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CLEANTEX

Clean and Innovative Textiles Strategy for Circular Economy

Intellectual Output 3: E-book

Practical guides on implementation of life cycle assessment and eco-design applied in textile design and manufacturing.

CLEANTEX project (CLEAN AND INNOVATIVE TEXTILES STRATEGY FOR CIRCULAR ECONOMY; project reference number2020-1-LT01-KA203-077874) is funded by the Erasmus+ programme of the European Union.

Content

1. Cleantex Project Introduction

1.1 Cleantex project

The European textile sector is facing major challenges to implement the green transition. CLEANTEX aims to develop customised training materials for companies and university students in the textile sector about circular economy and eco-design to boost their innovation potential to thrive sustainable solutions.

In this context, the CLEANTEX project is developing the tools for the upskilling of the textile sector and particularly higher education students, in order to obtain its objectives:

1. To support the upskilling of the textile industry (students and companies) towards the green transition favouring the uptake of skills in sustainability, circular economy and eco-design.

2. To foster innovative training methodologies based on multidisciplinary hands-on activities.

3. To strengthen knowledge, skills and competences using virtual learning methodologies and tools.

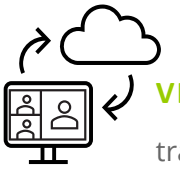
4. To promote the uptake of good practices towards a more sustainable textile industry.

5. To strengthen collaboration among universities, technological centres and the textile industry.

CLEANTEX will generate an impact to the different target groups including students of HEIs (both design and textile), textiles' companies and their managers as well as other stakeholders from the textile ecosystem, who will benefit from the outputs generated during the project lifetime.

For that, CLEANTEX aims to promote the uptake of circular economy and eco-design concepts to develop the skills of students in textile engineering and other disciplines through cross-sectoral cooperation in HEIs in order to tackle the main pollution problem in textile industry

and reach a more sustainable sector. For all these reasons, the Cleantex Consortium is working to elaborate a set of implementation activities will materialise the project objectives, supported by preparation, management, quality and dissemination activities that will ensure the outreach of its results even after the project has ended. All the project results are the outcomes of our intellectual outputs. CLEANTEX is developing four intellectual outputs and organising one intensive training summer course to address the project objectives, below it is possible to observe the main Intellectual outputs relating the Cleantex Project.



VIRTUAL TRAINING PROGRAM: Our learners can find a virtual training program with open educational resources on circular economy and eco-design with a focus on the textile industry.

BOOTCAMP: Developing an Industrial clean textiles bootcamp training with innovative materials and methodologies. Materials will also be used in the intensive training summer course.

LIFE CYCLE AND ECO-DESIGN E-BOOK: you are reading it right now; this e-book is a practical guide that includes practical cases on how to apply life cycle assessment and eco-design in the advanced textile manufacturing industry.

TRAINING SUMMER COURSE: Organising an intensive training summer course using the bootcamp methodologies with students from the 3 universities in CLEANTEX partnership. The summer course will be organized in 2022 in Ljubljana.

All intellectual outputs produced will remain online; that means that the virtual training program, the intensive summer school and the e-book will be available online and can be downloaded for free, and beyond that via direct inquiry to the partners. Interest stakeholders, who are interested in further studying the sector, could easily exploit them.

Moreover, CLEANTEX activities are aligned with new future policies like Circular Economy Policy and Industrial Policy and textile policies.

1.2 E-book goals

The aim is to create an e-book with practical guides on implementation of life cycle assessment (LCA) and eco-design applied in textile design and manufacturing. This e-book is a practical and efficient guide where the learner can find a clear and practical definitions of tools and methodologies related to LCA and eco-design regarding textile sector.

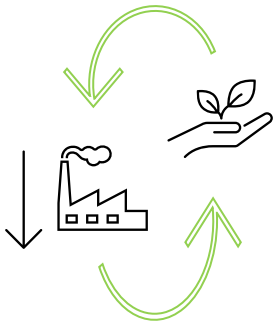
Also, in this e-book is possible to find a brief overview of the current textile situation for each step of the production value chain.

In particular, this e-book is crucial for the implementation of life cycle assessment and eco-design in the textile design and manufacturing. It gives readers practical information to improve the impact of textile industry in the circular economy, providing the necessary contents to apply LCA and eco-design in real cases as textiles or clothes. Moreover, it includes examples of how to perform an LCA in a practical way.

The Implementation of this e-book will be during the summer course, in order to test the activities previously done like: (IO1) the virtual training course and this one (IO3) the e-book; hackathons will be held in Ljubljana to improve the relationship between students and business sectors and obtain feedback in order to finish the e-book draft of IO3 because the first draft of the e-book will be proved in the summer course in Ljubljana. Also, more students from other universities acros European (and non-European) countries will have the possibility to get engaged in the e-book and project-based training after the end of the CLEANTEX project, furthermore, this type of content is not only specific for university students but can also be used by external organisations wishing to organise courses for managers, professionals, senior technicians, students and entrepreneurs in the textile industry.

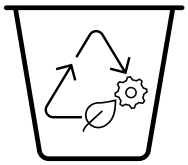
1.3 E-book benefits

The advantages of learning about LCA methodology and eco-design criteria applied in the textile sector can give the learner different points of view on how to apply different methodologies and good environmental practices and gain the potential benefits of using eco-design. Some of the numerous kinds of benefits are listed below:



Lower production and labour costs and greater efficiency

Most suitable product design life



Improved environmental performance

Easier disassembly and increased potential for recycling

Reduced material and resource costs

Lower waste disposal costs

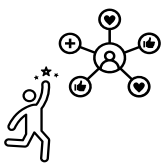
Easier and lower cost of compliance with legislation

Improved functionality and quality of products

Increased market share

Improved customer and supplier relationships

A better working environment and business culture for your staff



Ecodesign can also lead indirectly to economic benefits, such as providing a useful marketing tool and encouraging innovation and product development. Choosing eco-design and their good practices the companies will reduce their carbon footprint.

For more information about Cleantex project, please visit the project website: https://cleantexproject.eu/ and through social networks with the hashtag #CLEANTEXproject in LinkedIn and Twitter.

2. Methodologies

2.1 LCA definition

The methodology chosen to assess the potential environmental impacts is based on the life cycle assessment (LCA) methodology.

The first definition of the LCA was done by the Society of Environmental Toxicology and Chemistry (SETAC) (1993). According to SETAC, LCA can be defined as: "A process to evaluate the environmental burdens associated with a product, process, or activity by identifying and quantifying energy and materials used and wastes released to the environment; to assess the impact of those energy and materials used and releases to the environment; and to identify and evaluate opportunities to affect environmental improvements. The assessment includes the entire life cycle of the product, process or activity, encompassing, extracting, and processing raw materials; manufacturing, transportation and distribution; use, re-use, maintenance; recycling, and final disposal".

The LCA methodology exposed in this e-book is based on two ISO standards ISO 14.040[1] and ISO 14.044[2], as well as the recommendations of the International Life Cycle Data System (ILCD) Handbook.

LCA as standardized methodology follows four interrelated stages:

a) Goal and scope definition

b) Life cycle Inventory (LCI)

c) Impact assessment

d) Interpretation

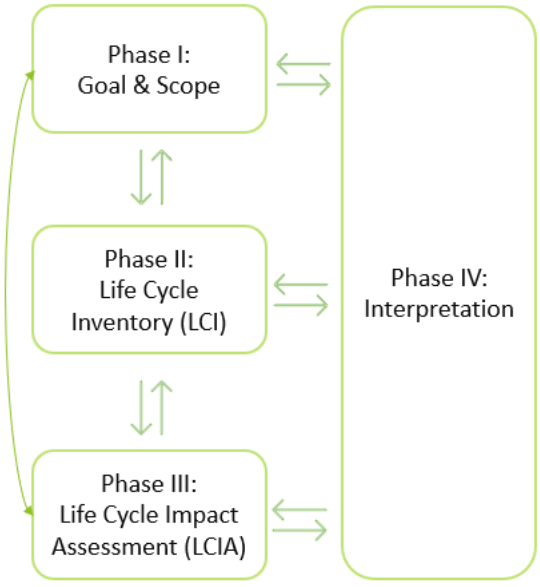


Figure 1: Stages of the LCA[2]

[1] ISO 14.040:2006: Environmental management - Life cycle assessment - Principles and framework.
[2] ISO 14.044:2006: Environmental management - Life cycle assessment - Requirements and guidelines.

Phase 1: Goal and scope definition

The first stage y is the goal and scope definition, which defines the general context for the study. In this stage, parameters such as the functional unit, the intended applications of the study, reasons for carrying out the study, the boundaries, the limitations and assumptions are described.

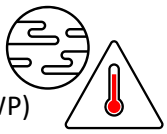
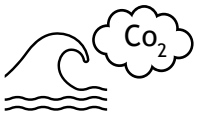
Phase 2: Life cycle inventory (LCI)

The inventory analysis comprises the data collection and the calculation procedures to quantify the inputs and outputs through the system boundaries. Two types of data are used to assess the environmental behaviour: primary and secondary data. Primary data is the one that is collected, measured, or estimated for product system; secondary data is derived from other sources such as literature or databases such us Ecoinvent.

Phase 3: Life cycle impact assessment (LCIA)

In this phase the potential effects produced in the environment are identified and characterised. These potential environmental impacts are associated with the inventory flow (phase 2). The calculations can be done using specialized software like SIMAPRO or GABI.

Environmental impact categories are used to express the potential environmental impacts, the ones showed in these lessons are the following:

- Global Warming Potential (GWP) 
- Eutrophication Potential (EP) 
- Acidification Potential (AP) 

- Primary Energy Demand (non-renewable) (PED) 
- Water Use and Water Consumption (WU and WC) 

Phase 4: Results and interpretation

In the final step of the LCA, the interpretation of results, a critical revision of the results is done to verify its reliability. In this step the completeness, sensitivity and consistency of data gathered, and results obtained are done to guarantee their representativeness and suitability to be incorporated in created processes for datasets and impact assessment methods.

In summary, the four phases of Life Cycle Assessment (LCA) consist of assessing each of the environmental effects generated throughout the life of the product, i.e. from the sources of primary resources (from its "cradle") to its consumption and final disposal (to its "grave"). This makes it possible to identify the impacts on the different environmental compartments beyond the boundaries of the production plant. The life of a product starts at the design and development of the product and ends at the end-of-life activities (reuse, recycling, etc.) as shown in the following figure:

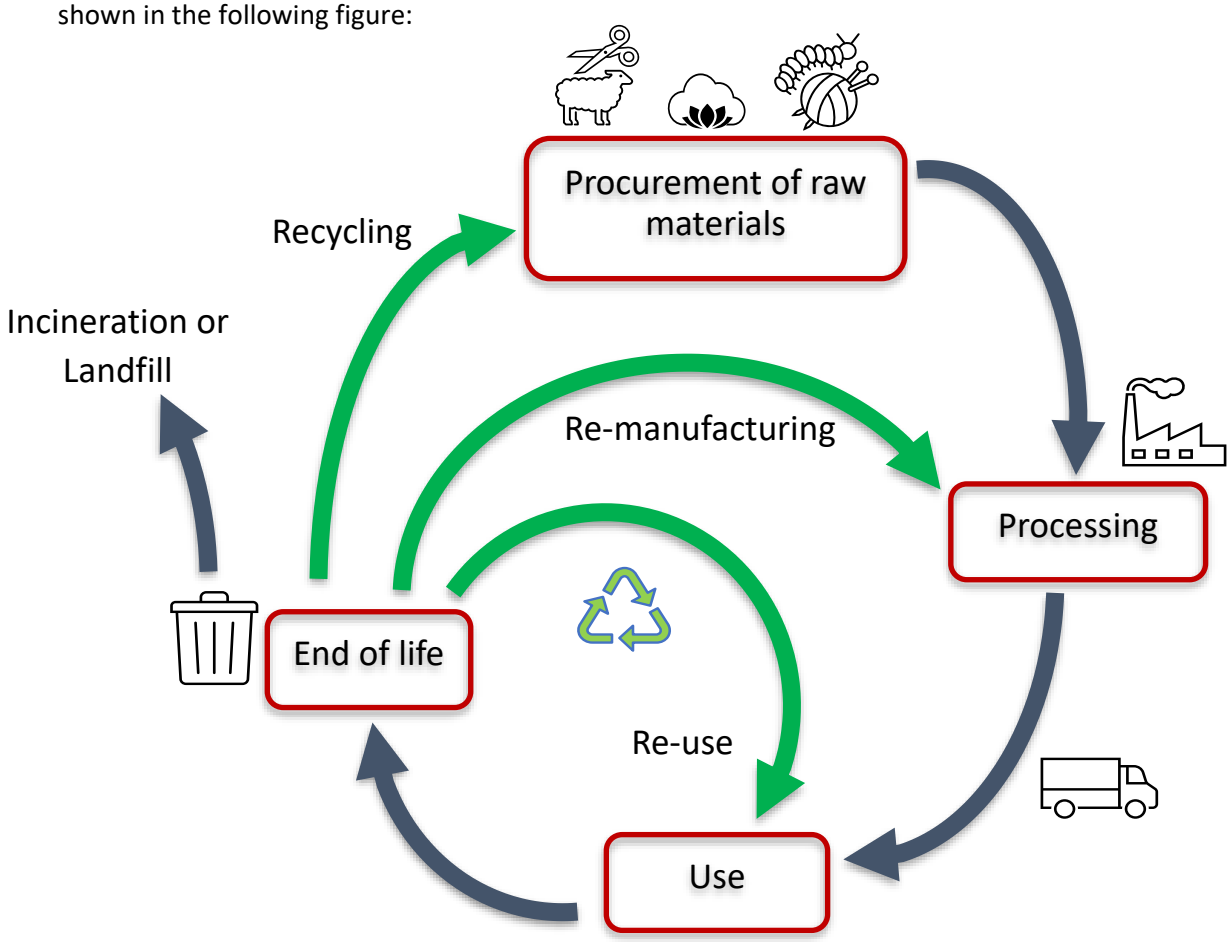


Figure 2: Phases of a textile life cycle

To better understand the concept of LCA and its methodology, this e-book highlights the first phase of LCA, goal and scope, to grasp the importance of focusing on scoping at different boundaries.

2.2 System definition

The classification of a Life Cycle Assessment depends mainly on the level of detail of each of these. Depending on the objective is important to put focus on certain stages of the process. For this reason, up to three types of LCAs can be distinguished:

- Conceptual LCA: is a qualitative study to identify the most significant potential impacts, the most critical points, therefore the data used are very general, but it allows us to differentiate the most significant stages of the entire life cycle.
- Simplified LCA: this analysis takes into consideration only generic data and covers the Life Cycle in a superficial way, followed by a simplification, focusing on the most important stages, and a reliability analysis of the results.
- Complete LCA: is a detailed qualitative and quantitative analysis, considering all stages and all available data.

It is for that reason the importance to define the LCA scope in the first phase of the assessment.

LCA Scope

There are different options to establish the LCA scope[3], as we can see below:

- **Gate-to-gate** the LCA focuses only at one value-added process in the entire production chain.

- **Cradle-to-gate** is an assessm ent of a product life cycle from resource extraction (cradle) to the factory gate.

- **Cradle to grave** covers the range from extraction of raw materials from the earth to manufacturing, product use and recycling/disposal at the end.

- **Cradle-to-cradle** in this case the scope closed the loop production.

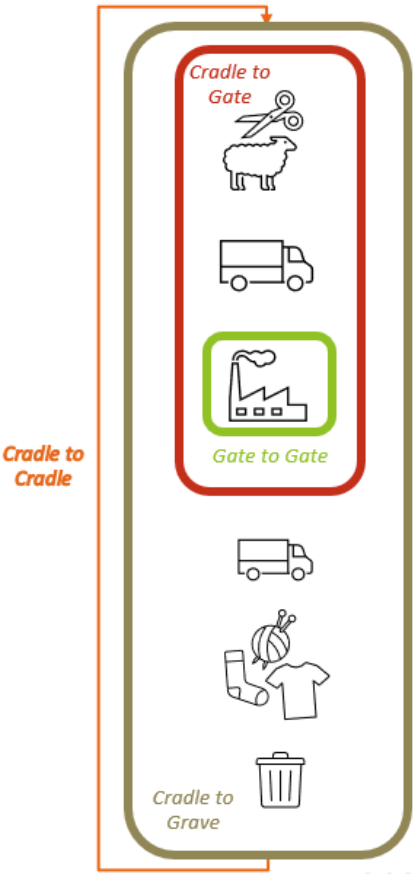


Figure 3: Different scopes of LCA

[3] For a more detailed definition, please refer to the MOOC and its recording of module 2: Eco-design for circular economy

2.3 Eco-design methodology

Eco-design can be defined as a set of actions aimed at environmental product improvement in the initial design phase, using improved functions, low-impacted material selection, application of alternative processes, improved transport and use, and minimisation of impacts in the final treatment at the end of life. Therefore, in the case of the textile sector, it is necessary to have a conception of textile products, considering the whole life cycle and consequently, to incorporate environmental criteria linked to the production process, but also important to consider the reduction of the environmental burden (waste and emissions) associated with the rest of the product life cycle.

Therefore, the principles of eco-design are:

- Design for sustainable sourcing:
  - Incorporation of recycled and recyclable materials
  - Use of renewable materials and energies
  - Choose a local provider
- Design for optimised resource use:
  - Saving energy, water and resources in overall.
  - Improve processes and apply cleaner technologies.
  - Rethinking needs and systems
- Design for environmentally sound and safe product use:
  - Use of less polluting raw materials
  - Select materials with low environmental impact and free of toxic products
  - Optimize the logistics of transport and packaging
- Design for prolonged product use:
  - Think cyclically to keep the product in the best possible condition for as long as possible
  - Establish fair and responsible business practices
  - Introduce conceptual product improvements
  - Communicate the environmental requirements or the correct use and reuse of the product
  - Extend the life of products
- Design for recycling:
  - Separation of components and simple identification of materials
  - Reduce the waste generated by the product and improve its final management

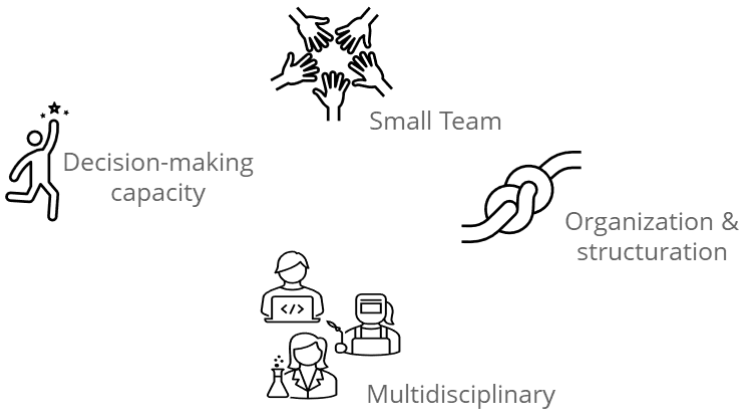
Figure 4: Eco-design principles

2.4 Eco-design phases

The phases of the eco-design process must incorporate environmental criteria, known as eco-briefing. This is where the critical points of the design and the stages where these critical points are found are identified.

The integration of the eco-design strategies and the conceptual development of the proposals is carried out through the following phases.

1. Team creation:



Usually, this team has different professional profiles to achieve success, such as:

- ✓ Designer
- ✓ Packaging Engineer
- ✓ Production Department
- ✓ Expert in Environmental Assessment
- ✓ Marketing Expert
- ✓ Sustainability Manager (Quality, Environmental, Risks, SDG)

2. Preparation → Product selection

The preparation of product selection should be linked to the ability to adapt old products to new ones.

The organisation needs motivation to improve its products or services on a routine basis. There are two types of motivation as it is shown below:

Internal Motivations:

External Motivations:

3. Environmental Product Assessment

The next phase of the eco-design process are related to improvement and enhancement actions and monitoring actions. The following eco-design strategy wheel by Brezet, H et al. shows the steps and characteristics related to a new concept in product or services development.

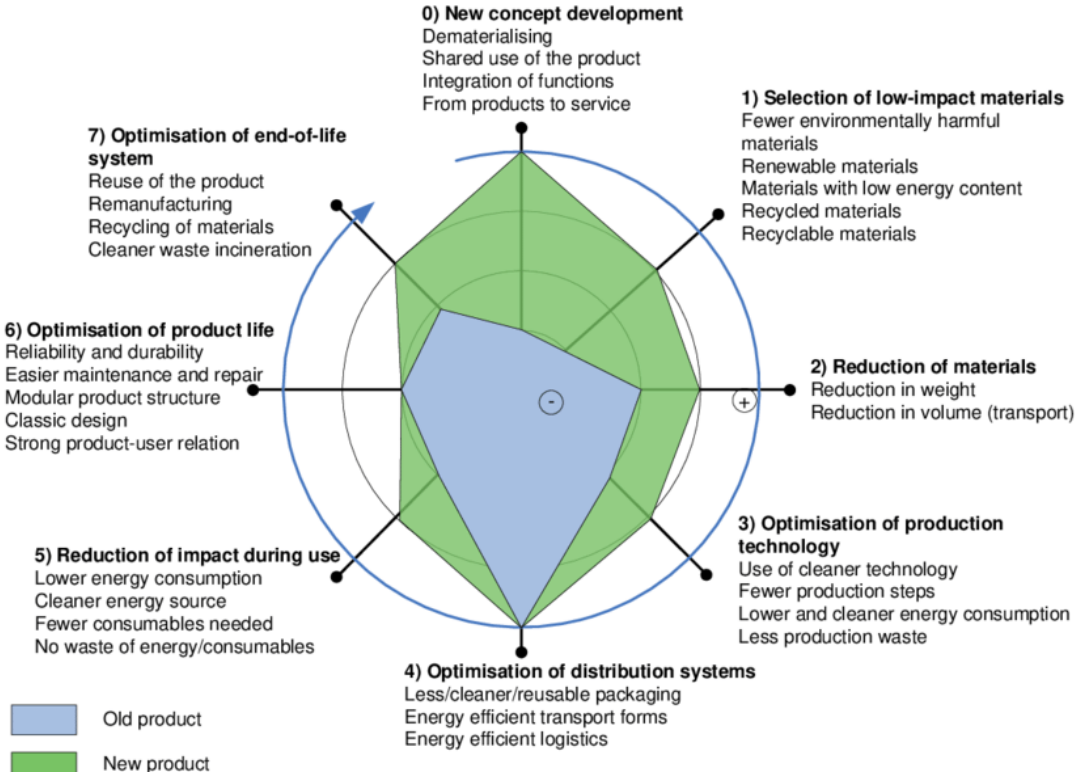


Figure 5: The ecodesign strategy wheel (Brezet and van Hemel, 1997)

To conclude with the stages of eco-design, it is important to highlight the environmental communication of the product since sharing best environmental practices gives more value to the product and creates environmental awareness.

3. Eco-design Criteria & LCA applied in real cases

Case 1 – MANUFACTURAS ARPE SL

MANUFACTURAS ARPE SL is a company from Arenys de Munt (Barcelona, Spain) operating since 1967, specialised in the design, production and stamping of sustainable customizable promotional gifts.

Phase of the value chain

Textile manufacturing / Raw materials.

Eco-design criteria applied

The company uses recycled fibres from post-consumer PET bottles to manufacture masks approved according to UNITE 0065: 2020 and AITEX test 2020TM2032, to prevent the transmission of infectious agents such as COVID-19.

MANUFACTURAS ARPE SL manufactures other products with this recycled material, such as towels. The products are GRS and OEKO-TEX Standard 100 certified.

Figure 1: Prototype Arpe mask made from recycled fibres.

Benefits of the strategy

Environmental benefits:

- It avoids the consumption of virgin polyester and the generation of waste from plastic bottles.
- Promotion of reusable masks as opposed to disposable masks, thus avoiding the generation of waste.

- Carbon footprint reduction by 74% to 99% relative to other types of masks (cotton, surgical, FFP2).

Economic benefits:

- The cost of recycled material is higher than that the non-recycled one, but it is still a competitive product.
- Increased sales as a result of the attractiveness of a product with added value and where the technical properties (filtration efficiency, breathability) are ensured, approved according to reference regulations.

Technical benefits:

- There is no need to change the existing technical process.

Social benefits:

- Contribution to the improvement of the health and well-being of society in the current COVID situation by also contributing the environmental value to the product.

Implementation barriers

- Investing in new technologies or research poses a risk because resources need to be allocated and it is not always clear what the return will be; and therefore, the application of circular strategies is complicated.

Replication Potential

- Possibility to make other products with the same recycled material stock.
- Possibility to replicate the process in other services or products.

Case 2 – HILATURAS ARNAU, S.L.

Hilaturas Arnau works with recycled fibres to produce fashion, upholstery and decoration and technical textiles. They work with materials such as recycled terrestrial and marine PET and Nylon from disused fishing nets, recycled aramids or other natural materials such as kapok, etc.

Phase of the value chain

End of life / Recovering fibres from other textile companies.

Eco-design criteria applied

The company recovers fibres from technical materials, such as para-aramid and meta-aramid, fire-retardant, anti-cut, vandal-proof and thermal fibres. With these fibres or blended with others, the company produces high-strength, flame-retardant yarns and fabrics.

Hilaturas Arnau is one of the few Catalan companies dedicated to recovering these fibres from technical textiles and are therefore a key piece in the territory and in the sector of technical textiles.

Figure 6: Examples of products derived from recycled fibres.

Benefits of the strategy

Environmental benefits:

- Prevention of waste generation from the use of excess material.
- Saving of virgin raw materials (fabric and filling).
- Saving of water, less impact on ecosystems and their natural resources.

Economic benefits:

- Creation of interesting and competitive product that can generate a new market lines and customer opportunities.
- Key business model in the application of EC in the technical textiles sector.

Technical benefits:

- Hilaturas Arnau helps new companies through its experiences, establishes a space of knowledge at the service of Innovative Companies.
- There is no need to change the existing technical process.

Social benefits:

- Boosting CE in the territory by contributing with new ideas that promote its principles.
- Liaise with the administration that promotes and gives incentives and fundings.

Implementation barriers

- Economic barriers, since researching in new technologies or in investigation involves a risk because of the resources allocated and the uncertainty of the return.
- Technological Barriers, the mechanical properties of the recycled material are reduced, and this makes it impossible to use them for some applications where high mechanical performance is required.

Replication Potential

- Possibility of sharing good environmental practices for innovative start-ups.
- These processes can take place at different stages of the production process (fabric, yarn...) and the order of the treatments can vary according to the final needs, therefore, best environmental practices can be implemented at different stages of the value chain.

Case 3 – ETISILK

Etisilk is a company from Manresa (Spain) with a textile tradition dating back to 1820. Etisilk manufactures outdoor fabrics and is part of a completely vertically integrated system, where all the key materials are controlled and/or produced, from pigment manufacturing to weaving and finishing.

Phase of the value chain

Textile manufacturing / Developing a new product using its own textile waste.

Eco-design criteria applied

With different kinds of waste and leftovers produced in the company group (discarded fabrics and yarns from different processes), Etisilk designs and creates a play blanket for babies. The only raw material used is the sewing thread. This blanket is foldable and, using a cover, it can be used as a puff when the child grows, so its use can be longer than the one for other similar products.

As the materials that are used to produce the blanket are for outdoor use, they all have the Oeko-Tex Class I, guaranteeing a high quality of the fabric and a safe use for the baby.

Figure 7: Aspect of the new product.

Benefits of the strategy

Environmental benefits:

- Avoids the generation of textile waste resulting from the use of discarded material with still good properties.
- Saving of virgin raw materials to produce a new product (fabric and filling).

Economic benefits:

- Creating a new value-added product that can attract new customers. Those customers would be from a different target.
- Economic savings derived from transport and waste management.

Technical benefits:

- The discarded fabrics have to be collected and selected manually before being sewn. There is no change in the process.

Social benefits:

- Circular economy boosts to the territory by bringing new ideas that promote the circular economy and eco design principles.
- Promote the circular economy in a different area such as baby products.
- Km 0 product.

Implementation barriers

- Not having detailed information on how the Circular Economy can be applied prevents us from moving in that direction, even though we know it is a future line of the market.
- A small investment needs to be done at the beginning. In this case this is focused only on the manufacturing and distribution process, so it is affordable for the company, which aims to implement this circular product.

Replication Potential

- Possibility to increase the range of products that Etisilk can offer, focused on the baby market or others.
- Other companies in the textile sector can replicate the process, choosing a product that can be manufactured using their own waste.

Case 4 – PONT, AURELL I ARMENGOL, S.L.

Pont, Aurell i Armengol is a company settled in Terrassa since 1875 that nowadays develops their activity in the punched nonwoven felts sector, manufacturing different ranges of products required by the automotive market.

Phase of the value chain

Textile manufacturing / Raw materials.

Eco-design criteria applied

The raw material mainly used by the company is recycled polyester. There are different techniques to bond the nonwovens, some of them using resins that, once cured, fix the position of the fibres, making the material stable. This makes the subsequent recycling process more complicated, as we have two materials instead of one.

However, the use of resins can be eliminated if polyester thermobonding fibres are used, keeping the final product monomaterial. These are added at the beginning of the process along with the other polyester fibres. These fibres melt with temperature, which allows the consolidation of the nonwoven.

This strategy is applied whenever possible.

Figure 8: Example of Pont Aurell i Armengol products.

Benefits of the strategy

Environmental benefits:

- The consumption of synthetic resins is avoided, reducing the impact of their production and distribution.
- It becomes a 100% polyester single-material product, making it easier to recycle at the end of its life.
- No wastewater is generated, and emissions are reduced.

Economic benefits:

- It represents an economic improvement in relation to the cost of raw materials, and also a decrease in the costs of their processing.
- Attracting new customers looking to incorporate environmental values into the car.

Technical benefits:

- The changes in the process are small (basically in the composition), not being necessary to add any new machinery to the production line. This makes economically feasible to adopt this process.

Social benefits:

- Added value of a product that has a circular design which the vehicle may incorporate.

Implementation barriers

- Not having detailed information on how the Circular Economy can be applied prevents us from moving in that direction, even though we know it is a future line of the market. Also, we must have a specific knowledge in the sector we are working in to know what we can change.
- Raw materials are needed to do the changes commented in this strategy, so a provider must be found.

Replication Potential

- Other companies working with the same materials can also adopt this strategy, once seen the good results of this example.
- Nonwoven fabrics are not only used in the automotive industry. Other sectors that work with the same product can also adopt the strategy.

Case 5 – Anonymous company

The company was founded in 1946 as a spinning and weaving company. It is a world-renowned company, specialising in the production of high-quality fabrics for upholstery furniture and home textiles.

Phase of the value chain

Textile Manufacturing / Raw materials.

Eco-design criteria applied

Due to the high use of synthetic fibres, the company produces raw materials for upholstery fabrics - 100% recycled polyester, multifilament yarn. PET production is almost 3 times higher than cotton and also 82 times higher than wool.

Oeko-Tex certification for your fabrics. This standard the main ecological standard for fabrics setting strict limits for harmful substances in textile products without any exceptions or reservations. Fabrics bearing the Oeko-Teks 100 mark do not have an adverse, harmful effect on consumers.

Figure 9: Example of raw materials (100% recycled polyester) for upholstery fabrics.

Benefits of the strategy

Environmental benefits:

- The solution is to use recycled polyester to reduce pollution and the amount of waste that enters water and soils. The production of recycled polyester emits 65.5% less carbon dioxide, uses 10 times less water, 70% less energy, saves fossil fuels and uses used and discarded plastic bottles. This raw material has the usual properties of polyester.

Economic benefits:

- The cost of recycled material is higher than that of non-recycled material, but it is still a competitive product.

Technical benefits:

- There is no change in the process.
- Waste that is generated during production must be collected and sold to companies that produce nonwovens.

Social benefits:

- Company is identified by a Global Location Number (GLN).

Implementation barriers

- Not having detailed information on how the Circular Economy can be applied prevents us from moving in that direction, even though we know it is a future line of the market.

Replication Potential

- Possibility to make other products with the same recycled material stock.
- Possibilities to replicate the process in other services or product.

Case 6 – Anonymous company

The company's field of activity is weaving of linen fabrics. It is one of the largest manufacturers of linen fabrics in the Baltic States. The company is a well-known manufacturer because it is able to combine the company's core values and high quality in its products.

Phase of the value chain

Textile manufacturing.

Eco-design criteria applied

The company is expanding its range of "green textiles", so in 2021 it accepted a new challenge - what is waste and how recycling can become a new resource. In production processes, residues are small fragments, edges, etc., these residues are reused - RE-USED FLAX

XX company has been operating in accordance with the universally recognized quality requirements that meet the OEKO-TEX 100 standards.

Figure 10: Example of a product company developed by reused linen fabric.

Benefits of the strategy

Environmental benefits:

- Sustainable & fully traceable.
- Flax fibre is environmentally friendly in itself, as it leaves no waste at all in production processes and does not cause any damage to nature and the environment as it grows.

Economic benefits:

- 100% made in EU.
- A new collection made from recycled yarn has made it possible to become a member of Fabric Source / Closed Loop.

Technical benefits:

- The process of recycling waste: Accumulation of flax waste. Now everything that cannot be used as final product are collected in special containers; Supplying collected waste to the garneting section and sliver production to special machines that produces yarns; Weaving the yarns into fabric.

Social benefits:

- The company has a CrefoCert STABILUS certificate, which is the official confirmation that the company that received it is solvent and in good economic condition, therefore we are reliable partners.
- Environmental protection and sustainability are top priorities, as innovative products must change the world, not our planet. Minimal environmental impact has become a new efficiency standard for the company.

Implementation barriers

- The transition to a circular economy has been beneficial as it has increased competitiveness, the company has offered competitive linen fabric development and production deadlines, as well as high quality and competitive pricing.
- Contributing to the global sustainability policy, the company has sought to ensure that the latest collections of linen products help to reduce the amount of industrial waste left in production processes, allow the reuse of existing raw materials and ensure transparency in production.
- All of the textile waste that used to be called as left-overs, including selvedges, small cuttings, yarn pieces, are now recycled into brand new yarns. And was is worth mentioning – it is the first time when the recycled yarns are 100% linen.

Replication Potential

- Possibility to make other products with the same recycled material stock.
- Possibilities to replicate the process in other services or product.

Case 7 – Tintoria di Quaregna

Tintoria di Quaregna was founded in Biella (Italy) in 1948 by Alfredo Mello Rella as a traditional dyeing company specialized in the processing of noble fibres and yarns (cashmere and wool) for the local area. From twenty years it has developed an eco-efficient dyeing process with herbs for textile applications as knitting, weaving and home décor, and a collection of natural yarns dyed with herbs

Phase of the value chain

Textile manufacturing / Raw materials.

Eco-design criteria applied

Tintoria di Quaregna developed NATURALE, an innovative and sustainable dyeing technology by using only dry herbs: the colours (colour card shows 61 colours) are obtained by infusion of blends of herbs, roots, plants flowers and tree bark coming from around the world (more than 60% from Europe and Italy). The dyeing process is 100% natural since chemical, additives, dye powders and extracts are not used. After the dyeing the herbs are used as fertilizers or for the production of biogas allowing the valorisation of the waste and ensure a sustainable loop. The company also produces a collection of natural organic yarns (wool, cotton, cashmere, linen...) and recycled synthetic yarns dyed with the innovative technology for flat knitting machines, circular knitting and weaving, so that the clothes are completely natural. Natural technology is approved by Woolmark and it's Gots and Traceability & Fashion certified.

Figure 11: Examples of Tintoria di Quaregna products.

Benefits of the strategy

Environmental benefits:

The innovative dyeing process results in:

- Lower CO2 emissions: chemical dyes, deriving from fossil fuels, imply the introduction of CO2 in the atmosphere, while natural dyes are from plants contributing, through chlorophyll photosynthesis, to the capture of CO2.
- Saving in energy consumption;
- Less quantities of water (35%); furthermore, after treatment water is entirely return to the river, completely clean.
- No use of toxic chemicals for dyeing and treatment of fibres as wool;
- Waste herbs are stocked as biomass for different purposes as fertilizers in agriculture and biogas for energy production, so the waste is turned into value.

Economic benefits:

- Reduced wastewater treatments.
- The price of natural dyes is higher than traditional dyes, but the production cost can be controlled in terms of water saving and reduction of quantities of chemicals used.

Technical benefits:

- Possibility to convert old production machines and use them for the innovative dyeing process.
- Great variety of colour range according to the needs of the clients.
- High quality of the colours, guaranteed in fastness (colours comply with National Safety Regulation GB 18401 standard)

Social benefits:

- The use of natural clothes has positive impact on human health and wellbeing, avoiding for example the risk of allergic reaction deriving from the use of chemicals; furthermore, it is demonstrated, by an ongoing study, that the herbs release oxidizing substances providing benefits on the people.
- Working conditions of the workers are improved since they don't use chemical substance.
- Tintoria di Quaregna supports the production of the added value product in the local area, favouring the exchange with local farmers or for example, developing hydroponic culture of plants for natural dyes.

Implementation barriers

- High initial investments due the research costs.
- At the launch the new product was poorly welcomed by the market.

Replication Potential

- Possibility to reproduce different shade of colours.
- Possibility to dye other materials with the sustainable process.
- Replication in several sectors as home decor and biomedical (for example functional textile containing anti-inflammatory substances).

Case 8 – Atelier Riforma

Atelier Riforma is an innovative social start-up, based in Turin (Italy), incorporated as a SRL in May 2020. Its mission is to promote the circular transition in the textile-fashion industry through innovative technologies, thus reducing its environmental impact.

Phase of the value chain

End of life.

Eco-design criteria applied

After 3 years of experience in the management of used clothes, Atelier Riforma has created Re4Circular: the first technology based on Artificial Intelligence that automates the cataloguing and digitization of textile waste, connected to a B2B digital marketplace that allows collection entities to direct their clothes towards circular uses. The platform allows any company in the textile-fashion industry to source the most suitable used clothes for its business, thus allowing a higher quality of the circular product and the success of the business. Examples of circular fashion businesses that can benefit from this service are: second-hand shops (looking for defect-free garments), recycling companies (which select clothing based on material and colour), and refashioning brands (looking for good quality garments, even if they have defects). Thus, the company facilitates the textile-fashion industry's use of secondary raw material (discarded clothes) instead of new virgin resources, thus greatly simplifying reuse, recycling and upcycling.

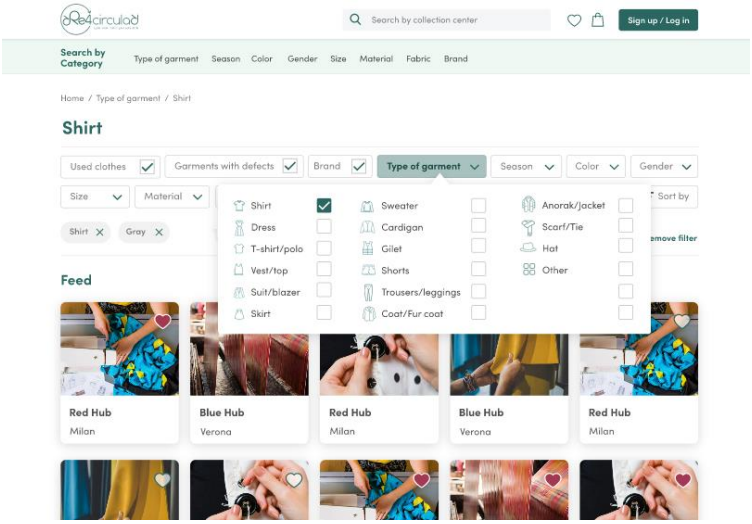


Figure 12: Examples of products related to Re4Circular by Atelier Riforma

Benefits of the strategy

Environmental benefits:

- Reduction of the amount of discarded garments that are disposed of in landfills or burned in incinerators.
- Increase of amount of discarded garments that become secondary raw material for circular products, through reuse, recycling or upcycling (thus reducing the textile-fashion industry's demand for new virgin resources).

Economic benefits:

- Atelier Riforma helps entities that collect used clothes to valorise them from an economic point of view and thus resell them to circular companies that reuse, recycle or upcycle used clothes
- Atelier Riforma supports the growth of circular fashion by providing companies (e.g. second-hand shops, recycling companies, refashioning brands) with a convenient and efficient tool to find and buy online the secondary raw material most suitable for their business.

Technical benefits:

- AI-based tool for automatic sorting and digitisation of post-consumer garments.
- Sorting tool linked to a digital marketplace, which allows garments to be simultaneously catalogued and offered for sale online B2B, directing them to circular destinations.

Social benefits:

- They reduce the amount of textile waste exported to developing countries (thus avoiding the burden of waste management on them).
- By facilitating the application of circular fashion on a large scale, they contribute to the progressive lowering of prices of circular products, making them more accessible.

Implementation barriers

- The chain of used clothes is quite rigid and players are not very inclined to change their way of working
- Used clothes are of lower and lower quality and, as they are available in increasing quantities, it is assumed that they will have a lower and lower price (thus with little possibility of margin and investment in new technologies, if not through public subsidies).

Replication Potential

- Re4Circular is not an internal technology of Atelier Riforma, it is a service, designed to be provided to any reality that needs it (without geographical limits).
- This makes it possible to potentially apply this virtuous circular model to a very wide scale: the aim is to spread it throughout the EU.

Case 9 – RadiciGroup

RadiciGroup is one of the most active Italian chemicals manufacturers at an international level. Its business areas are focused on: chemical intermediates, high performance polymers, advanced textile solutions. Vertical integrated production, in particular of polyamide, is one of the company's strengths.

Phase of the value chain

Textile manufacturing / Raw materials.

Eco-design criteria applied

RadiciGroup created, through the implementation of eco-design principles, a mono material ski suit (jacket and trousers) manufactured with Renycle®, a polyamide yarn (nylon) deriving from the pre-consumer mechanical recycling of the company's production scraps, having the same properties as the virgin material. Almost all the ski suit parts are made of polyamide, including zippers, Velcro straps, buttons, seam thread and labels. The choice to use chemically compatible materials allows for an immediate end-of-life mechanical recycling of the ski suit, without the need of separating the various components, in order to obtain high performance polymers for different sectors such as the automotive, furniture, sport goods (as ski boots and bindings) industries. The sustainable ski suit was developed in collaboration with DKB, an Italian company specialized in technical sportswear.

*Figure 13: **Examples of RadiciGroup products.***

Benefits of the strategy

Environmental benefits:

- Recycling of secondary raw materials.
- No consumption of non-renewable resources (fossil fuels).
- Lower CO2 emissions.
- Saving in water and energy consumption during the mechanical recycling.
- End of life recycling and reusing of materials to produce durable goods that can be, at the end of their life, recycled again.

Economic benefits:

- Though it is not possible, at present, to economically evaluate the positive impacts of the project, from an empirical point of view it is reasonable to state that this project increased the interest in circular economy garments and recycled yarns, potentially representing a new market share.
- Also, the new supply chain specifically created has potential economic possibilities to deploy.

Technical benefits:

- The performance and quality of the recycled material product is comparable to a virgin material product.
- A successful application of eco-design principles to a technical, demanding final application.
- Possibility of recycling and reusing the material at the end of its life, in this way the principles of circular economy are applied.

Social benefits:

- The creation of new and local value chains to implement circular economy principles.
- A successful case history of circular economy able to represent an example (and to provide education) to the textile industry.

Implementation barriers

- Design barrier: modification and adaptation of the supply chain, taking into account that all the components of the ski suit, normally made of different materials, had to be produced in polyamide to obtain a single-material product.
- Technical barrier: research and study of polyamides with different properties to satisfy the requirement of quality and performance of the different accessories in the final product.

Replication Potential

- Possibility to replicate other mono material garments (as jackets, sweaters, etc…), bearing in mind that the target of the ski suit was already high, notwithstanding the technical challenges have been met and the project has succeeded.

Case 10 – TINTESS

Tintess was born in 1969 as a yarn dyeing company. In a few years the business expands, constantly expanding the structure and types of processing. A line for dyeing, finishing and printing fabrics has been added up to introduce sophisticated machines to improve all process.

Phase of the value chain

Textile manufacturing / Processing.

TINTESS
PRINTING | DYEING
FINISHING

Eco-design criteria applied

The company built a biological purification system of water purification and sludge disposal, whose effectiveness is based on a first chemical-physical process followed by a double biological stage that is the most advanced process in Italy and unique in Europa.

Tintess adopts and implements sustainable solutions in many directions, all united by a subtle green: from the integration of a photovoltaic system capable of producing part of the energy necessary for the operation of the company, to the use of plants and machinery that require an increasingly contained consumption of water.



Figure 14: Instalation and product of TINTESS

Benefits of the strategy

Environmental benefits:

- 222,000 m3 / year water "cleaned" by the system.
- 235,000 Kw / h Photovoltaic energy produced per year.
- 5.000 sqm Green area an ideal ratio between green area and production areas, which today stands at 2:1.
- Compliance with REACH regulations, in terms of evaluation and authorization of chemical substances, to ensure a higher level of protection of human health and nature.

Economic benefits:

- The improvement and construction of energy saving systems contributes to a significant reduction in the cost of energy.
- Competitiveness in the market, being able to offer sustainable products made with high-tech machines in an eco-friendly environment.
- Increased of water purification and sludge disposal service from other industries.

Technical benefits:

- An important research and studies made with technology university, concerns the dewatering of sludge, a process that allows to quantitatively decrease the masses of waste to be handled, with a positive impact on emissions and related scents

Social benefits:

- Contribute to the improvement of the health and well-being of society in the current

Implementation barriers

- Not having detailed information on how the Circular Economy can be applied prevents us from moving in that direction, even though we know it is a future line of the market.
- Investing in new technologies or research poses a risk because resources need to be allocated and it is not always clear what the return will be; and therefore, the application of circular strategies is complicated.

Replication Potential

- Possibility to make other products with the same recycled material stock.
- Possibilities to replicate the process in other services or product.

Case 11 – MUSA

MUSA is an a Greek premium sustainable and ethical apparel brand based in Athens, Greece. It was founded in 2020 and bases its ethics on local and zero-waste production, supporting small businesses and spreading conscious awareness for long-lasting pieces.

Phase of the value chain

Textile manufacturing.

Eco-design criteria applied

The activities of MUSA, start and end based on sustainable thinking. The fabrics are ethically selected from local manufacturers and suppliers. All materials used are certified eco- friendly on both the environment and the skin. The production aims to support small businesses and enhance local economy. Musa creates small scale collections, customised sizes according to the client and its sales are focused on local market. By creating high quality and simple design, the brand is adopting and focuses on spreading, the impact of long- lasting clothes, therefore, fostering conscious consumption and slow- fashion mindset. In the end of the collection, the brand utilizes its remains by creating accessories as a way of eliminating waste.

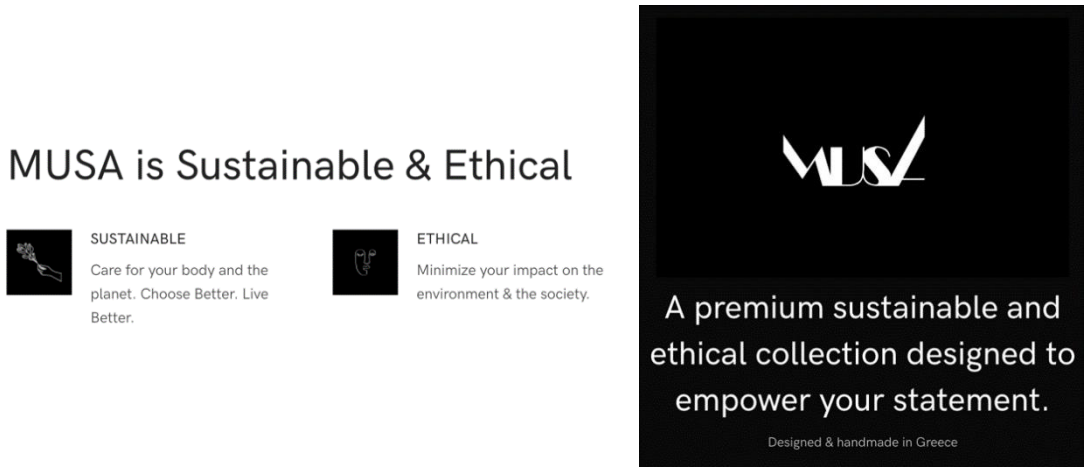


Figure 15: MUSE brand and its benefits

Benefits of the strategy

Environmental benefits:

- In order to avoid overproduction and inventory, the brand creates small scale collections and customised sizes by using ethically manufactured fabrics and materials, follows zero-waste production by utilizing leftovers and creates long- lasting garments.

Economic benefits:

- Due to its local activity, the brand supports small to medium size business.

Technical benefits:

- Simple production, loyal customers and high-quality garments.

Social benefits:

- Contribute to the improvement of ethical buying and conscious consumption.

Implementation barriers

- The local community, and an actually large part of it is still not used to following a simple buying mindset, which sets the brand in a critical position as to how to train the market. On the other hand, and due to the high-quality production, the prices are no close to the low prices offered by fast-fashion.

Replication Potential

- The brand receives back if any defected clothing and reuses it in future collections. Furthermore, MUSA offers a customisation service for customers with insignificant sizes. The materials used are all recyclable as well.

Case 12 – 3QUARTERS

3QUARTERS is an innovative circular brand from Athens, Greece. They address the textile waste problem by creating one-of-a-kind products from waste or deadstock urban fabrics. We employ a fully circular and zero-waste policy throughout our business model.

Phase of the value chain

Textile manufacturing / End of life.

Eco-design criteria applied

They work with local leftover, deadstock or waste textiles, focusing on synthetic fabrics. They have already processed more than 3 tonnes of textile waste. The company keeps their production in-house and apply a 100% zero-waste policy. They keep and repurpose all their offcuts, spent threads and other waste.

3QUARTERS design their products to be easily disassembled and repairable. Also, they offer free repairs for life and insist on taking back our products at the end of their lives for safe in-house repurposing. The company uses no virgin plastic, use zips and accessories from recycled materials and their raw materials follow the highest standards of sustainability. For example, their straps are made from organic hemp.

Figure 16: 3QUARTERS products.

Benefits of the strategy

Environmental benefits:

- 3QUARTERS works with waste synthetic fabrics from Athens.
- They calculate more than 300 tonnes of these fabrics end up in landfills every year and we have already processed more than 3 tonnes with our capacity growing fast.
- With the EU Green Deal focusing on textile waste the company anticipates a dramatic reduction in discarded fabrics in the coming years.

Economic benefits:

- 3QUARTERS insists on buying deadstock, leftover or waste textiles. They want to show that waste has value and also support the local community. They establish collaborations with various industries dealing in textiles and elite institutions in creating value from waste

Technical benefits:

- Not use any proprietary technology and are happy to share their knowhow. Their aim is to create a network of collaborators that deal with the textile waste problem in a circular and low-impact way.

Social benefits:

- 3QUARTERS works with local tradespeople and help support them by paying fairly for their waste.
- They also work with disadvantaged communities, employ people from sensitive social groups (immigrants and asylum seekers), and provide educational events for schools and colleges.

Implementation barriers

- Lack of education and incentives for industries dealing with textiles to repurpose their waste. Most do not even understand the need to deal with fabric waste and the real impact of it. We find it extremely challenging to communicate and consequently acquire old fabrics.

Replication Potential

- 3QUARTERS believe that sustainability and circularity need to be developed on a local basis. The company address local problems with the textile waste of Athens. In principal the model can be replicated by applying it to specific local issues and textiles. In their network they are aware of similar initiatives in different locations.

Case 13 – BETI d.d.

Beti d.d. is one of the largest employers in Bela krajina, Slovenia, employing more than 150 people. Beti d.d. is involved in the global supply chains of world-renowned sports and fashion brands that seek the most advanced materials for their collections and promote the development of sustainable products. The company ensures the highest quality standards and responsiveness.

Phase of the value chain

Textile manufacturing / Raw materials.

Eco-design criteria applied

DyeCareTM 1.0 is Beti's most sustainable yarn to date, made from 100% recycled polyester obtained by recycling bottles. Beti Technologies' development group has improved the dyeing process on existing technological equipment. Unlike the standard polyester dyeing process, which includes 6 steps, i.e. washing, dyeing, rinsing, reductive washing, rinsing, softening, the DyeCareTM 1.0 dyeing process is shortened to 4 steps, which reduces energy consumption. The quality is confirmed by the certificates OEKO-TEST Standard 100 class 1, Bureau Veritas and Global Recycled Standard (GRS). For the DyeCareTM 1.0 yarn, the company received the GOLD AWARD for the best innovation 2021, awarded by the Chamber of Commerce of Dolenjska and Bela krajina.

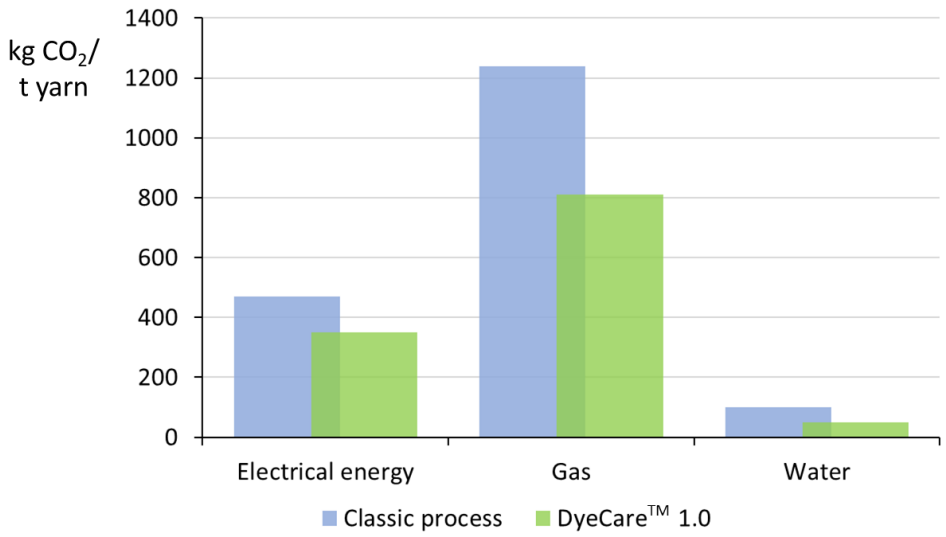


Figure 17: Carbon footprint of energy and water consumption for DyeCare™ 1.0 and classic yarn processes

Benefits of the strategy

Environmental benefits:

- The use of 100% recycled polyester, obtained by recycling bottles, helps reduce raw material consumption and promotes the transition to a circular economy.

- The DyeCare™ 1.0 process saves more than 51% water, 21% electricity and reduces gas consumption, which has a direct impact on the 34% reduction in CO_2 emissions compared to the standard process.
- The reduction in water consumption reduces the amount of wastewater, which in turn reduces the environmental impact.

Economic benefits:

- The DyeCare™ 1.0 innovation has a significant impact on the company's overall business as market demand for sustainable products increases. This contributes to higher added value and company profits.
- The reduction in dyeing time leads to higher productivity.

Technical benefits:

- The use of the Dos&Dye robot in the DyeCare™ 1.0 process makes it possible to apply the process quickly and efficiently to any colour shade without compromising on quality and functionality.

Social benefits:

- The DyeCare™ 1.0 innovation helps reduce the impact on the local natural environment and improve working conditions for the company's employees, contributing to the development of the local community and beyond. The innovation enables the creation of new sustainable jobs with higher added value, especially in the areas of research and development, sales and quality assurance. DyeCare™ 1.0 strengthens the reputation of the company and the textile industry in Slovenia in general.

Implementation barriers

- There are no implementation barriers. The DyeCare™ 1.0 dyeing process is easy to perform. It takes place on existing technological equipment with existing dyes and textile auxiliaries. DyeCare™ 1.0 yarn has the same properties as our standard yarn, which is dyed using the standard process. Most importantly, DyeCare™ 1.0 yarns retain unchanged colour fastness, especially wash fastness.

Replication potential

- With its DyeCare™ 1.0 innovation, the company is encouraging other textile manufacturers to switch to more sustainable yarns. The functionalities of the DyeCare™ 1.0 yarn allow customers to easily replace classic yarns with this yarn.

Case 14 – INPLET d.o.o.

INPLET d.o.o. is a Slovenian company, operating since 1982, producing fine elastic and rigid fabrics for clothing, medical and other purposes.

Phase of the value chain

Textile manufacturing / Raw materials.

Eco-design criteria applied

The company uses recycled polyamide and elastomer from pre-consumer waste generated during the standard manufacturing process. Since 2018, we have had a sustainable collection: fabrics made from 100% recycled polyamide, fabrics blended with recycled elastomer and a range of fabrics made from biodegradable polyamide. The fabrics are certified according to GRS and OEKO-TEX Standard 100.

Figure 18: Inplet sustainable collection.

Benefits of the strategy

Environmental benefits:

- Reduction of resource consumption, emissions and waste in the production process.
- Production of recycled polyamide generates almost 9 times less CO_2 emissions than standard polyamide.
- Biodegradable DNA.

- Reduction of environmental impact.

Economic benefits:

- The cost of recycled material is higher than that of non-recycled material, but it is still a competitive product.
- Higher sales due to the attractiveness of a value-added product.
- Customers are willing to pay more for a recycled and biodegradable synthetic fabric.

Technical benefits:

- There is no change in the process.

Social benefits:

- The end customer is paying more attention to issues such as waste reduction, material. quality, environmental impact and ethical consumption.
- More local sourcing.

Implementation barriers

- Not enough pre-consumer raw material is available.
- Complicated administrative burden to prove traceability throughout the complete chain.
- Different approaches to the same issue.

Replication Potential

- Possibility of producing other products with the same recycled raw material.
- Possibility of transferring the process to other services or products.

Case 15 – TEKSTINA d.o.o.

TEKSTINA is a private SME operating since 1828 in Ajdovščina, Slovenia. It is a leading textile company in the field of sustainable textile manufacturing, including weaving and finishing, with its own highly qualified experts and facilities for research and development, design, testing and production.

Phase of the value chain

Textile manufacturing / Recovering fibres.

Eco-design criteria applied

TEKSTINA management system is certified according to ISO 9001 and ISO1401. The products are certified with Oeko-Tex Standard 100, STeP by OEKO-TEX®, GOTS, GRS certificates.

TEKSTINA is part of the Horizon 2020 project New Cotton. The project aims to foster innovations that enable bio-based textile value chains to become more resource-efficient and circular, reducing their carbon, greenhouse gas and water footprints in line with climate, energy and sustainability goals. The New Cotton project brings together the entire circular textile value chain to demonstrate the transformation of textile waste into equivalent or even higher-value garments (e.g., denim and casual wear) with significantly lower environmental impacts, while meeting the performance needs of brands and consumers.

Figure 19: Infinna™ – the super fibre the world's been waiting for.

Benefits of the strategy

Environmental benefits:

- Infinna™ produces up to 80% less CO_2 emissions than cotton. In comparison, emissions from European viscose/modal/Tencel production are 42-62% lower than cotton.

- Infinna™ has the lowest global warming potential, even compared to modern European viscose plants that run on energy from biomass or municipal solid waste.
- Infinna™ reduces water consumption by 99% compared to cotton - only 50 litres/1 kg of fibre compared to 20,000 litres/1 kg for cotton production.
- The textile products are made of 100% Innfina™ fibres or blends with other cellulose fibres and contain no fossil-based synthetic fibres. This results in easier recyclability, biodegradability, and no plastic microfibres entering the ocean.
- No toxic chemicals are used in the production of Infinna™, instead a natural chemical, urea, is used.
- The sustainability analysis includes LCA in accordance with ISO 14040.

Economic benefits:

- Infinna™ has a commercially competitive price level with even better fibre quality. The estimated price of Infinna™ is 1.5-2 EUR/kg, which is lower than that of viscose and competes with cotton, whose average price is over 1.5 EUR/kg.

Technical benefits:

- Infinna™ fibre technology is realistic and suitable for large manufacturers to adopt in existing viscose and pulp mills.

Social benefits:

- The New Cotton project enables the localization of the sourcing of raw materials (waste garment), which will contribute to the creation of new jobs and businesses.
- For every 1,000 tonnes of waste textiles collected, seven full-time jobs and 15 indirect jobs will be created.

Implementation barriers

- Fibre manufacturers are unwilling to switch to the new material (e.g., scepticism about the technology or the quality of the product).
- The fashion industry is sceptical or too slow to adopt the new material.
- Consumer awareness is not yet sufficient.

Replication Potential

- Tough competition in the field of new textiles.

Case 16 – LA GENTLE FACTORY

La Gentle Factory is born in 2013 in Roubaix in France. Initially focused on men wear, the brand now offers a collection for women and children. The Gentle Factory is now a team of about fifteen employees who work with manufacturers throughout France.

Phase of the value chain

Textile manufacturing / Raw materials.

Eco-design criteria applied

The 100% French brand combines style and convictions to offer quality clothing made from organic or recycled materials for a casual look. Modern T-shirts and Sweatshirts for the whole family that alternate between sobriety and refreshing messages. Organic cotton is certified by GOTS and recycling thread is certified by GRS.

La Gentle Factory constantly monitors innovation in the textile industry: new dyeing processes, new recycling method, new production method… All fabrics used are Oeko-Tex certified and the leather used for shoes, belt and "jacron" is vegetable tanned.

Figure 20: Gentle Factory.

Benefits of the strategy

Environmental benefits:

- Local: Each product in collection is produced locally, reducing the environmental impact of transport
- Organics: Organic fibres to reduce impact on the environment, especially pesticide and water use.
- Recycled: Recycled fibres to reduce impact relate to production of virgin material, of dyeing and the impact of climate change too.

The brand uses a Life Cycle Analysis (LCA) tool from BUREAU VERITAS (EIME), used to measure the environmental impact of our products on different criteria: Global Warming Potential (GWP in Kg CO2 eq.), Water Use (WD in dm3) and Eutrophication (WE in Kg PO42–).

The LCA of our sweatshirt in recycled cotton/polyester made in France, from knitting to manufacture is compared to a "conventional" sweatshirt made in Asia, from virgin cotton and virgin polyester. On the CO2 Emissions, the Gentle Factory process reduce the impact of 15% compared to a "conventional process" and the water consummation in reduce by two.

Economic benefits:

- Born from a big brand of textile menswear, La Gentle Factory became independent in 2019 driven by Christele MERTER. Since the beginning, the brand saw the price of first materials and especially the organic cotton increased a lot. The price of a recycled/organic material is a lot higher than a virgin material. Since 2021, increasing of Energy Price add a complication to the textile sector.

Technical benefits:

- The introduction of new materials requires continuous innovation and close collaboration with all actors in the value chain.

Social benefits:

- Involved locally, the brand works with some forty French companies with unique know-how and committed to corporate social responsibility. Among these companies, some have the mission of offering employment to people weakened by disability.
- In addition to manufacturing clothes, the brand has launched the "Gentle ACADEMY", a platform dedicated to the consumer, to sharing tips and advice on how to choose, maintain and revalue clothes.

Implementation barriers

- The first prototype is created in 2013, a 100% recycled jumper. The product is ethical but not successful in stores. It lacks one small detail: The style. But following this mistake, the brand's promise is born, to offer products that are both responsible and beautiful.

- Investing in new technologies or research poses a risk because resources need to be allocated and it is not always clear what the return will be; and therefore, the application of circular strategies is complicated.

Replication Potential

- Possibility to make other products with the same recycled material stock.
- Possibilities to replicate the process in other services or product.
- Possibilities to innovate with the creation of new materials from cotton waste from manufacturing: creation of vase and glasses in Cellulosic Acetate.

Case 17 – Les 3 Tricoteurs

"Les 3 Tricoteurs" is a French company based in Roubaix, France, initiated by three textile engineers with the objective to produce on demand in a local ecosystem. It also aims to promote transparency by inviting consumers to a bar-workshop.

Phase of the value chain

Textile manufacturing.

Eco-design criteria applied

The company's model is mainly oriented towards on-demand production. The aim is indeed to produce less but better. In this sense, natural materials and recycled materials, are favoured to promote the durability of products and limit the discharge of micro-plastics into the oceans.

The company is also part of the social and solidarity economy and has chosen trusted partners and labels to ensure traceability throughout the chain. It also encourages interaction with local and regional companies in order to boost the local economy.

Figure 21: Team & office of Les 3 Tricoteurs

Benefits of the strategy

Environmental benefits:

- On-demand production avoids extra production.
- Promotes local production and interactions in a local ecosystem.
- Benefits from the relatively low-carbon energy mix of France.

Economic benefits:

- Whole garment knitting reduces waste production, with less than 1% of loss.
- On-demand production avoids stocks and unsold products.

Technical benefits:

- Production of whole garment does not need cutting and sewing steps.
- Seamless enable products to be more comfortable and sustainable.
- Enables customized products with a stronger emotional relationship to consumer.
- Extends lifespan of products thanks to customization.

Social benefits:

- Creates interactions with the consumer and promotes transparency.
- Contributes to the improvement of local textile ecosystem.
- Creation of employment (textile and non-textile oriented).

Implementation barriers

- High machinery costs.
- Recruiting of specific skilled technician.

Replication Potential

- Possibility to replicate the concept in other places.
- Possibilities to replicate the process in other products.
- Possibility to upscale the concept.

Case 18 – MODIMALISME

SASU Sabine Dubuis Albisser is a company from Lille, created in 2020, it manufactures locally in order to transfer the textile experience acquired generation after generation, to guarantee the quality of the processes and to value manual work.

Phase of the value chain

Textile manufacturing.

Eco-design criteria applied

Today, the various fashion brands, produce more and more clothes, collections and thus offers for their customers. However, sometimes the supply does not meet the demand and the brands are left with millions of unsold pieces in stock. Modimalisme transforms unsold textiles into new clothes or accessories for sale on the shelves. Working with fashion brands that provide the state of unsold stock, the company brings together workshops of seamstresses, designers and local model makers who imagine the ways of transformation, the second life of unsold garments and create the prototypes of these transformations. These are then entrusted to local workshops of insertion and confectioners, embellishers to realize the product in miniseries. In 2021, an upcycled collection from 2,000 unsold pieces and 800 meters of fabric was marketed: bi-material trench coat, blouse, pants and tee-shirt are on the program, at prices between 24 and 129 euros.

Figure 22: Products obtained by transformation of a down jacket and sold by Modimalisme.

Benefits of the strategy

Environmental benefits:

- Avoids the generation of textile waste or burning resulting from the unsold garments.
- Saving of virgin raw materials to produce a new product.

- Each emblematic product is associated with a value sheet that quantifies the environmental benefits. Based on objective data, it helps to demonstrate to customers, to the ecosystem actors, to each of us the validity of this revalorization approach with a view to a larger scale deployment.
- We have compared the environmental impact of our pyjashorts manufactured in circular mode versus linear mode: 95% less air pollution, 94% less fossil fuel, 24000kms less, 97.5% less polluted water.

Economic benefits:

- It gives back value to products that no longer had any.
- It generates employment in solidarity workshops facilitating the reintegration of people in difficult social situations.
- This participates in the relocation of the textile industry, many workshops have been created in the last 2 years and the historical manufacturers reinvest, re-equip and re-hire, re-train and develop the necessary skills.

Technical benefits:

- Establishment of a know-how of textile transformation.
- With the help of our team of designers, we balance creative ideas with the constraints of realization.

Social benefits:

- Collaboration between brands and local talents to imagine a more responsible fashion.
- Relocation of manufacturing by reviving a historical know-how.
- Partnership with actors of the Social and Solidarity Economy (establishments of service of help by the work of handicapped persons and an association of help to the reintegration of women far from employment).

Implementation barriers

- The cumbersome internal process of brands (difficult to break!).
- Brands always think in terms of return on investment / profitability with the same KPIs.
- Costs, especially for French manufacturing.

- Consumers used to low prices do not always understand the prices of Upcycling.
- A long and costly preparation phase of the garment.
- Management of the generated waste to be taken into consideration.
- Insufficient production capacity and know-how to date.

Replication Potential

- Possibility to make other products with the same methodology.
- Possibilities to replicate the process in other services or product.

4. Summary

The CLEANTEX project has been created with the aim of developing customised training materials for companies and university students in the textile sector. These support materials develop transcendental topics for the advancement of the sector, such as circular economy and eco-design to boost its innovation potential to develop sustainable solutions.

CLEANTEX aims to promote the adoption of circular economy and eco-design concepts to develop the skills of textile engineering students and other disciplines, through cross-sectoral cooperation in higher education institutions, to address the main pollution problem in the textile industry and achieve a more sustainable sector.

For all these reasons, the CLEANTEX Consortium works to elaborate a set of implementation activities that materialise the project objectives, supported by preparation, management, quality, and dissemination activities that will ensure the dissemination of its results even after the project has ended. All project outcomes are the results of our intellectual outputs.

CLEANTEX develops four intellectual outputs: a virtual training programme, a bootcamp, a training camp, and a life cycle and eco-design e-book.

In particular, this e-book is a practical guide on the implementation of life cycle assessment and eco-design applied in textile design and manufacturing. Its structure starts with an introduction to the project and highlights the goals and benefits of the CLEANTEX project.

As for the theoretical part, this e-book contains Life Cycle Assessment (LCA) and eco-design methodologies, as outlined below:

- LCA: The e-book covers the definition of LCA, its four interrelated stages and their respective description, the environmental impact categories used to express the potential environmental impacts, and the life cycle stages of a product, including procurement of raw materials, processing, transport, use and end-of-life (reuse, remanufacturing, recycling and incineration or landfill). The e-book also shows the system definitions linked to the different LCA scopes.
- Eco-design: This e-book contains the definition, principles, and phases of eco-design.

The practical part of this eBook is related to real cases of products from different companies, all of them related to LCA and eco-design criteria applied in the textile sector. The CLEANTEX consortium collected 16 cases from different countries including Greece, Lithuania, France, Italy, Slovenia and Spain.

Each case has its own explanation. Thus, each case defines the stage of the value chain where the LCA or eco-design criterion is applied, the practices for applying the respective criteria, the benefits of the strategy (environmental, economic, technical and social benefits), the barriers to implementation and the potential replication of each product.

From CLEANTEX we invite you to challenge on environmental awareness, as through this e-book you will have the chance to learn good environmental practices that will allow you to see the textile sector in a different way. Do not hesitate to contact us if you have any questions regarding this e-book or the project. If you click on this link you will be directed to the main page of the CLEANTEX Project, where you can find more information and other results such as a virtual training.

It is our pleasure to share our knowledge with you.

Resumen del proyecto

El proyecto CLEANTEX nace con el objetivo de desarrollar materiales de formación personalizados para empresas y estudiantes universitarios del sector textil. Estos materiales de apoyo desarrollan temas trascendentales para el avance del sector, como la economía circular y el ecodiseño, para impulsar su potencial de innovación y desarrollar soluciones sostenibles.

CLEANTEX tiene la meta de promover conceptos de economía circular y ecodiseño para desarrollar las habilidades de los estudiantes de ingeniería textil y otras disciplinas mediante la cooperación intersectorial en las IES, para abordar el principal problema de contaminación en la industria textil y lograr un sector más sostenible.

Por todas estas razones, el Consorcio Cleantex está trabajando para elaborar un conjunto de tareas que materialicen los objetivos del proyecto, relacionadas en actividades de preparación, gestión, calidad y difusión, que aseguren la difusión de sus resultados incluso después de que el proyecto haya finalizado. Todos los resultados del proyecto son los resultados de nuestros productos intelectuales.

CLEANTEX está desarrollando cuatro productos intelectuales; un programa de formación virtual, una formación en materia de textiles (Bootcasmp), un campamento de formación y un libro electrónico sobre el ciclo de vida y el diseño ecológico.

En concreto, este libro electrónico es una guía práctica sobre la implementación del análisis de ciclo de vida y el ecodiseño aplicado al diseño y la fabricación de textiles. Su estructura comienza con una introducción del proyecto y destaca los objetivos y beneficios del proyecto CLEANTEX.

En cuanto a la parte teórica, este libro electrónico contiene las metodologías de ACV y ecodiseño, tal y como se expone a continuación:

- ACV: El libro electrónico cubre la definición de ACV, sus cuatro etapas interrelacionadas y su respectiva descripción, las categorías de impacto ambiental utilizadas para expresar los posibles impactos ambientales y las etapas del ciclo de vida de un producto, incluyendo la obtención de materias primas, el procesamiento, el transporte, el uso y el fin de vida (reutilización, remanufacturación, reciclaje e incineración o vertido). El libro electrónico también muestra las definiciones del sistema, vinculadas a los diferentes ámbitos del ACV y sus límites.
- Ecodiseño: Este libro electrónico contiene la definición, los principios y las fases del diseño ecológico.

La parte práctica de este libro electrónico está relacionada con casos reales de productos de diferentes empresas, todos ellos relacionados con el ecodiseño y los criterios de ACV aplicados en el sector textil. El consorcio CLEANTEX recopiló 16 casos de diferentes países; Grecia, Lituania, Francia, Italia, Eslovenia y España.

Cada caso tiene su propia explicación. Así, cada caso define la etapa de la cadena de valor en la que se aplica el criterio de ACV o de ecodiseño, las prácticas para la aplicación de los respectivos criterios, los beneficios de la estrategia (beneficios ambientales, económicos, técnicos y sociales), las barreras para la aplicación y la posible replicación de cada producto.

Desde CLEANTEX, te invitamos a apostar por la conciencia ambiental, ya que a través de este libro electrónico tendrás la oportunidad de aprender buenas prácticas ambientales que te permitirán ver el sector textil de una manera diferente. No dudes en ponerte en contacto con nosotros si tienes alguna duda sobre este e-book o el proyecto en sí. Si haces clic en el siguiente enlace, te llevará a la página principal del Proyecto CLEANTEX, donde podrás encontrar más información y otros resultados, como los de la formación virtual.

Es un placer para nosotros compartir nuestros conocimientos contigo.

Περίληψη

Το έργο CLEANTEX δημιουργήθηκε με στόχο την ανάπτυξη εξατομικευμένου εκπαιδευτικού υλικού για εταιρείες και φοιτητές στον κλάδο της κλωστοϋφαντουργίας. Αυτά τα υλικά υποστήριξης αναπτύσσουν υπερβατικά θέματα για την πρόοδο του κλάδου, όπως η κυκλική οικονομία και ο οικολογικός σχεδιασμός ενισχύοντας τις δυνατότητες καινοτομίας και την ανάπτυξη βιώσιμων λύσεων.

Το CLEANTEX στοχεύει να προωθήσει την υιοθέτηση ιδεών κυκλικής οικονομίας και οικολογικού σχεδιασμού για την ανάπτυξη των δεξιοτήτων των φοιτητών κλωστοϋφαντουργίας στον κλάδο των μηχανικών και όχι μόνο, μέσω διατομεακής συνεργασίας στα ΑΕΙ. Στόχος είναι η αντιμετώπιση του κύριου προβλήματος ρύπανσης της κλωστοϋφαντουργίας και η επίτευξη ενός πιο βιώσιμου τομέα .

Για όλους αυτούς τους λόγους, η σύμπραξη CLEANTEX εργάζεται για να εκπονήσει ένα σύνολο δραστηριοτήτων υλοποίησης που φέρνουν εις πέρας τους στόχους του έργου, υποστηριζόμενες από ασκήσεις προετοιμασίας, διαχείρισης, ποιότητας και διάδοσης που θα διασφαλίσουν τη μετάδοση των αποτελεσμάτων ακόμη και μετά το τέλος του έργου. Το υλικό που έχει πραχθεί στο έργο είναι παράγωγα των πνευματικών μας αποτελεσμάτων.

Το CLEANTEX αναπτύσσει τέσσερα πνευματικά αποτελέσματα: ένα εικονικό πρόγραμμα εκπαίδευσης, ένα bootcamp, ένα εκπαιδευτικό πρόγραμμα και ένα ηλεκτρονικό βιβλίο για τον κύκλο ζωής (LCA – Life Cycle Assessment) και οικολογικού σχεδιασμού.

Συγκεκριμένα, αυτό το ηλεκτρονικό βιβλίο είναι ένας πρακτικός οδηγός για την εφαρμογή της αξιολόγησης του LCA και του οικολογικού σχεδιασμού που εφαρμόζονται στον σχεδιασμό και την κατασκευή κλωστοϋφαντουργικών προϊόντων. Η δομή του ξεκινά με μια εισαγωγή στο έργο και αναδεικνύει τους στόχους και τα οφέλη του έργου CLEANTEX.

Όσον αφορά το θεωρητικό μέρος, αυτό το ηλεκτρονικό βιβλίο περιέχει μεθοδολογίες αξιολόγησης Κύκλου Ζωής (LCA) και οικολογικού σχεδιασμού, όπως περιγράφονται παρακάτω:

- LCA: Το ηλεκτρονικό βιβλίο καλύπτει τον ορισμό του LCA, τα τέσσερα αλληλένδετα στάδια και την αντίστοιχη περιγραφή τους, τις κατηγορίες περιβαλλοντικών επιπτώσεων που χρησιμοποιούνται για την έκφραση των πιθανών περιβαλλοντικών επιπτώσεων και τα στάδια του κύκλου ζωής ενός προϊόντος, συμπεριλαμβανομένης της προμήθειας πρώτων υλών, της επεξεργασίας , μεταφορά, χρήση και τέλος ζωής (επαναχρησιμοποίηση, ανακατασκευή, ανακύκλωση και αποτέφρωση ή απόρριψη σε

χωματερές). Το ηλεκτρονικό βιβλίο εμφανίζει επίσης τους ορισμούς του συστήματος που συνδέονται με τα διαφορετικά πεδία LCA.

- Οικολογικός σχεδιασμός: Αυτό το ηλεκτρονικό βιβλίο περιέχει τον ορισμό, τις αρχές και τις φάσεις του οικολογικού σχεδιασμού.

Το πρακτικό μέρος αυτού του ebook σχετίζεται με πραγματικές περιπτώσεις προϊόντων διαφορετικών εταιρειών, όλα σχετικά με LCA και κριτήρια οικολογικού σχεδιασμού που εφαρμόζονται στον κλάδο της κλωστοϋφαντουργίας. . Η σύμπραξη CLEANTEX συγκέντρωσε 16 περιπτώσεις από διαφορετικές χώρες όπως την Ελλάδα, τη Λιθουανία, τη Γαλλία, την Ιταλία, τη Σλοβενία και την Ισπανία.

Κάθε περίπτωση έχει τη δική της εξήγηση. Έτσι, κάθε περίπτωση ορίζει το στάδιο της αλυσίδας αξίας όπου εφαρμόζεται το κριτήριο LCA ή οικολογικού σχεδιασμού, τις πρακτικές εφαρμογής των αντίστοιχων κριτηρίων, τα οφέλη της στρατηγικής (περιβαλλοντικά, οικονομικά, τεχνικά και κοινωνικά οφέλη), τα εμπόδια στην εφαρμογή και την πιθανή αναπαραγωγή κάθε προϊόντος.

Εκ μέρους του CLEANTEX σας προσκαλούμε να αμφισβητήσετε την περιβαλλοντική ευαισθητοποίηση, καθώς μέσω αυτού του ηλεκτρονικού βιβλίου θα έχετε την ευκαιρία να μάθετε καλές περιβαλλοντικές πρακτικές που θα σας επιτρέψουν να δείτε τον κλάδο της κλωστοϋφαντουργίας με διαφορετικό μάτι. Μη διστάσετε να επικοινωνήσετε μαζί μας εάν έχετε οποιεσδήποτε ερωτήσεις σχετικά με αυτό το ηλεκτρονικό βιβλίο ή το έργο. Εάν κάνετε κλικ σε αυτόν τον σύνδεσμο, θα κατευθυνθείτε στην κεντρική σελίδα του Έργου CLEANTEX, όπου μπορείτε να βρείτε περισσότερες πληροφορίες και άλλα αποτελέσματα, όπως την εικονική εκπαίδευση.

Είναι χαρά μας να μοιραστούμε τις γνώσεις μας μαζί σας.

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SANTRAUKA

CLEANTEX projekto tikslas – sukurtą mokymo medžiagą pritaikyti tekstilės sektoriaus įmonėms ir universitetų studentams. Ši pagalbinė mokymo medžiaga plėtoja sektoriaus pažangos temas, pavyzdžiui, žiedinę ekonomiką ir ekologinį dizainą, siekiant padidinti inovacijų potencialą, kuriant tvarius sprendimus.

CLEANTEX siekiama skatinti žiedinės ekonomikos ir ekologinio dizaino koncepcijų taikymą, ugdyti tekstilės inžinerijos ir kitų disciplinų studentų įgūdžius, bendradarbiaujant su aukštosiomis mokyklomis, sprendžiant pagrindinę taršos problemą tekstilės pramonėje ir sukuriant tvaresnį sektorių.

Dėl visų šių priežasčių CLEANTEX konsorciumas stengiasi parengti rinkinį veiklų, kurios įgyvendintų projekto tikslą, paremtą pasirengimo, valdymo, kokybės ir sklaidos veikla, kuri užtikrintų rezultatų sklaidą, net ir pasibaigus projektui. Visi projekto rezultatai yra mūsų intelektinės veiklos rezultatai.

CLEANTEX kuria keturis intelektualinius rezultatus: virtualią mokymo programą, stovyklą, treniruočių stovyklą ir gyvavimo ciklo bei ekologinio dizaino elektroninę knygą.

Visų pirma, ši elektroninė knyga yra praktinis gyvenimo ciklo vertinimo ir ekologinio dizaino, taikomo tekstilės projektavimo ir gamybos srityje, įgyvendinimo vadovas. Jo struktūra prasideda projekto įvadu ir pabrėžia CLEANTEX projekto tikslus ir naudą.

Kalbant apie teorinę dalį, šioje elektroninėje knygoje yra gyvavimo ciklo vertinimo (Life Cycle Assessment (LCA)) ir ekologinio projektavimo metodikos:

- LCA: elektroninė knyga apima LCA apibrėžimą, keturis tarpusavyje susijusius etapus ir atitinkamą jų aprašymą, poveikio aplinkai kategorijas ir produkto gyvavimo ciklo etapus, įskaitant žaliavų įsigijimą, perdirbimą, transportavimą, naudojimą ir eksploatacijos pabaigą (pakartotinis naudojimas, perdirbimas, perdirbimas ir sudeginimas arba šalinimas sąvartynuose). Elektroninėje knygoje taip pat pateikiami sistemos apibrėžimai, susieti su skirtingomis LCA apimtimis.
- Ekologinis dizainas: šioje e. knygoje pateikiamas ekologinio projektavimo apibrėžimas, principai ir etapai.

Praktinė šios elektroninės knygos dalis yra susijusi su realiais skirtingų įmonių gaminių atvejais, visi jie susiję su LCA ir ekologinio dizaino kriterijais, taikomais tekstilės sektoriuje. CLEANTEX konsorciumas surinko 16 atvejų iš įvairių šalių – Graikijos, Lietuvos, Prancūzijos, Italijos, Slovėnijos ir Ispanijos.

Kiekvienas atvejis turi savo paaiškinimą. Taigi, kiekvienu atveju apibrėžiamas vertės grandinės etapas, kuriame taikomas LCA arba ekologinio projektavimo kriterijus, atitinkamų kriterijų taikymo praktika, strategijos nauda (aplinkosauginė, ekonominė, techninė ir socialinė nauda), įgyvendinimo kliūtys ir galima kiekvieno produkto atkartojimą.

Iš CLEANTEX kviečiame mesti iššūkį apie aplinkosauginį sąmoningumą, nes šios e. knygos dėka turėsite galimybę išmokti gerosios aplinkosaugos praktikos, kuri leis jums kitaip pažvelgti į tekstilės sektorių. Nedvejodami susisiekite su mumis, jei turite klausimų dėl šios e. knygos ar projekto. Jei spustelėsite šią nuorodą, būsite nukreipti į pagrindinį CLEANTEX projekto puslapį, kur rasite daugiau informacijos ir kitų rezultatų, tokių kaip virtualūs mokymai.

Mums malonu pasidalinti savo žiniomis su jumis.

Riepilogo

Il progetto CLEANTEX nasce con l'obiettivo di sviluppare materiali formativi personalizzati per aziende e studenti universitari del settore tessile. Questi materiali di supporto sviluppano temi trascendentali per il progresso del settore, come l'economia circolare e l'eco-design per aumentare il suo potenziale di innovazione per sviluppare soluzioni sostenibili.

CLEANTEX mira a promuovere l'adozione di concetti di economia circolare ed eco-design per sviluppare le competenze degli studenti di ingegneria tessile e di altre discipline, attraverso la cooperazione intersettoriale negli istituti di istruzione superiore, per affrontare il principale problema di inquinamento nell'industria tessile e raggiungere un settore più sostenibile .

Per tutti questi motivi, il Consorzio CLEANTEX lavora per elaborare una serie di attività di implementazione che concretizzino gli obiettivi del progetto, supportate da attività di preparazione, gestione, qualità e divulgazione che garantiranno la diffusione dei suoi risultati anche dopo la conclusione del progetto. Tutti i risultati del progetto sono i risultati dei nostri output intellettuali.

CLEANTEX sviluppa quattro output intellettuali: un programma di formazione virtuale, un bootcamp, una training camp e un e-book sul ciclo di vita del prodotto e sull'eco-design.

In particolare, questo e-book è una guida pratica sull'implementazione della valutazione del ciclo di vita e dell'eco-design applicati nella progettazione e produzione tessile. La sua struttura inizia con un'introduzione al progetto ed evidenzia gli obiettivi ei vantaggi del progetto CLEANTEX.

Per quanto riguarda la parte teorica, questo e-book contiene metodologie di Life Cycle Assessment (LCA) e di eco-design, come di seguito riportato:

- LCA: l'e-book copre la definizione di LCA, le sue quattro fasi interconnesse e la rispettiva descrizione, le categorie di impatto ambientale utilizzate per esprimere i potenziali impatti ambientali e le fasi del ciclo di vita di un prodotto, compreso l'approvvigionamento delle materie prime, la lavorazione , trasporto, uso e fine vita (riutilizzo, rigenerazione, riciclaggio e incenerimento o discarica). L'e-book mostra anche le definizioni di sistema legate ai diversi ambiti LCA.
- Ecodesign: questo e-book contiene la definizione, i principi e le fasi dell'ecodesign.

La parte pratica di questo ebook è relativa a casi reali di prodotti di diverse aziende, tutti legati a criteri di LCA e di eco-design applicati nel settore tessile. Il consorzio CLEANTEX ha raccolto 16 casi da diversi paesi tra cui Grecia, Lituania, Francia, Italia, Slovenia e Spagna.

Ogni caso ha la sua spiegazione. Pertanto, ogni caso definisce la fase della catena del valore in cui viene applicato l'LCA o il criterio di progettazione ecocompatibile, le pratiche per l'applicazione dei rispettivi criteri, i vantaggi della strategia (benefici ambientali, economici, tecnici e sociali), gli ostacoli all'attuazione e la potenziale replica di ciascun prodotto.

Da CLEANTEX ti invitiamo a sfidarti sulla consapevolezza ambientale, poiché attraverso questo e-book avrai la possibilità di apprendere buone pratiche ambientali che ti permetteranno di vedere il settore tessile in modo diverso. Non esitate a contattarci se avete domande su questo e-book o sul progetto. Se clicchi su questo link verrai indirizzato alla pagina principale del Progetto CLEANTEX, dove potrai trovare maggiori informazioni e altri risultati come un training virtuale.

È nostro piacere condividere la nostra conoscenza con voi.

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Résumé

Le projet CLEANTEX a été créé dans le but de développer des supports de formation personnalisés pour les entreprises et les étudiants universitaires du secteur textile. Ces supports développent des sujets transcendants pour l'avancement du secteur, tels que l'économie circulaire et l'éco-conception afin de stimuler son potentiel d'innovation pour développer des solutions durables.

CLEANTEX vise à promouvoir l'adoption des concepts d'économie circulaire et d'éco-conception pour développer les compétences des étudiants en ingénierie textile et d'autres disciplines, par le biais d'une coopération intersectorielle dans les établissements d'enseignement supérieur, afin de résoudre le principal problème de pollution dans l'industrie textile et de parvenir à un secteur plus durable.

Pour toutes ces raisons, le Consortium CLEANTEX élabore un ensemble d'activités de mise en œuvre qui concrétisent les objectifs du projet, soutenues par des activités de préparation, de gestion, de qualité et de diffusion qui assureront la diffusion de ses résultats même après la fin du projet. Tous les résultats du projet se présentent sous forme de produits intellectuels.

CLEANTEX développe quatre ressources : un programme de formation virtuel, un bootcamp, une semaine de formation et un livre électronique sur le cycle de vie et l'éco-conception.

En particulier, ce livre électronique est un guide pratique sur la mise en œuvre de l'analyse du cycle de vie et de l'éco-conception appliquées à la conception et à la fabrication de textiles. Sa structure commence par une introduction au projet où on souligne les objectifs et les avantages du projet CLEANTEX.

En ce qui concerne la partie théorique, cet e-book contient des méthodologies d'analyse du cycle de vie (ACV) et d'éco-conception, comme indiqué ci-dessous :

- ACV : l'e-book couvre la définition de l'ACV, ses quatre étapes interdépendantes et leur description respective, les catégories d'impact environnemental utilisées pour exprimer les impacts environnementaux potentiels, et les étapes du cycle de vie d'un produit, y compris l'approvisionnement en matières premières, la transformation, le transport, l'utilisation et la fin de vie (réutilisation, refabrication, recyclage et incinération ou mise en décharge). L'e-book présente également les définitions des systèmes liées aux différents champs d'application de l'ACV.
- Éco-conception : Cet e-book contient la définition, les principes et les phases de l'éco-conception.

La partie pratique de cet e-book est liée à des cas réels de produits de différentes entreprises, tous liés à l'ACV et aux critères d'éco-conception appliqués dans le secteur textile. Le consortium CLEANTEX a regroupé 16 cas provenant de différents pays, dont la Grèce, la Lituanie, la France, l'Italie, la Slovénie et l'Espagne.

Chaque cas a sa propre explication. Ainsi, chaque cas définit l'étape de la chaîne de valeur où le critère d'ACV ou d'éco-conception est appliqué, les pratiques d'application des critères respectifs, les avantages de la stratégie (avantages environnementaux, économiques, techniques et sociaux), les obstacles à la mise en œuvre et la reproduction potentielle de chaque produit.

Avec CLEANTEX, nous vous invitons à relever et gagner le défi de la sensibilisation à l'environnement, car grâce à cet e-book, vous aurez la possibilité d'apprendre de bonnes pratiques environnementales qui vous permettront de voir le secteur textile d'une manière différente. N'hésitez pas à nous contacter si vous avez des questions concernant cet e-book ou le projet. Si vous cliquez sur ce lien, vous serez dirigé vers la page principale du projet CLEANTEX, où vous pourrez trouver plus d'informations et d'autres résultats tels qu'une formation virtuelle.

C'est avec plaisir que nous partageons nos connaissances avec vous.

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Povzetek

Projekt CLEANTEX je zasnovan z namenom pripraviti učna gradiva za usposabljanje univerzitetnih študentov in strokovnjakov iz tekstilnih podjetij na področju krožnega gospodarstva in eko-dizajna. Gradiva vključujejo interdisciplinarne teme, ki promovirajo vpeljavo konceptov krožnega gospodarstva in eko-dizajna v tekstilnem sektorju ter s tem pomembno prispevajo k povečanju njegovega inovacijskega potenciala za razvoj trajnostnih rešitev.

Namen projekta CLEANTEX je hkrati izboljšati znanje in spretnosti študentov tekstilnega inženirstva, oblikovanja in menedžmenta, da bi zmanjšali onesnaževanje v tekstilni industriji in dosegli večjo trajnost v sektorju.

Konzorcij projekta CLEANTEX zato izvaja niz aktivnosti, ki uresničujejo cilje projekta in zagotavljajo širjenje rezultatov projekta tudi po njegovem zaključku. Tem aktivnostim so v podporo aktivnosti vodenja, širjenja in spremljanja kakovosti projekta.

Najpomembnejši rezultati projekta CLEANTEX vključujejo spletno učilnico z virtualnim programom usposabljanja, strukturo hekatona, poletno šolo in e-knjigo o analizi življenjskega cikla (LCA) in eko-dizajnu.

E-knjiga predstavlja praktični vodnik za uporabo LCA in eko-dizajna pri načrtovanju in proizvodnji tekstilij. Vključuje tri poglavja. V uvodnem poglavju so predstavljeni namen in cilji projekta CLEANTEX. V teoretičnem delu sta opisani metodologiji LCA in eko-dizajna, in sicer:

- LCA: e-knjiga predstavlja opredelitev LCA, njene štiri medsebojno povezane stopnje in njihov opis, kategorije vplivov na okolje, ki se uporabljajo za določitev morebitnih vplivov na okolje ter stopnje življenjskega cikla izdelka, ki vključujejo nabavo surovin, predelavo, prevoz, uporabo in konec življenjske dobe (ponovna uporaba, predelava, recikliranje in sežiganje ali odlaganje na odlagališču). V e-knjigi so opredeljene tudi definicije sistemov, povezanih z različnimi področji LCA.
- eko-dizajn: e-knjiga vključuje opredelitev, načela in faze eko-dizajna.

Praktični del e-knjige opisuje izdelke različnih tekstilnih podjetij, pri katerih so bili v proizvodnji uporabljeni kriteriji LCA in eko-dizajna, ki se uporabljajo v tekstilnem sektorju. Konzorcij CLEANTEX je izbral 16 primerov dobrih praks iz različnih držav, in sicer Grčije, Litve, Francije, Italije, Slovenije in Španije.

Pri vsakem izdelku je opredeljena stopnja vrednostne verige, v kateri so bili uporabljeni kriteriji LCA ali eko-dizajna, opisane so prakse za uporabo navedenih kriterijev, koristi uporabljene strategije (okoljske, gospodarske, tehnične in družbene koristi), ovire pri izvajanju in morebiten prenos uporabe na druga področja.

Projekt CLEANTEX se loteva različnih izzivov, povezanih z okoljsko ozaveščenostjo. Z e-knjigo je mogoče spoznati dobre okoljske prakse, ki prikazujejo drugačen, bolj pozitiven pogled na tekstilni sektor. V kolikor imate v povezavi z e-knjigo ali projektom kakršnakoli vprašanja, nas lahko kontaktirate. S klikom na povezavo boste preusmerjeni na glavno stran projekta CLEANTEX, kjer boste našli več informacij o projektu in njegovih rezultatih, med drugim tudi spletno učilnico.

Z veseljem delimo svoje znanje z vami.

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