the solutions found (new material, waste management)



Objective

The Additional Pilot Covid-19 wants to define a potential new way to manage medical textile waste in order to foster their recycle and/or reuse.

Context

The dramatic increase in the use of disposable textile medical devices (e.g. medical masks, surgical gowns, surgical drapes, gloves, etc.) related to the COVID-19 emergency is leading to an increase of waste production. Usually, these wastes come from medical structures (hospitals, clinics, surgeries, etc.) and they follow specific procedures (according to national and international regulations) for their after-use disposal, packaging, transport, stock, destruction and / or sanitation. COVID-19 emergency is changing the waste stream due to the large use of protective medical devices (in particular medical masks) by citizens with a waste that is generated outside the usual medical structures and that doesn't follow the usual disposal procedure but is collected with the urban waste.

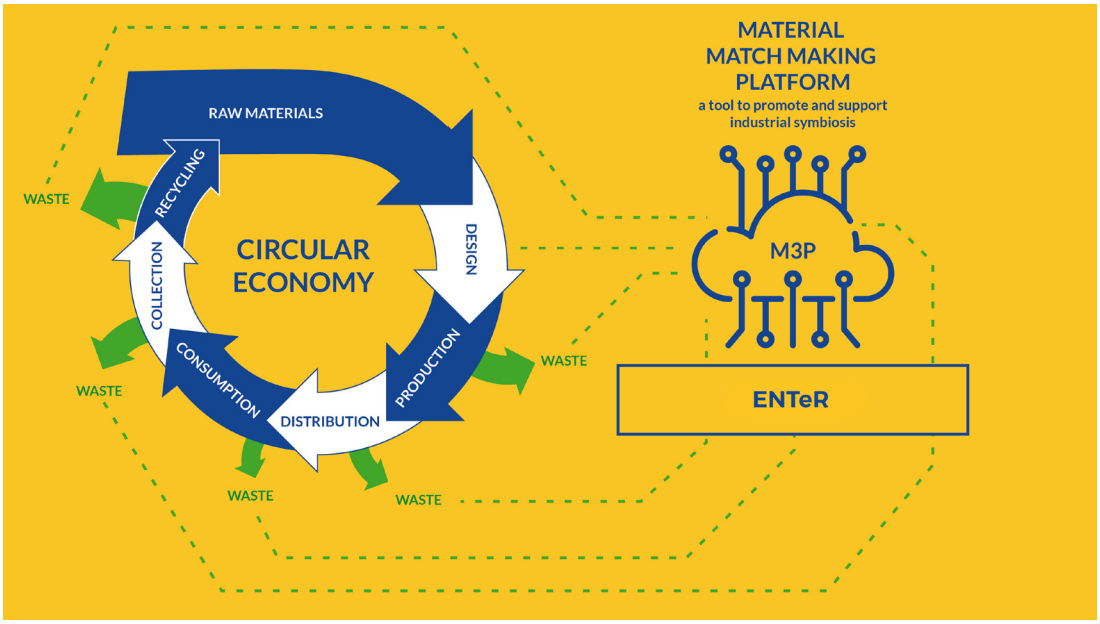
Operational steps

- Study the medical textile waste nature (in terms of base material, chemicals and biological contamination);
- Define the current procedures for medical textile waste management;
- Study chemicals removal and biological decontamination needed for recycle/reuse of the materials;
- Evaluate economic and environmental benefits coming from recycle/reuse;
- Create guidelines and best practices for a new and more sustainable waste management for municipalities, regions and other relevant authorities.

Result obtained

Guidelines for textile waste coming from medical devices concerning COVID-19 emergency:

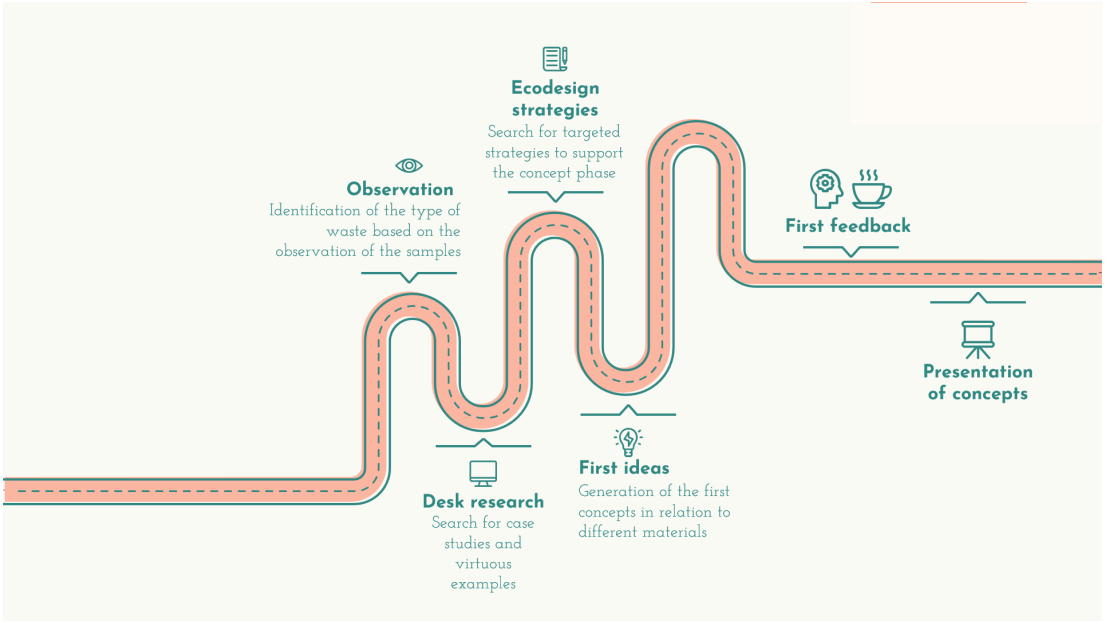
- Treatment of medical textile waste
  - Current procedures for the management of medical textile waste
  - Materials and chemicals for medical textiles
  - Chemicals removal and sanitation
- Recovery of medical textile waste
  - Standard protocols for the management and treatment of medical textile waste
- Reuse of medical textile waste
- Environmental evaluation
- Economic evaluation
- Best Practices



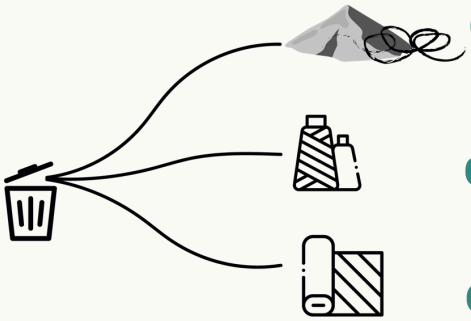
3. CONCEPTS FOR THE CIRCULAR ECONOMY

A laboratory for the promotion of the circular economy, in which creativity and high technical skills are combined with versatility and technological innovation. Thus during the ENTeR project, together with the designers, the waste textile materials of the textile industries were studied in an effective way in order to give new life to the waste and face the challenges related to reuse and reuse.

Methodology



Waste Classification



01 MACRO/MICROWASTE

Small and irregularly cut waste, branded and that can be used as filler in new materials

02 YARNS

Spools not out of stock but whose yarn is new and of good quality

03 FABRICS

Pieces of non-branded fabric, fairly large and good quality pieces

Waste Analized

Concepts realized

Portapanino

COTTOM

UNWINDABLE JERSEY

PUL COTTON JERSEY

CIRCULAR MATERIALS
Cotton (for external part and laces) and warp knit (for label)
ADDITIONAL MATERIALS
PUL cotton jersey (waterproof fabric suitable for contact with food)

MATERIAL ORIGIN: 60% circular materials, 40% virgin materials
PROCESSING: cutting, assembly, stitching
USE: the object avoids the use of disposable wrapping material, is washable and reusable, allowing you to easily bring your lunch to work or school.
END OF LIFE: the object must be manually disassembled to be properly recycled, PUL could be a problem at the end of its life, but for the functionality and durability of the product it is the only usable material on the market today.

Lunch box

PUL COTTON JERSEY

COTTON

CIRCULAR MATERIALS
Cotton (per outer bag with laces)

ADDITIONAL MATERIALS
PUL cotton jersey (waterproof fabric suitable for food contact for inner bag)

MATERIAL ORIGIN: 60% circular materials, 40% virgin materials
PROCESSING: cutting, assembly, stitching
USE: the object avoids the use of disposable wrappers, it is washable and reusable
END OF LIFE: the object must be manually disassembled to be properly recycled, PUL could be a problem at the end of its life, but for the functionality and durability of the product it is the only usable material on the market today.

Labels

UNWINDABLE JERSEY

CIRCULAR MATERIALS
Unwindable jersey

MATERIAL ORIGIN: 100% circular materials
PROCESSING: printing, cutting, hot cauterization of the edges (probably feasible, after verification, with laser cutting)
USE: the label is washable, strong and durable
END OF LIFE: the object must be disassembled manually, is it potentially possible to recycle the material again?

Seat cover

SHEET IN PP

FABRIC ELASTIC

14

CIRCULAR MATERIALS
Tarpaulin in PP
ADDITIONAL MATERIALS
Cotton thread, Elastic fabric

MATERIAL ORIGIN: 95% circular materials, 5% virgin material
PROCESSING: washing of the material, cutting, assembly, packaging
USE: Waterproof, sturdy and durable bicycle seat cover
END OF LIFE: the object must be manually disassembled to be properly recycled

Dress cover

SHEET IN PP

14

CIRCULAR MATERIALS
Tarpaulin in PP
ADDITIONAL MATERIALS
Cotton thread, Zipper

MATERIAL ORIGIN: 95% circular materials, 5% virgin material
PROCESSING: washing of the material, cutting, assembly, packaging
USE: Accessory for wardrobe / storage and transport of clothes
END OF LIFE: the material can be recycled

Padded

THIS PROTOTYPE MAINLY WANTS TO EVALUATE THE CAPACITY OF VISCOSE STRINGS TO ACT AS PADDING.

LINING, PADDING AND LABEL SO ASSEMBLED COULD CONSTITUTE THE BASE FOR CIRCULAR UPHOLSTERY (CUSHIONS, QUILTS, COATS ..)

9

1

8

CIRCULAR MATERIALS
Lining (outside), viscose cords (padding), warp knit (label)

MATERIAL ORIGIN: 100% circular materials
PROCESSING: cutting and sewing of the lining, printing, cutting and cauterization of the label, padding and final stitching
USE: good softness and compactness of the upholstery, good yield in the lining (the cords do not tend to come out of the lining)
END OF LIFE: the object must be disassembled, the padding can probably be reused in a second cycle

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ENTeR – Expert Network on Textile Recycling

ENTeR works in five central European countries that are involved in the textile business, to promote innovative solutions for waste management that will result in a circular economy approach to making textiles.
The project will help to accelerate collaboration among the involved textile territories, promoting a joint offer of innovative services by the main local research centres and business associations ("virtual centre"), involving also public stakeholders in defining a strategic agenda and related action plan, in order to link and drive the circular economy consideration and strategic actions.
The approach of the proposal and the cooperation between the partners are oriented to the management and optimization of waste, in a Life Cycle Design (or Ecodesign) perspective.