SmarTextil

Sustainability & Traceability

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1. INTRODUCTION

The current economic system is linear, in which humanity extracts resources from the planet, uses and discards them. The same applies to clothing: we buy a garment and when we get tired of it, we throw it away and buy another one. Each time we do this we are consuming finite resources from the environment and polluting it with wastes. Hence, this model cannot work in the long term because it is not sustainable.

In contrast, nature works in a circular system in which the waste from one cycle is actually the raw material for the next. Circular economy is based on applying this principle to the current economic system.

What is SmarTextil?

SmarTextil is a specialised information manager start-up that applies circular economy concepts to the textile sector to improve the management of end of life products, through secure traceability of materials to optimise their utilisation.

Purpose, vision, mission and values

- ✓ **Purpose**: We exist to create traceable, transparent, robust, digital and sustainable supply chains of the textile sector.
- ✓ **Mission**: We give a robust knowledge hub where the manufacturer can check information related to the end of life of their products, eco- design behaviour… and the waste manager and recycler can check the composition of the fibres received.
- ✓ **Vision**: We want to achieve a change of thinking in the textile industry for the reuse of materials and circular economy.
- ✓ **Values**: We see possibilities, not boundaries, based on a circular economy and partnerships to grow together.

Team

SmarTextil is made up of three professionals who are enthusiastic about the circular economy and aware of the imperative need to develop tangible sustainable alternatives to the textile supply chain given the high level of consumption.

Marina Moreno Álvarez	Director
Nuria Serrano Barthe	IT Manager
Javier Díez Medina	Environment Manager

2. BUSINESS MODEL

Business idea

❖ Understanding the problem

As noted in the introduction, the current consumption model is based on a "take-make-use-waste" philosophy, i.e., a linear model, which is not sustainable as it is intimately linked to the limit of resources and energy.

The same philosophy applies in the textile sector where 100.000 tons of textiles are discarded every year just in Spain and only 15- 25% are collected [1]. Every year, each person in Spain consumes an average of 34 clothing items and discards between 10 and 14 kg [2].

Consumers buy textile products, and these are often discarded before the end of their life cycle (that is, before they are unwearable) for various reasons such as over-consumption, change in fashion trends, cheap sale prices, personal satisfaction etc. Currently, there is a lack of options known to the consumers to recycle these materials, so their life cycle is abruptly cut off. Although it is true that the secondary market is on the rise, hence extending its life cycle, it does not solve the fact that landfill will most likely be the end of life of those garments.

On the other hand, one of the biggest barriers of textile recycling is that separation of end of life products is not carried out efficiently.

Figure 1. Current linear model

All these reasons reinforce the need for a change in the current textile management model, which will be pushed to the next level by the implementation of the EPR derived from Directive (UE) 2008/851 and transposed in Spain as Law 7/2022 (*Ley 7/2022, de 8 de abril, de residuos y suelos contaminados para una economía circular*). This new regulation framework drives to make a change from a linear to a circular model in the textile sector, hence, making this moment an excellent opportunity for SmarTextil. The most relevant points of this law are discussed in Chapter 3.

- **Proposed solution**

SmarTextil was created to answer the problems of the textile industry by providing a traceability service and knowledge hub based on the characteristics of the garments, specifically the materials and elements that make them up, in order to optimise their subsequent recovery, within a circular economy framework. SmarTextil's approach allows us not only to improve recycling, but also to assess the sustainability of the garments made by textile brands.

SmarTextil will own the hub and will be responsible for its maintenance and updating. It will also manage the partnerships between the different actors involved in the process.

- **Value proposition**

SmarTextil's value proposition focuses on managing a valid information system in the different stages of the product life cycle through the creation of a knowledge hub. The value creation for each actor is shown below:

- Manufacturer

- Textile containerisation strategies will be mandatory.
- Verified information about garment composition, dyeing, colour and physico-chemical processes used.
- Improvements in the ecodesign of their garments.
- Manufacturing impacts using indicators, ecocosts and social costs.

- Recycler

- Verified information about garment composition, dyeing, colour and physico-chemical processes used.
- Ease of separating the incoming material flows due to the RFID implemented in the garments providing verified information about the textile composition.
- More economic return on the selected material, as it does not contain improprieties.

- Consumer (to be decided together with the manufacturer)

- Access verified information for more responsible consumption.
  - Planet

- Increasing the circularity of textile materials reduces both the consumption of finite resources as well as emissions into the atmosphere, discharges into water and energy consumption for manufacturing, transporting, selling, etc.

Therefore, with our activity, at SmarTextil we contribute to:

Canvas

The graph below shows the business Canvas of the proposal.

<table>
<tr><th>Anticipation and environmental impact</th><th>Circular value chain</th><th>Problem/Need</th><th>Unique value proposal</th><th>Customer and stakeholder relations</th><th>Customer segments</th><th>Anticipation and social impact</th></tr>
<tr>
<td rowspan="4">IMPACTS OF THE COMPANY ON THE ENVIRONMENT
POSITIVE
- Landfilling reduction of textile material
- Increased recycling
- Smaller environmental footprint
- Resource savings (water and chemicals)

NEGATIVE
- End-of-chain solution, not over-production (transition model)</td>
<td>ORIGIN
- Average user.
- Clothing shops.
- Big brands.

DESTINATION
- Producing sectors
- Building sector
- Automotive sector (seats and others)
- Textile (upholstery, curtains, carpets, blankets, sheets, cushion stuffing, bags, backpacks)</td>
<td>Lack of traceability, lack of information on the textile material.

Lack of textile circularity. Very short life cycles

High use of resources for new manufacturing (water, chemicals, etc.)</td>
<td rowspan="2">The idea is to offer a knowledge hub to textile companies and recyclers in which information is collected

Value for the MANUFACTURER:
- Verified information about garment composition, dyeing and colour and physico-chemical processes used.
- Improvements in the eco-design of their garments.
- Complying with Law 7/2022

Value for the RECYCLER:
- Verified information about garment composition, dyeing and colour and physico-chemical processes used.
- Ease in separating incoming material flows due to the RFID implemented in the garments.
- More economic return on the selected material, as it does not contain improprieties.

Value for the CONSUMER (to be decided in conjunction with the manufacturer): able to access verified information in order to consume more responsibly.

Value for the PLANET: reduced consumption of limited resources, emissions to the atmosphere, discharges to water and energy consumption</td>
<td>Average user

Brands (manufacturers and shops)

Recyclers</td>
<td rowspan="2">AFFECTED
Average user
Brands
Recyclers

Sectors interested in recycled textiles
- Construction sector
- Automotive sector (seats)
- Textile (upholstery, curtains, carpets, blankets, sheets, cushion padding, bags, backpacks)</td>
<td>SOCIETAL IMPACTS ON INDUSTRY
Little current awareness due to the consumption model that is advertised on social media and traditional media.

Expectations of improvement when it comes to social awareness and consumption patterns.

Improving eco-design, use of mono-materials, etc.

Limited recycling technology</td>
</tr>
<tr>
<td colspan="2">Key resources

Human resources: textile recycling technology expert and textile eco-design expert

Collaboration with textile brands

Server that stores the hub information

Direct line of communication with the recycler (webpage)

Well-supported material and impact analysis (indicators)

Webpage</td>
<td>Communication & Sales

Brands: marketing and advertising, web

Recyclers: marketing and advertising, web</td>
<td>IMPACTS OF BUSINESS ON SOCIETY

Greater control of the supply chain</td>
</tr>
<tr>
<td colspan="3">Cost structure

Staff

Server

Computer and telephony equipment

Online platform

Licences

Bills (electricity...)</td>
<td colspan="2">Revenue stream

Hub access = €/ year

€/ kg recovered (per line)

Advice/ training for designers

Advice/ training for recyclers</td>
<td></td>
</tr>
<tr>
<td colspan="5">Business model and circular innovation

Textile traceability in order to recover flows to industries in compliance with the waste hierarchy.</td>
<td></td>
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</table>

Figure 2. Business model canvas

Idea validation

The proposed business model has evolved and has been validated through the verification of a series of hypotheses via surveys to consumers and interviews with experts and the different stakeholder groups.

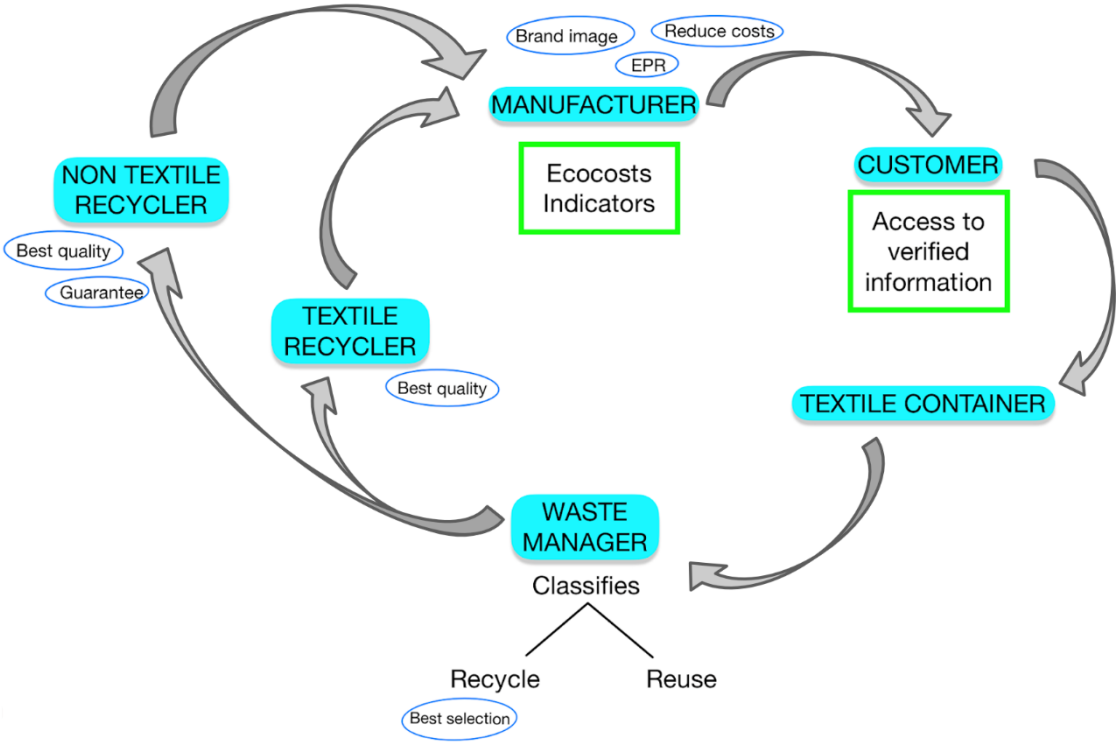

Figure 3. SmarTextil circular model

❖ Consumers

Since consumers, together with legislation, are one of the key stakeholders that push textile companies to act in one direction or another, it was decided to interview them.

➢ Hypotheses

The main hypothesis to be validated within this is "there is a market of customers who acknowledge that recycling is one of the solutions to reduce the environmental impact of the textile industry and are therefore willing to buy and even pay more for recycled clothing". Then, 11 hypotheses have been developed to get to know this segment. The results of the most relevant ones are shown below. The questionnaire defined for the survey can be found in Appendix 2.1. whereas the results obtained, and their analysis can be found in Appendix 2.2.

- 83% of users acknowledge that the environmental impact of the textile industry is high or very high.
- 77% of users would be willing to pay more for sustainable clothing.

- 92% of users would be willing to leave their homes to use textile containerization to environmentally manage end of life textile products.
- 71% of users believe that textile recycling could be a solution to the problem of textile waste generation.
- 84% of answers were positive to recycle their clothes to reduce the environmental impact.

➢ Survey

The survey reached 325 people. The sample profile is biassed towards two age intervals (18- 25 years and 56- 65 years). However, despite its dispersion of ages, the respondents voted similarly, so it is considered representative.

Age	# survey respondent	% of total sample
18- 25 years	82	25%
26- 35 years	44	14%
36- 45 years	29	9%
46- 55 years	61	19%
56- 65 years	82	25%
> 65 years	27	8%
Total	325	100%

The sample profile is biassed towards the female segment, hence there is more information from women than men. However, it is representative of a household since the woman might push the other members, so it is considered representative.

Sex	# survey respondent	% of total sample
Female	215	66%
Male	105	32%
Prefer not to say	5	2%
Total	325	100%

❖ **Stakeholders**

In this section, 9 interviews were conducted either with experts, managers in garment brands or public administration. All interviews can be found in Appendix 2.3.

➢ Experts

These interviews were focused on validating the feasibility of the business model as well as other details to improve the final implementation. Hence, they have been a key part to choose the most suitable technology for the developed model. The following lines describe the most important topics for each profile where the interviews conducted revealed that:

- Strategy sustainability consultant: system traceability must include more garment information such as fibre, spinning, weaving, dyeing and finishing of fabric, printing, etc.

- Sustainability consultant in textile and fashion industry: textile recycling will become relevant when its business model becomes profitable enough. Also, there is a lack of industries working in this field. However, traceability is the first step for change and industry should be willing to do so. It is necessary to know where the flows come from in order to analyse them.

- Expert in textile circular economy: it is more feasible to trace from the origin of the garment's manufacture to its use and collection, rather than from the origin of materials because of their delocalisation. The best technology for automated garment identification is RFID. This technology is woven in the thread garment itself and consumers could cut labels without any consequence to the identification process carried out during recycling.

- Technical manager in an urban waste management company: it was stated that these projects are really interesting and would avoid big quantities of improper waste which causes great trouble in the classifying process, like clogging lines and forced stops for repairs. However, it is difficult to include new machines in the current line because the contracts signed to manage urban waste are closed and for long terms. Also, any change requires testing and implementation whose costs are higher than the value generated. However, they would be willing to collaborate in a non-monetary way. They suggest that the textile Collective Extended Producer Responsibility System (CEPRS) should work in a similar way to the current packaging CEPRS (ECOEMBES) where an additional fee is paid for waste management and that it would work efficiently if a large number of companies joined.

- Textile waste manager and secondary market seller: a pilot project was carried out where more than half of the garments arrived with no label and the results were not very successful. From their point of view, they believe that the solution should not come from recycling but from the origin, from generation. Also, traceability itself does not bring them much value because they return clothes to the market, but, on the other hand, they are producers of textile waste with materials that they cannot use.

  - Companies in the textile sector

Interviews were carried out with different companies in the sector, all of them manufacturers of textile garments and accessories with an international presence. These interviews were essential to identify the needs of the companies in terms of the new

waste legislation and to ratify our business model in a commercial way. The following conclusions are presented:

- There is a growing trend towards the purchase of sustainable textile garments and accessories.
- The costs derived from the EPR will be charged on to the consumer.
- Lack of technology in textile recycling.
- The importance of eco-design and of the materials used taking into account their subsequent recycling.
- The traceability system has to be simple to implement and reliable. It should also be able to inform the consumer.
- Some brands may be reluctant to share the same traceability system with others because of brand image and reputation.

➢ Public administration

An environmental technical assistant in local public administration was interviewed. From his/ her point of view, administrations are interested in providing a quality and sustainable service at the lowest cost. The greatest value for the public administration is to know the quantity that is managed in the textile flow, not its characteristics and other data.

3. CONTEXT ANALYSIS

General context

❖ Political and legal factors

New political and legal changes in the sustainability field are coming from the EU (European Union), among which the DPP (Digital Product Passport) is one of the most relevant. The DPP initiative aims to gather data on a product and its supply chain and share it across all actors, so they have a better understanding of the products they use and their embodied environmental impact. It is part of the proposed Ecodesign for Sustainable Products Regulation as well as the Circular Economy Action Plan. Its goal is to lay the groundwork for a gradual introduction of a digital product passport in textiles, construction, and electric batteries markets by 2024 [3]. The implementation of DPP in these value chains is designed to support [4]:

- Sustainable product production.
- Value creation through circular business models.
- More informed purchasing decisions.
- Compliance verification with legal obligations.

The new Spanish regulatory framework, Law 7/2022, was briefly introduced in Chapter 1. The following are the most relevant points of this law [5]:

- The Extended Producer Responsibility (EPR) scheme for textiles is set for a maximum period of 3 years from the entry into force of the law (7th final provision).
    - EPR transfers to manufacturers the cost of managing the waste generated by the products they place on the market. It is a concept coined within the EU policy that is summarised by the "polluter pays" principle [6].
- By 31 December 2024 textile containerisation is mandatory (Article 25).
- By 2035 increasing the preparation for reuse and recycling of municipal waste to a minimum of 65% by weight is mandatory (Article 26).
- The destruction or disposal by landfill of unsold surplus of non-perishable products is prohibited (Article 18).

Also, it is important to mention that the entire textile, fashion and footwear value chain in Spain has set to work to develop the "Transformation of the Sector in the 2022-2029 horizon" initiative, promoted by the Textile and Fashion Observatory. This reindustrialization project will mobilise investments worth 14.961 million € [7].

Finally, it is also important to mention that Europe wants to become global leader in the transition towards sustainability, helping to set global standards and reaping the social and economic benefits of having been a pioneer in this field [8].

❖ **Socio- cultural factors**

As it can be seen in the next Figure, the level of interest in the environment has been increasing steadily, moderately in the previous decade and very sharply in the last two years [9].

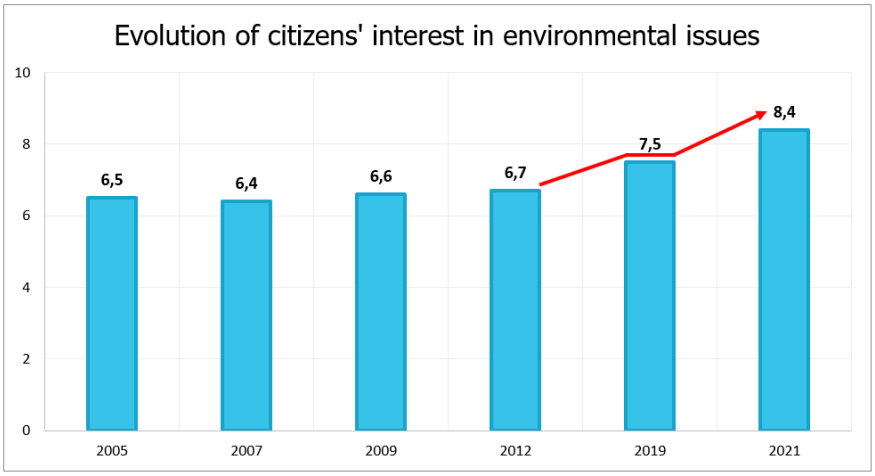

Figure 4. Evolution of citizens' Interest in environmental issues [9]

Also, [9] states that citizens are aware of the environmental issues and their capacity for personal influence hence, leading us to shift towards a new form of consumption and relationship with the environment.

❖ **Technological factors**

➢ Textile recycling

Textile recycling includes from the disassembly of the original part or shredding to the regeneration into new yarn, which requires a high level of integration throughout the value chain and relies on technological developments. However, it is still in its infancy due to these challenges [10]:

- Market challenges: the low level of supply currently limits the integration of post-consumer recycled textile fibres into production.
- Technological challenges: current technology is not yet sufficiently developed to support textile recycling on a commercial scale. Some of the existing technological challenges include material separation, quality restoration and handling of contaminants found in clothing.
- Systemic challenges: mainly the complexity of the supply chain and the lack of transparency.
- Lack of regulation and a tax system that promotes recycling.

Despite the challenges facing textile recycling, we must highlight the projection for the coming years, with new projects for the construction of both chemical and mechanical recycling plants [18].

This absence of chemical recycling plants in Spain is one of the reasons why SmarTextil decided to focus on the mechanical recycling of cotton the first and second years, in addition to the fact that Spain is Europe's largest producer of recycled fibre [19].

In 2027, with the construction of new recycling plants, we will start working with polyester, as will be seen later in the marketing plan.

After analysing these challenges, it is concluded that traceability is the tool for revolutionising textile recycling.

- Big data and blockchain

Technological development is very fast and the main trends in technology also influence the development areas that can affect our environment. The possibility of using big data to establish a direct connection between the RFID located in the garment and our knowledge hub allows our model to evolve and meet even further needs from our clients. Also, the possibility of using blockchain to guarantee our customers that the information is truthful adds a very high level of robustness to the model.

Market

❖ Previous considerations

Awareness of textile brands has increased dramatically in recent years. Several examples of this trend are shown below:

- H&M already makes its clothes from 64.5% recycled, organic or more sustainably sourced materials, according to its 2020 sustainability report. In addition, one of its objectives for the coming years is to achieve 100% of its materials being recycled or coming from other sustainable sources by 2030 [11].
- Inditex has several objectives such as: by 2023, all products will use 100% cotton and man-made cellulosic fibres from more sustainable sources, while by 2025 all polyester and linen will be 100% from more sustainable sources. In addition, last year more than 47% of the garments were Join Life, a label that recognises those that stand out in terms of the sustainability of materials and processes [12].
- Mango has set the goal of using 100% eco cotton and 50% recycled polyester in its garments by 2025, and that 100% of the cellulosic fibres they use will be of controlled origin by 2030 [13].

❖ Segmentation

Market segmentation arises naturally out of legal obligation and the initiative of brands themselves (as it was shown in the previous section). It is important to mention that in the fashion industry there is no lobby but brands, unlike other industries. Hence, textile

companies are not used to working together. However, SmarTextil wants to be the backbone of the textile industry in order to achieve a successful sustainable value chain. Therefore the communication actions developed in the marketing plan are essential.

The market of interest can be divided into Spanish textile manufacturers and recyclers.

❖ Competitors

The competitors identified are as follows:

- TextileGenesis is living proof that this idea is viable today since it is a custom-built traceability platform for the fashion & textile ecosystem. However, we differentiate ourselves from them because we focus on compliance with the law and promote the waste hierarchy [14].
- Haelixa also aims to prove product origin and traceability. However, their approach is different from ours because they use traceability technology based on DNA which adds more difficulty to the communication process [15].
- Zyosh is a system for measuring the degree of release of micro and nanoparticles according to the number of washes the garment has been subjected to. Hence, its activity is limited to durability whereas our activity is wider [16].
- I:CO also aims to build textile circularity. However, they only work with a recycler, hence limiting its options [17].

SWOT

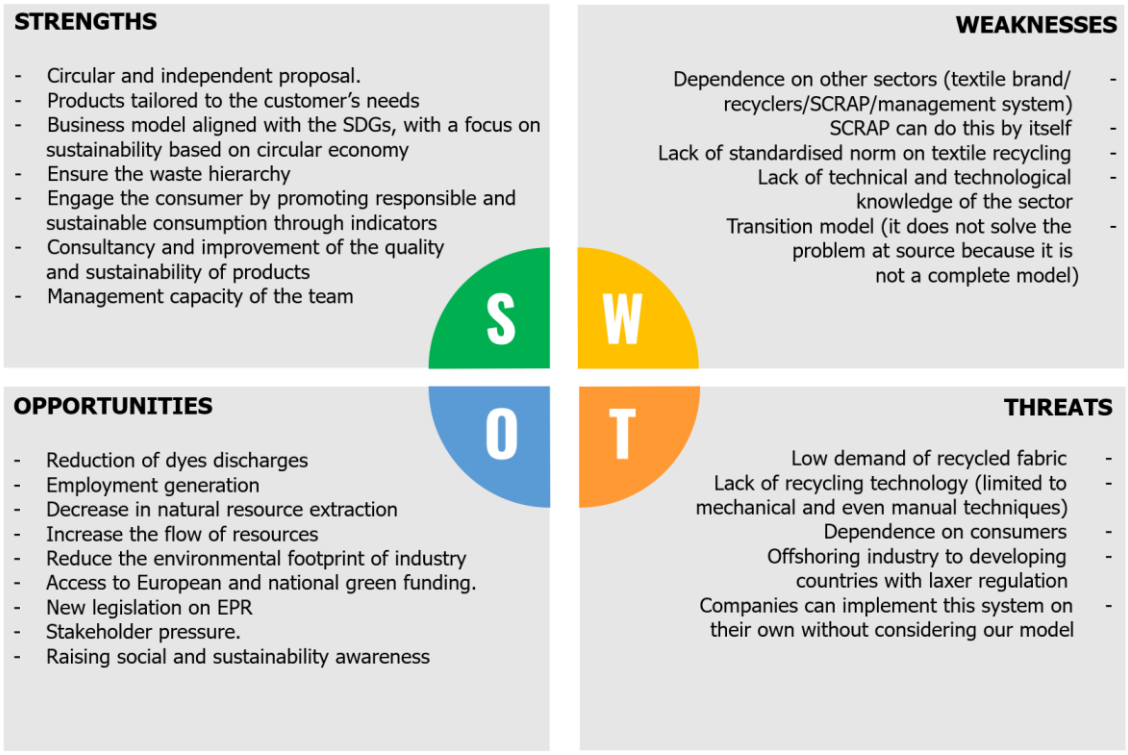

Figure 5. SWOT

4. OPERATIONAL PLAN

This section covers the different activities that take place in the business both internally as well as externally.

Process map

SmarTextil's activity focuses on offering a knowledge hub to textile manufacturers and recyclers. SmarTextil's process map is shown below, based on the concept of Porter's value chain, where processes are identified and classified as strategic, key and support. In addition to this, the key processes are also described, through a SIPOC diagram (Supplier- Input- Process- Output- Consumer).

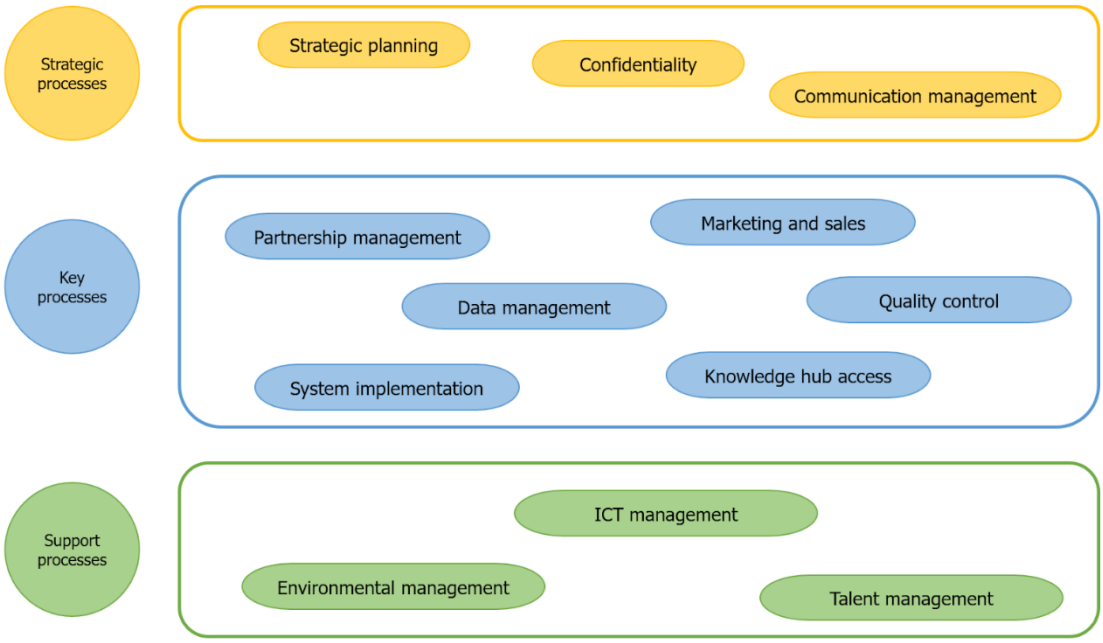

Figure 6. SmarTextil process map

- **Strategic processes**

  - Strategic planning

Strategic planning has been developed on the basis that from 31st December 2024 extended producer responsibility will be mandatory (Law 7/2022). This is why the objectives and initiatives to be developed by the different areas of the organisation have a total duration of 5 years.

  - Communication management and confidentiality

As mentioned in previous Chapters, external communication is a key element to maintain an optimal relationship with the different stakeholders, as well as confidentiality and

trust with the client, which are both an essential part of the business model. Hence, good communication management will allow us to position ourselves as a benchmark in the field of the textile circular economy.

❖ Key processes

As mentioned above, the key processes are described below.

➢ Partnerships

Given the importance of partnerships with the manufacturer, for SmarTextil the management of alliances is fundamental for the development of the business. It is necessary to forge these alliances with textile manufacturers, managers, textile recyclers and other industries that benefit from recycled textile for their operations (construction, automotive...).

The correct management of alliances will allow us to add other actors to the value chain, adding input flows and achieving objectives.

Partnerships will be developed through the online platform and the commercial sales team.

➢ Sales marketing

For SmarTextil the marketing and sales activity is fundamental, given the importance of achieving alliances with companies in the textile sector, i.e., with manufacturers.

The commercial activity will be carried out through the online platform and the commercial sales team.

The sales representatives will work in geographical areas in different parts of the country, as the most important manufacturers' brands in the country are located in different areas of the peninsula such as Madrid, Valencia, A Coruña and Málaga.

➢ Implementation of the system at the manufacturer

	SUPPLIER	INPUT	PROCESS		OUTPUT	CUSTOMER
Implementation of the system at the manufacturer	Environmental technical department	Manufacturer's data	1) Material audit	Certification of material quality and properties(standards, own brand, supplier audit)	Textile product with traceable information →	Waste manager (external)
	IT technical department		2) Data creation in the hub and connection to RFID		Traceable information →	IT technical department
Data management	IT technical department	Knowledge Hub	Feedback with manufacturer, manager and recycler		Confidentiality →	Manufacturer, operator and recycler
					Accuracy guarantee →	Manufacturer, operator and recycler

Figure 7. Supplier-Input-Process-Output-Customer diagram

Supplier: the 2 departments of SmarTextil involved in the implementation of the system at the manufacturer are the Environmental technical department (in charge of surveying

the implementation itself) and the IT technical department (in charge of data creation in the hub).

Input: the input of this key process is the contract signed with the manufacturer together with the clothing's data of the manufacturer. That data is collected from the manufacturer's database.

Process: the Environmental technical department of SmarTextil audits the data collected in order to certify and validate the material quality and properties that standards, manufacturer and suppliers claim to have. Following that, the IT technical department adapts and integrates that audited data into the SmarTextil hub. Then, the IT technical department connects the hub with the RFID that will be placed in the garment. It is important to mention that this RFID will be the same as the one textile manufacturers currently use in order to avoid modifying their logistics system. By doing this, the transition will be smooth, and the RFID will be free of charge for the brand. The current RFID is placed in the tag and consumers tend to remove it due to reasons of discomfort. This is why the manufacturer must guarantee that the RFID remains with the garment so the traceability cycle can be closed. Also, from SmarTextil's point of view It shall be verified that the *enhanced* RFID does not affect the current logistics system.

Before moving on to the "Output" a brief explanation of why RFID technology was chosen is given below:

Textile sorting is a key element of the business model since it is one of the bottlenecks in the recycling chain. The material recognition technology must be reliable, fast, non-destructive and economical to efficiently separate textiles. There are 3 technologies to be considered:

- Spectroscopy: not considered because it requires a library of material samples.
- Near infrared (NIR): not considered because, up until now, it has been able to detect pure materials, not blends.
- Radio Frequency Identification (RFID): already being used in the clothing industry for logistical, shop inventory or anti- theft purposes.

The chosen technology for this business idea is RFID since both textile manufacturers and recyclers are familiar with it.

Output: before detailing the indicators included in the traceable information it is important to note that the traceability system will not reach either the raw material production or the raw material processing. The main reason for not considering these two stages was the feedback from the experts who recommended not to include them due to their complexity. This is why our robust and independent audit process is a key part of the business model of SmarTextil.

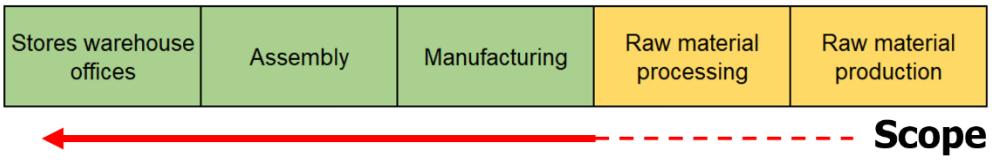

Figure 8. Scope of SmarTextil

The indicators that can be included in the traceable information are:

- Manufacturer's own indicators: in order to merge the Smartextil hub with the manufacturer's preferences.
- GRI Standards: in order to merge the Smartextil hub with the current ESG most used reporting standard.
- Law 11/2018 on non-financial information and diversity: in order to merge with Spanish legislation indicators.
- Textile Exchange Standards: in order to merge the Smartextil hub with the current most used standards in the textile industry.
- TU Delft ecocosts: to give environmental and measurable information both to the consumer and the manufacturer.
- TU Delft social costs: to give social information both to the consumer and the manufacturer.
- Cradle to Cradle Certified (product circularity): in order to measure the recyclability of the garment.
- Composition of the garment itself.

More information about the indicators is available in Appendix 4.1.

Customer: once the user of the textile product with traceable information disposes of it, it will arrive to the waste manager whereas the traceable information remains in the hub where it will be managed by the IT technical department.

➢ Data management

The IT technical department is in charge of the maintenance and management of the SmarTextil hub. In this key process, the IT technical department will improve and change the indicator's system in order to meet the demands of the manufacturer, recycler and legislation at the time. For example:

- Once the textile CEPRS is established in Spain, it will most likely be accompanied by eco-modulation classification for clothes, as in France. Therefore, these changes will be incorporated into the SmarTextil hub.
- It is important to mention that the textile sector will have its own GRI Sector Standard, which has not yet been published. However, once it is, the SmarTextil hub will include those indicators.

- Once the EU Strategy for Sustainable and Circular Textiles is approved the SmarTextil hub will also include Digital Product Passport information.

In addition to this, SmarTextil will also provide a consultancy service where an expert information diagnosis will be done on terms of both monthly sustainability reports and eco-design advice:

- Once the first traceable garments reach the end of their life, it will be possible for the brand to analyse whether the expected durability and quality match the actual ones. In this way, the manufacturer can develop a more efficient ecodesign.
- Sustainability reports will be provided by analysing the information in the knowledge hub to give the manufacturers a solid background to make business decisions.

Finally, it should be noted that throughout the collaboration (and at the end of it with the manufacturer, recycler and waste manager), confidentiality and verification will be ensured.

➢ Quality control

Supplier: The environment department will guarantee the traceability system is working properly.

The main objective of quality control is to provide true and accurate information, i.e. that the tags correctly describe the product and that the RFID system reads the tags correctly. This department will grow as soon as the traceability system becomes operational, to ensure the viability and quality of the materials which the different recycling sectors receive.

Input: Information gathered through visits to manufacturers and the laboratory report from the chosen samples.

Process: Tasks conducted by the environment department of SmarTextil are:

- Visits to manufacturers: Factories will be evaluated to guarantee an optimal implementation of RFID on each garment line within its threads. This ensures that the label endurance over time therefore information traceability until the end garment's life cycle. Another objective is to verify that the RFID tags match the characteristics of the garments through a reading test.

    - In the first year, visits to manufacturers and recyclers will be carried out every three months to ensure the launch of the quality system and compliance with the requirements.
    - In the second year, twice a year for proper maintenance.

- In the third year, as we open a new line of recycled polyester, the visits for this stream will be every three months while those for cotton are maintained on a twice-yearly basis.
- Finally, in years 4 and 5, both composition lines will have twice a year maintenance visits.

- Laboratory analysis: During the visits, the environmental team will accompany a laboratory technician to take samples from each clothing line according to the type of composition in order to analyse the quality of the clothing.

- Visits to waste managers: A procedure like the manufacturer's visit is carried out to check the sorting process and to gain feedback on the implementation of the system.

Output: The functions developed in this part enables a tool to cross-check the data and strengthens the system. On the other hand, the laboratory analysis provides the information that allows a better assessment of each garment line.

➢ Hub access

Access to the knowledge hub will take place through the online platform.

This will provide textile information about possible fabric blends and their best uses in terms of recyclability or shredding for use in other industries. This information is useful both for the manufacturer when designing garments and choosing fabrics and for the textile manager and recycler when deciding which recycling technique is most effective.

For all those actors who want to have this information available, a yearly subscription will be charged to access the registry.

The platform will consist of a brief training on how to navigate through it and will be completed with training for manufacturers on the eco-design of garments, knowledge of their life cycle and the destination and circularity that the garment can acquire depending on the different characteristics chosen (type of fabric, colour, metallic parts, etc.).

❖ **Support processes**

➢ Environmental management

Since SmarTextil focuses on the implementation of a circular economy model in the textile sector, the environmental area is critical. The Environmental technical department, apart from its previously explained key role, will serve as a constant advisor specially when it comes to blockchain technology, given its high energy consumption.

➢ Information and Communication Technology (ICT) management

SmarTextil's operations are highly dependent on ICT. Hence, the main goal of the IT technical department, is to achieve excellence in the development of the following activities:

- Coordination of software development/ acquisition, maintenance and upgrades.
- Coordination with online payment platforms.
- Management of physical servers and databases.
- Internal and external ICT support.
- Implementation of communication between the hub, RFID and blockchain.

➢ Talent management

SmarTextil believes in the internal training of our employees and that they learn with us from their beginnings to their professional evolution together with the company.

For this reason, we encourage the hiring of personnel with little experience so that they can learn to use the knowledge acquired during their studies and have a professional projection in the path of recycling and circular economy.

To retain talent, at SmarTextil we offer a good work-life balance, internal promotion, training plans and annual salary review.

Resources

❖ **Human resources**

The beginnings of SmarTextil are represented in the following diagram where the different levels can be seen in a comparison between year 1 and year 5.

In this approach, we can see that in year 1, the direction assumes the responsibility for the management of the commercial area at first, in this case in Madrid and Valencia.

Based on the estimated growth of the company, a progressive increase in the workforce is planned until year 5, when the number of positions of responsibility and technicians in the environmental, IT and commercial areas will increase.

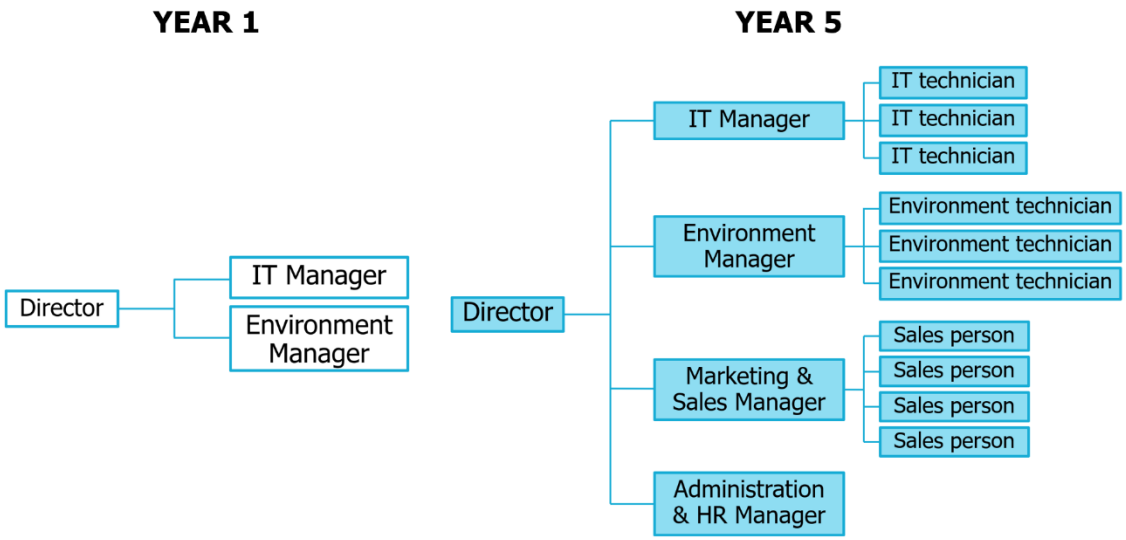

Figure 9. Evolution of SmarTextil's employees

❖ **Physical resources**

The physical resources needed by the staff are laptops and mobile phones to do the work, as SmarTextil encourages teleworking. Eventually there will be a coworking office for meetings with clients.

5. MARKETING PLAN

Business type

SMARTEXTIL is a B2B (Business to Business) company since its activity focuses on the sale of services to other companies. SmarTextil serves two types of customers: textile manufacturers and recyclers. Since they are very specific, communication actions will be segmented.

Quantified analysis of the potential market

In order to address the Total Addressable Market (TAM) we have calculated the maximum theoretical textile recycling capacity in Spain. According to [19], worldwide in 2015, only 0.5 million tonnes were closed loop recycled whereas 6.4 million tonnes were downcycled and 1.1 million tonnes were lost during the recycling process. Hence, the maximum worldwide textile recycling capacity was 8.0 million tonnes in 2015. This data was extrapolated to Spain through the population difference and this way the maximum theoretical textile recycling capacity in our country was obtained.

Since our business focuses on cotton and polyester, we have used data on textile garment composition [19] and extrapolated it to the maximum theoretical recycled capacity in Spain (TAM) to calculate the Served Available Market (SAM).

Given that it is a newborn organisation the Serviceable Obtainable Market (SOM) covers just cotton in the first two years, after which polyester lines begin. Also, in order to be prudent in the first year, we have assumed a market capacity of 0.5% of the cotton SAM. This percentage increases as textile recycling initiatives emerge in Spain to increase capacity as can be seen in the next Table.

INCREASE OS THE SERVICEABLE OBTAINABLE MARKET						
		Year 1	Year 2	Year 3	Year 4	Year 5
Textile manufacturer clients (big brands)		1	1	2	2	3
Textile recyclers clients		2	4	6	8	10
Waste managers clients		1	2	3	4	5
SmarTextil (%) cotton		0,50%	1,00%	2,00%	3,00%	5,00%
Real Market from cotton (tonnes)	12.656	63	127	253	380	633
SmarTextil (%) polyester				0,25%	0,50%	1,23%
Real Market from polyester (tonnes)	25.818			65	129	318

Table 1. Increase of SOM over the years.

Total Addressable Market (tonnes)	Served Available Market (tonnes)		Serviceable Obtainable Market (tonnes)	
	Cotton	Polyester	Cotton	Polyester
50.623	12.656	25.818	63	65

Table 2. TAM, SAM and SOM.

Pricing strategy

SmarTextil will have two distinct revenue streams.

- **Manufacturers**

The charging strategy depends on the type of material the input stream is composed of, i.e., mono, bi or multi composition with two missions to incentivise:

- Eco-design (i.e., transition to mono-material garments) and responsible manufacturing by brands.
- Responsible consumption by users.

When assuming the number of garments that have mono, bi or multi material proportions in their composition, data from 2020 [19] has been used.

In the first two years, our business focused exclusively on cotton. We have selected three different types of compositions with respect to cotton blends. These are:

- 100% cotton garments, i.e., mono material garments.
- Bi-material garments, i.e., cotton blended with another fibre.
- Multi-material garments, i.e., cotton blended with more than one fibre.

The choice of the fee was calculated on the principle of how much it would increase the final price of the garments. Given that, according to data from the survey carried out, users are willing to pay between 5 and 10% more for garments with sustainable standards, we have selected an increase of 0,50€ for 100% cotton garments (as shown in the Table below) with our traceability system implemented with respect to others that do not have it. Then, an approximate increase of 0,80€ for bi-material garments and 1,00€ for multi-material garments has been decided. A sensibility analysis can be found in Appendix 5.1.

It is important to note that the revenue generated in the leading textile brand in Spain from its sustainable collection that features recycled textile fibres is 45,32 €/kg [12] while our revenue is less than 2,00€/kg for all fees. More information is available in Appendices 6.1 and 6.2.

These rates would follow the same criteria for polyester garments.

FEE RATES			
	Mono	**Bi**	**Multi**
Garment type	37,30%	35,20%	27,50%
Fee	2,20%	3,50%	4,40%
Revenues (€/kg)	1,00	1,59	1,99
€/garment	0,50	0,79	1,00
Revenues (€/garment)	0,50	0,79	1,00
Price impact (-)	0,01	0,02	0,03

Table 3. SmarTextil's fee rates.

- **Knowledge hub and consultancy**

The service of the knowledge hub and consultancy is based on the elaboration of monthly reports where information about the quality of the final composition of the recycled fibres is reported.

The usual reports with model information are included in the price paid by the manufacturer for the different fabric composition lines. These reports will be prepared for each customer and will be handled by the Environmental department.

On the other hand, since it is an information system that grows every year, we have sufficient information to be able to provide specialised reports on the flows into and out of the system at the request of our customers when required. These specialised reports cost between 2.000 and 5.000 €. These data are not yet reflected in the financial plan because they are focused on a more mature system over the next few years.

Main communication actions

It was previously mentioned in Chapter 4 that communication management and confidentiality is considered a strategic process. The image that we want to promote at SmarTextil is based on our differentiating element, traceability. Just like our traceability, the blue colour is diffused throughout the letters and becomes an integrated whole.

SmarTextil

Figure 10. SmarTextil logo

❖ Internal communication

Our employees are a fundamental part of the dissemination of the company's values. Therefore, we aim to generate pride of belonging through: welcome and training plans, feedback sessions and internal promotion as was previously described in Chapter 4.

❖ External communication

Our external communication targets textile manufacturers and recyclers and is differentiated in online and offline marketing.

➢ Marketing offline

- Visits to textile manufacturers, waste managers and recyclers: 3 big textile manufacturers, 5 waste managers and 10 recyclers will be attracted thanks to the visits made by the Commercial department where SmarTextil's services and its value proposition will be presented. SmarTextil has decided to focus its activity on large textile brands because of their mature logistics.

    - In the first year, the two managers, together with the Direction, will be in charge of the Commercial area in order to attract customers. Visits will be made to the main brands in the central area (Madrid) and to recyclers in the Mediterranean area.
    - In the second year we will have a salesperson to maintain our engagement with waste recyclers in Valencia and guarantee customer relations.
    - In the third year, new recyclers will appear due to European projects. In addition, with the start of the polyester business line, commercial activity will require a new boost. Finally, a new collaboration with another big brand will be closed. This is why 3 sales persons are required.

    - In the fourth and fifth year, the number of sales representatives is increased to 4 with the intention of consolidating the previous relationships and gaining new market share from the big textile brands.

  Although waste managers and recyclers are not a source of income, they are an indispensable part of ensuring the proper functioning of the circular textile cycle.

- MGM (Member Get Member): this technique will take place once several textile manufacturers and recyclers are recruited. However, it will reach its full potential once the CEPRS is fully developed since both textile manufacturers and recyclers will collaborate on it.

- Trade fairs and congresses: as mentioned in Chapter 4, the generation of alliances is a critical aspect for SmarTextil in order to make ourselves known. This is why

it is essential to participate in the main trade fairs and congresses related to circular economy, sustainable development, etc., as well as those related to the textile sector (aligned with the textile manufacturers and recyclers that use our service).

- Marketing online

- Webpage: to access the part of the webpage intended for our clients, each one has an username and password provided by SmarTextil when contracting our services. In this area, the knowledge hub as well as the sustainability reports will be available for the customer to download or check online. Also, the webpage offers other services as a means of publicising SmarTextil. The webpage will be a responsive web, which are web pages that modify their appearance depending on the device on which they are displayed. You can check the webpage at:

  https://envirosmartextil.wixsite.com/smartextil

- Social networks, specifically LinkedIn, where SmarTextil has a profile through which we will try to create a community aligned with our values.

  https://www.linkedin.com/in/smartextil/

- Articles in specialised online press with the aim of publicising our business to experts.

Customer loyalty

Our biggest challenge is to achieve a partnership with a major textile brand and its permanence. A 5-year agreement will be signed with annual reviews to analyse the quality of the relationship and service and to identify strengths and areas for improvement. A confidentiality contract will also be formalised to preserve the relationship between both parties.

In addition, a strong portfolio of recyclers will be developed to have the best technology for each type of textile composition line available. Similarly, annual reviews will be carried out with each recycler to not only guarantee quality but also to improve the service we provide. The same procedure will be followed for waste managers in order to ensure the best separation technology available as well as to know their needs.

In this type of business, the continuous evaluation of customer satisfaction is fundamental, as well as the personalised follow-up of each one of them. Therefore, solid relationships will be established with them using CRM (Customer Relationship Management) as a form of business management based on communication, trust, and knowledge of the client in order to adapt services to their needs and guarantee loyalty. In this way, our customers will be part of SmarTextil, and we will improve together.

6. FINANCIAL PLAN

Starting points

The time horizon used for the financial plan of SmarTextil is 5 years and will be reviewed periodically to adapt it to the needs of the company and the business environment. The following Table summarises the main input variables used.

Annual wage increase	3%
Corporate tax	25%
Interest rate on external financing	4%
Term conditions	3-5 years
Company social security contributions	33,40%

Table 4. Financing plan variables

The annual wage increase is intended to serve to retain talent and acknowledge the hard work of our employees. 25% is the tax on profits of corporations in Spain and an interest rate of 4% has been chosen for a loan of 5 years to be paid from year 3 onwards. Social security ranges between 30-35%.

Investments

The equipment required for SmarTextil's business is mainly technological. Therefore, each employee must have a laptop, a personal phone and the necessary licences as detailed in the following Table. Other services required are as well related to the technological field such as internet, VPN service and the server maintenance. It can be seen in the following Table that costs increase each year as SmarTextil's activity increases.

The server and software architecture development has the highest cost in the first year because it is developed from scratch whereas during the following years it only requires maintenance.

Finally, the coworking space that is rented for short periods for meetings with manufacturers, recyclers and stakeholders is also considered.

PHYSICAL RESOURCES					
	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Owned laptops	3	4	9	13	15
Increase laptops	3	1	5	4	2
Owned mobile phones	3	4	9	11	15
Increase mobile phones	3	1	5	2	4

	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Temporary rental of coworking space	605	605	605	605	605
Office365	180	240	540	780	900
Server maintenance	370	370	740	740	740
Laptops	1947	649	3245	2596	1298
Mobile phones	480	160	800	320	640
Mobile tariff	47,19	62,92	141,57	173,03	235,95
Internet tariff	660	660	660	660	660
VPN tariff	69,84	93,12	209,52	302,64	349,2
Server + software architecture development	10.000	1.000	1.000	1.000	1.000

Table 5. Physical resources

Financing

The amount considered to start SmarTextil operations is a total sum of 160.000 € where 60.000 € are backed by shared capital and 100.000 € by a bank loan. This is mainly dedicated to payrolls, online and conventional marketing, laboratory tests, physical resources and maintenance.

According to the financial plan, capital injection will only be required in the first year as the business dynamics allow for organic growth without the need for a capital increase.

Repayment of the loan will start from the end of the third year, when SmarTextil starts making profits. According to the financial plan, the loan will be fully paid by the end of year 5. There are some credit lines dedicated to finance companies and entrepreneurs such as the ICO line (Official Credit Institute) and the European Investment Bank (EIB). Both of them offer flexible loans, from 100% financing up to a maximum of 12,5 million. The repayment period for these loans can begin after year two [20 and 21].

Revenues

According to the pricing strategy of the marketing plan explained above, SmarTextil's fees rely on the material type, whether it is mono-material, bi-material or multi-material. These fees apply both to cotton and polyester. Hence, this configuration establishes six different lines, three for cotton and three for polyester.

Following the strategic plan, projections for the first two years revenues are made up on cotton and then, from year 3 onwards, polyester lines start. Despite mono-materials being the most traced lines, measured in weight, the highest revenues come from bi-materials followed very closely by multi-materials lines due the fact that SmarTextil fee aims to promote mono-material garments.

Manufacturers will be charged for supporting the tracking system for each garment line. As it was previously mentioned, the fee also includes a monthly analysis where the performance and metrics are reported. On this matter, sales are growing every

year, as SmarTextil increases its market share: at the end of the fifth-year sales are close to 1,5 million euros and 950 tonnes.

REVENUES					
	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**
	Line 1: mono cotton				
(€/year)	23.535	47.069	94.138	141.207	235.346
(tonnes/year)	23,60	47,21	94,41	141,62	236,03
	Line 2: bi cotton				
(€/year)	35.333	70.667	141.334	212.000	353.334
(tonnes/year)	22,27	44,55	89,10	133,64	222,74
	Line 3: multicotton				
(€/year)	34.702	69.405	138.810	208.215	347.024
(tonnes/year)	17,40	34,80	69,61	104,41	174,02
	Line 4: mono polyester				
(€/year)			24.005	48.011	118.106
(tonnes/year)			24,07	48,15	118,45
	Line 5: bi polyester				
(€/year)			36.040	72.080	177.317
(tonnes/year)			22,72	45,44	111,78
	Line 6: multipolyester				
(€/year)			35.396	70.793	174.151
(tonnes/year)			17,75	35,50	87,33
TOTAL (€)	93.570	187.141	469.723	752.306	1.405.278

Table 6. Revenues

The Figure below shows the diagram representing the evolution of sales over five years.

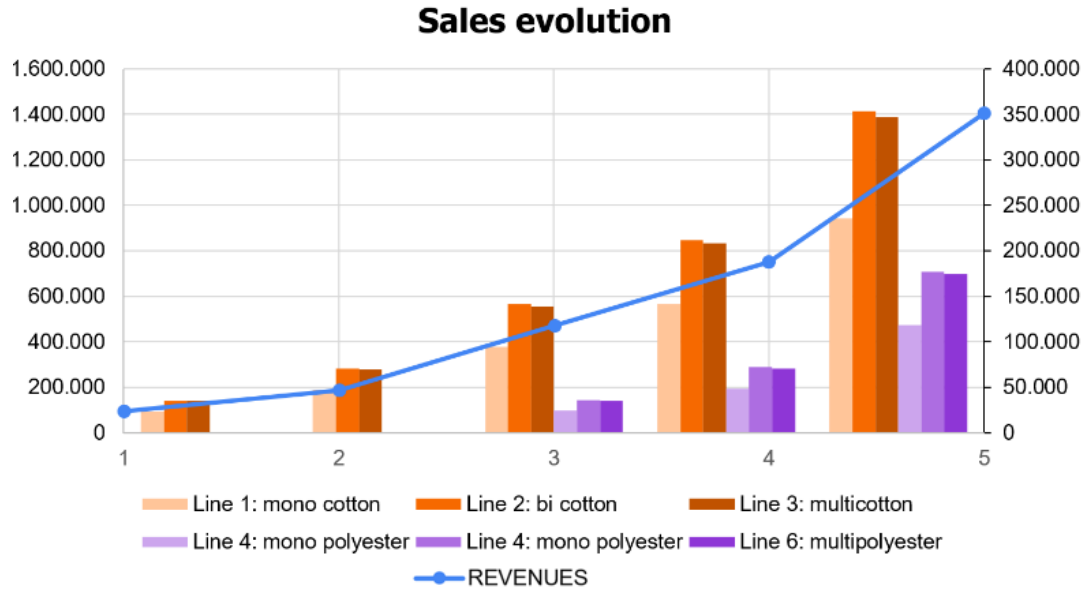

Figure 11. Sales evolution

Costs

To support all SmarTextil's services there is a large investment in human resources as can be seen in the expenditure on salaries. Office resources increase according to staff growth while tests and visits rise in line with increase of SmarTextil services. Last year's tests decrease because long term lines require less testing.

Marketing cost mainly includes SEO service in order to increase the likelihood of reaching new customers, on the long-term marketing raises due to CRM service to maintain clients. On the other hand, communication increases due to the opening of new markets and the costs involved in the first contact visits in those years in which SmarTextil grows the most.

	Year 1	Year 2	Year 3	Year 4	Year 5
Salaries	113.390	137.402	291.292	372.208	529.144
Office resources	11.932	3.031	3.896	4.261	4.490
Test	10.125	20.249	18.427	26.729	20.286
Visits for quality tests	3.600	3.000	14.400	12.000	15.600
Marketing	2.400	2.400	18.000	26.000	36.000
Communication	42.163	60.163	89.044	105.244	129.244
Total costs (€)	**183.609**	**226.245**	**435.059**	**546.442**	**734.765**

Table 7. Total costs

Profit and loss statement

The profit and loss statement reflects the difference in income and expenditure over the years. In the first two years the result is negative due to the expenses in human resources and the costs necessary to start and publicise the activity. From the third year onwards, profits are made. The profits generated from year 3 onwards will go to to reserves that will be used to finance SmarTextil's growth when starting the new business line.

PROFIT AND LOSS ACCOUNT					
	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Sales	93.570	187.141	469.723	752.306	1.405.278
Variable operating expenses	25.657	26.280	36.723	42.989	40.376
HR	113.390	137.402	291.292	372.208	529.144
Marketing and communication	44.563	62.563	107.044	131.244	165.244
Amortisation	607	202	1.820	2.549	3.034
Profit (EBIT)	-90.646	-39.306	32.844	203.315	667.479
Financial expenses	4.000	4.000	2.667	1.333	1.333
Profit before tax	-94.646	-43.306	30.177	201.981	666.146
Taxes	0	0	7.544	50.495	166.536
Net profit (NP)	**-94.646**	**-43.306**	**22.633**	**151.486**	**499.609**

Table 8. Profit and loss account

Balance sheet and cash flow

As can be seen in the balance sheet, the closing of each financial year is positive, which shows the financial viability of the company. There is also a notable increase in equity from year 4 onwards as a result of the accumulation of reserves that could also be used to keep increasing SmarTextil's cotton and polyester market share after year 5 without resorting to leasing.

BALANCE SHEET					
	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**
ASSETS					
Fixed assets	2.427	3.236	7.281	10.197	12.135
Depreciation of fixed assets	607	809	2.629	5.179	8.212
FIXED ASSETS	1.820	2.427	4.652	5.019	3.923
Cash flow	63.534	19.621	6.696	124.482	591.853
CURRENT ASSETS	63.534	19.621	6.696	124.482	591.853
LIABILITIES					
Capital	60.000	60.000	60.000	60.000	60.000
Net profit	-94.646	-137.952	-115.319	36.167	535.776
OWNERS' EQUITY	-34.646	-77.952	-55.319	96.167	595.776
Long-term loans	100.000	100.000	66.667	33.333	0
LONG TERM LIABILITIES	100.000	100.000	66.667	33.333	0
CURRENT LIABILITIES	0	0	0	0	0

Table 9. Balance sheet

The cash flow is positive during the 5 financial years, allowing the company to operate under normal conditions, with sufficient cash generation to meet the expected payments. The cash flow increases significantly from year 4 onwards thanks to the new business line.

CASH FLOW					
	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Initial cash flow	0	63.534	19.621	6.696	124.482
Sales	93.570	187.141	469.723	752.306	1.405.278
Capital	60.000	0	0	0	0
Loans	100.000				
TOTAL CASH	253.570	250.675	489.344	759.002	1.529.760
Fixed assets	2.427	809	4.045	2.916	1.938
Supplies	11.932	3.031	3.896	4.261	4.490
HR	113.390	137.402	291.292	372.208	529.144
Marketing and communication	44.563	62.563	107.044	131.244	165.244
Financial expenses	4.000	4.000	2.667	1.333	1.333
Loan repayments	0	0	33.333	33.333	33.333
Other expenses (laboratory)	13.725	23.249	32.827	38.729	35.886
Payment of profit tax	0	0	7.544	50.495	166.536
TOTAL PAYMENTS	190.036	231.054	482.649	634.520	937.906
CASH BALANCE	**63.534**	**19.621**	**6.696**	**124.482**	**591.853**

Table 10. Cash flow

Feasibility calculation

The analysis of the main economic and financial indicators shows satisfactory results for SmarTextil's business model. The **Return Of Investment (ROI)** is positive from year 3 when we actually start to generate profits and reaches a value of 112,04 % in the fifth year which suggests that, for every 124 € earned, the company has had to invest 100 €. The **Return of Equity (ROE)** of 83,86 % in year 5 indicates that for every 100€ invested by shareholders, the company is able to generate 83,86 € in net profit in year 5, an attractive value for investors. The next Table shows that SmarTextil's progression is increasing, setting a solid growth that will allow for future expansion of the business.

PROFITABILITY					
	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**
ROI	-138,70%	-178,28%	289,44%	157,00%	112,04%
ROE	273,18%	55,56%	-40,91%	157,52%	83,86%

Table 11. Profitability indicators

In terms of **liquidity**, all the indicators show that although, especially when the new business line starts in year 3, the liquidity is enough to keep the company running, from the fourth year onwards the working capital indicator improves.

LIQUIDITY					
	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Working capital	63.534	19.621	6.696	124.482	591.853

Table 12. Liquidity indicators

The **indebtedness** indicator implies that except obviously in the start-up of the company where the weight of debt is large, this reaches zero in year 5, since the long-term loan is completely paid. Secondly, the **coverage** indicator shows that the company is solvent enough to meet its financial expenses. Hence, SmarTextil is a company committed to investors and its obligations to them.
Finally, the **solvency** indicator is lower than 1 from years 1 to 3 because the activity is starting. Once both lines are up and running, the solvency indicator is greater than one (year 4), which implies that the value of the company's assets is greater than one. Hence, the value of the company's assets is for year 4 greater than its debts and that it is therefore solvent.

SOLVENCY					
Indebtedness	-2,89	-1,28	-1,21	0,35	0
Coverage	-22,66	-9,83	12,32	152,49	500,61
Solvency	0,64	0,2	0,1	3,73	N/A

Table 13. Solvency

The **operating cash flow** is an important indicator of the financial health of a company. As can be seen in the Table below, SmarTextil's operating cash flow is positive from the third year of operation onwards and shows a considerable increase in both years 4 and 5.

Also, the following Table shows the values of the **Net Present Value (NPV)** and the **Internal Rate of Return (IRR)**, the main indicators to evaluate the generation of value by a company.
The NPV value has been calculated with a discount rate of 15%. The NPV of 87.592 € is higher than the invested capital and the IRR of 38,87% shows that SmarTextil is a profitable company and a very attractive investment for interested partners and investors.

NPV (NET PRESENT VALUE) & IRR (INTERNAL RATE OF RETURN)						
	Year 0	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Operating profit		-90.646 €	-43.306 €	22.633 €	151.486 €	499.609 €
Taxes		0 €	0 €	7.544 €	50.495 €	166.536 €
Depreciation		607 €	809 €	2.629 €	5.179 €	8.212 €
Investment	-14.359 €					
Operating cash flow	-14.359 €	-90.039 €	-42.497 €	17.718 €	106.169 €	341.285 €

NPV	87.592 €
IRR	38,87%

Table 14. Operating cash flow, VNA and IRR.

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8. APPENDICES

APPENDIX 2.1. Online survey (please see next page)

Market Research - Master's Final Project on the Environment

Hello,
Thank you for agreeing to participate in our survey. It will only take you 2-3 minutes to answer it.
We would like to remind you that your answers are anonymous and will be used exclusively for a market analysis that is part of a market analysis that is part of a Master's Final Project on the Environment.
Thank you very much for your collaboration.
*Compulsory

*Obligatorio

1. 0. Nowadays, what do you think is done with the clothes we throw away? *

   Marca solo un óvalo.

   - ◯ The clothes are sent to landfills
   - ◯ The clothes are sold to developing countries
   - ◯ The clothes are recycled
   - ◯ The clothes are donated (NGOs...)
   - ◯ The clothes are managed and reused (independent organizations)
   - ◯ Otro: _____

2. 1. What do you consider to be the impact of the textile industry on the environment? *

   Marca solo un óvalo.

	1	2	3	4	5	
Low impact	◯	◯	◯	◯	◯	High impact

3. 2. Approximately how many new clothes did you buy so far this year (2022)? Please answer with the number. *

   _____

4. 3. Approximately how many second-hand clothes did you buy so far this year (2022)? Please answer with the number. *

Marca solo un óvalo.

- ◯ I do not buy second-hand clothes
- ◯ Otro: _____

5. 4. Would you be willing to pay more to wear sustainable clothing of the same quality as conventional (non-sustainable) clothing? *

Marca solo un óvalo.

- ◯ I would not be willing to pay more
- ◯ Between 5-10%
- ◯ Between 10-20%
- ◯ Between 20-30%
- ◯ Between 30-40%
- ◯ Between 40-50%
- ◯ More than 50%

6. 5. Have you ever bought clothes that you didn't wear (or wore few times) and regretted buying them? *

Marca solo un óvalo.

- ◯ Yes
- ◯ No

7. 6. In relation to the previous question, on a scale from 0 to 10, how often do you regret buying clothes? *

Marca solo un óvalo.

	0	1	2	3	4	5	6	7	8	9	10	
Unusual	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Very common

8. 7. Have you ever been bothered by buying a garment for little use (e.g. New Year's Eve outfits, wedding dresses, fancy dresses...)? *

Marca solo un óvalo.

- Yes
- No

9. 8. Do you feel that you lack space in your wardrobe because of the amount of clothes that have little or no use? *

Marca solo un óvalo.

- Yes
- No

10. 9. Do you currently have clothes at home that you don't wear, but you don't get rid of them because you don't know how? *

Marca solo un óvalo.

- Yes
- No
- Perhaps

11. 10. Would you be willing to leave your home to use a textile recycling container? *

Marca solo un óvalo.

- Yes
- No
- Perhaps

12. 11. Where would you prefer the textile recycling container to be located? Several answers are possible. *

Selecciona todos los que correspondan.

- [ ] I prefer it to be at the entrance hall of my building.
- [ ] I prefer it to be in the clothes shop
- [ ] I prefer it to be on the street, like the yellow or blue container.
- [ ] I prefer it to be in a local waste facility
- [ ] Otro: _____

13. 12. Do you think the public would be willing to leave their homes to use the textile recycling containers? *

Marca solo un óvalo.

- ◯ Yes
- ◯ No
- ◯ Perhaps

14. 13. Currently, what do you do with the clothes you don't want and don't wear? Several answers are possible. *

Selecciona todos los que correspondan.

- [ ] Place it in the grey bucket
- [ ] Place it in a independent organization container.
- [ ] Putting it up for sale on the secondary market (Vinted, Wallapop...).
- [ ] Give it in inheritance
- [ ] Donate it to NGOs
- [ ] Nothing, I store it in the wardrobe
- [ ] Otro: _____

15. 14. Regarding the previous question, do you think that the practice(s) you have ticked help to solve the problem of textile waste generation? *

Marca solo un óvalo.

- ◯ Yes
- ◯ No
- ◯ Perhaps

16. 15. Do you think that recycling textile material can be a solution to the problem of textile waste generation? *

Marca solo un óvalo.

- ◯ Yes
- ◯ No
- ◯ Perhaps

17. 16. What would motivate you to recycle clothes? Several answers are possible. *

Selecciona todos los que correspondan.

- ☐ Reducing the impact on the environment
- ☐ Freeing up wardrobe space
- ☐ Discount point system in shops
- ☐ In-store promotions
- ☐ Reduction in waste collection tax
- ☐ Otro: _____

Profile Information

We are almost there. We just need to know a little bit about you.
These are 3 very generic questions so that we can analyse the data properly.
Thanks again for your time.

18. 16. What is your age range? *

Marca solo un óvalo.

- ◯ 18- 25 years
- ◯ 26- 35 years
- ◯ 36- 45 years
- ◯ 46- 55 years
- ◯ 56- 65 years
- ◯ More than 65 years

19. 17. What is your postcode? *

_____

20. 18. Which gender do you identify with? *

Marca solo un óvalo.

- Male
- Female
- I prefer not to say

End of the Survey

We have finished!
Thank you very much for your help.
If you have any further comments you can leave them below.

21. Any comments, idea or suggestion that came to mind filling the survey?

APPENDIX 2.2. Online survey results and hypothesis validation

No hypothesis validated. This question was asked to gain insight into the current perspective of the respondents.

- **Question 0**: Nowadays, what do you think is done with the clothes we throw away?

	All answers		F		M		18- 45 years		45- >65 years	
They are donated (Cáritas, NGOs…)	78	25%	58	28%	20	20%	23	15%	55	34%
They are sent to landfills	132	42%	83	40%	48	48%	87	57%	45	28%
They are recycled	41	13%	28	13%	12	12%	20	13%	21	13%
They are reused (Humana)	19	6%	13	6%	6	6%	8	5%	11	7%
They are sold to developing countries	46	15%	28	13%	15	15%	15	10%	31	19%
Total	316	100%	210	100%	101	100%	153	100%	163	100%

Additional comments: 9 answers were not analysed due to a formal defect. Feedback from results suggested that the survey should have allowed more than one answer in this question and included "churches" as an option. Even though the option "they are sent to landfills" is majority, there is a huge percentage of respondents who donate their clothes showing that there is sensitivity towards improving the management that is taking place. Thanks to this new information, a new hypothesis (Hypothesis xx) was developed.

Hypothesis 1: x out of 10 users acknowledge that the environmental impact of the textile industry is high or very high.

- **Question 1**: What do you consider to be the impact of the textile industry on the environment?

	All answers		F		M		18- 45 years		45- >65 years	
1 (very low)	2	1%	0	0%	2	2%	1	1%	1	1%
2	7	2%	1	0%	6	6%	4	3%	3	2%
3	46	14%	27	13%	19	18%	22	14%	24	14%
4	131	40%	82	38%	47	45%	60	39%	71	42%
5 (very high)	139	43%	105	49%	31	30%	68	44%	71	42%
Total	325	100%	215	100%	105	100%	155	100%	170	100%

✓ Validated? Yes. 83% of users acknowledge that the environmental impact of the textile industry is high or very high.

Additional comments: Men seem to be slightly less aware of the impact of the textile industry.

No hypothesis validated. This question was asked to gain insight into the current perspective of the respondents.

- **Question 2**: Approximately how many new clothes did you buy so far this year (2022)? Please answer with just the number.

	All answers		F		M		18- 45 years		45- >65 years	
0	22	7%	8	4%	14	13%	10	6%	12	7%
1	22	7%	10	5%	12	11%	9	6%	13	8%
2	31	10%	22	10%	9	9%	10	6%	21	12%
3	42	13%	24	11%	18	17%	20	13%	22	13%
4	31	10%	21	10%	10	10%	12	8%	19	11%
5	38	12%	25	12%	11	10%	22	14%	16	9%
6	25	8%	16	7%	8	8%	12	8%	13	8%
7	16	5%	9	4%	7	7%	7	5%	9	5%
8	19	6%	16	7%	3	3%	7	5%	12	7%
9	3	1%	2	1%	1	1%	3	2%		0%
10	29	9%	24	11%	4	4%	11	7%	18	11%
12	8	2%	5	2%	3	3%	6	4%	2	1%
13	1	0%	1	0%		0%		0%	1	1%
14	1	0%	1	0%		0%		0%	1	1%
15	14	4%	12	6%	2	2%	11	7%	3	2%
19	1	0%	1	0%		0%	1	1%		0%
20	13	4%	10	5%	2	2%	9	6%	4	2%
22	1	0%	1	0%		0%		0%	1	1%
30	3	1%	3	1%		0%	3	2%		0%
31	1	0%	1	0%		0%	1	1%		0%
50	1	0%	1	0%		0%	1	1%		0%
60	1	0%	1	0%		0%		0%	1	1%
100	2	1%	1	0%	1	1%		0%	2	1%
Total	325	100%	215	100%	105	100%	155	100%	170	100%

Additional comments: According to the weighted average, people buy 2,36 items of clothing in 4 months, women buy more than men (3,05 vs 2,92) and older people buy more than younger people (2,78 vs. 2,50).

No hypothesis validated. This question was asked to gain insight into the current perspective of the respondents.

- **Question 3**: Approximately how many second-hand clothes did you buy so far this year (2022)? Please answer with just the number.

	All answers		F		M		18- 45 years		45- >65 years	
1	19	6%	9	4%	10	10%	13	8%	6	4%
2	19	6%	13	6%	6	6%	12	8%	7	4%
3	6	2%	5	2%	1	1%	3	2%	3	2%
4	2	1%	1	0%	1	1%	1	1%	1	1%
5	2	1%	2	1%		0%	1	1%	1	1%
6	1	0%	1	0%		0%	1	1%		0%
9	1	0%	1	0%		0%	1	1%		0%
I do not buy 2nd hand clothes	274	85%	182	85%	87	83%	122	79%	152	89%
Total	324	100%	214	100%	105	100%	154	100%	170	100%

Additional comments: People do not buy second-hand clothes hence, the business idea should not focus on that market.

Hypothesis 2: x out of 10 users would be willing to pay more for sustainable clothing

- **Question 4**: Would you be willing to pay more to wear sustainable clothing of the same quality as conventional (non-sustainable) clothing?

	All answers		F		M		18- 45 years		45- >65 years	
Between 5-10%	108	33%	77	36%	29	28%	58	37%	50	29%
Between 10-20%	59	18%	32	15%	27	26%	34	22%	25	15%
Between 20-30%	43	13%	31	14%	12	11%	19	12%	24	14%
Between 30-40%	14	4%	10	5%	4	4%	4	3%	10	6%
Between 40-50%	7	2%	5	2%	2	2%	3	2%	4	2%
More than 50%	20	6%	13	6%	6	6%	6	4%	14	8%
I would not be willing to pay more	74	23%	47	22%	25	24%	31	20%	43	25%
Total	325	100%	215	100%	105	100%	155	100%	170	100%

✓ Validated? Yes. 77% of users would be willing to pay more for sustainable clothing.

Additional comments: It is important to note that increasing the price too much might lead to customer's loss although it might be possible to counteract this effect with an effective marketing campaign that addresses the environmental benefits of recycling clothing (see Question 16).

Hypothesis 3: x out of 10 users regretted having bought clothes that they later wore a few times or not at all.

- **Question 5**: Have you ever bought clothes that you didn't wear (or wore very little) and regretted buying them?

	All answers		F		M		18- 45 years		45- >65 years	
No	64	20%	25	12%	38	36%	31	20%	33	19%
Yes	261	80%	190	88%	67	64%	124	80%	137	81%
Total	325	100%	215	100%	105	100%	155	100%	170	100%

- **Question 6**: In relation to the previous question, on a scale of 0 to 10, how often do you regret buying clothes?

	All answers		F		M		18- 45 years		45- >65 years	
0	35	11%	12	6%	22	21%	16	10%	19	11%
1	64	20%	37	17%	27	26%	31	20%	33	19%
2	94	29%	65	30%	28	27%	42	27%	52	31%
3	59	18%	48	22%	10	10%	27	17%	32	19%
4	27	8%	16	7%	10	10%	17	11%	10	6%
5	21	6%	16	7%	4	4%	11	7%	10	6%
6	11	3%	10	5%	1	1%	6	4%	5	3%
7	9	3%	7	3%	2	2%	3	2%	6	4%
8	4	1%	3	1%	1	1%	1	1%	3	2%
10	1	0%	1	0%	0	0%	1	1%	0	0%
Total	325	1	215	100%	105	100%	155	100%	170	100%

✓ Validated? Yes. 80% of users regretted having bought clothes that they later wore a few times or not at all.

Additional comments: Women have more regrets than men. This might be linked to the fact that women buy more clothes than men. However, people do not regularly regret buying clothes that they do not wear or wear a few times.

Hypothesis 4: x out of 10 users are annoyed by paying for clothes that only have very casual use (e.g. New Year's Eve)

- **Question 7**: Have you ever been bothered by buying a garment for little use (e.g. New Year's Eve outfits, wedding dresses, fancy dresses...)?

	All answers		F		M		18- 45 years		45- >65 years	
No	65	20%	29	13%	34	32%	26	17%	39	23%
Yes	260	80%	186	87%	71	68%	129	83%	131	77%
Total	325	1	215	1	105	1	155	1	170	1

✓ Validated? Yes. 80% of users are bothered by buying clothes for little use (e.g., New Year's Eve).

Additional comments: Women are more bothered than men. This might be linked to the fact that women buy more clothes than men.

Hypothesis 5: I think the consumer is annoyed by not having storage because of unworn garments.

- **Question 8**: Do you feel that you lack space in your wardrobe, due to the amount of clothes that have little or no use?

	All answers		F		M		18- 45 years		45- >65 years	
No	150	46%	81	38%	66	63%	84	54%	66	39%
Yes	175	54%	134	62%	39	37%	71	46%	104	61%
Total	325	100%	215	100%	105	100%	155	100%	170	100%

✓ Validated? Partially, because the results are very similar. 54% of the consumers are annoyed by not having storage because of unworn garments.

Additional comments: Women and older people feel they lack more space than men and younger people. Although it seems that people do not mind having less wardrobe space in Question 16 the option "free up wardrobe space" was the second most popular choice.

Hypothesis 6: x out of 10 users would use my service because it would free up storage in an environmentally friendly way.

- **Question 9**: Do you currently have clothes at home that you don't wear, but you don't get rid of them because you don't know how?

	All answers		F		M		18- 45 years		45- >65 years	
No	140	43%	98	46%	41	39%	60	39%	80	47%
Yes	102	31%	73	34%	28	27%	51	33%	51	30%
Perhaps	83	26%	44	20%	36	34%	44	28%	39	23%
Total	325	100%	215	100%	105	100%	155	100%	170	100%

✗ Validated? No, because the question was not well formulated (it may mislead the respondent by asking two subquestions) so it did not allow us to validate the hypothesis with enough certainty.

Hypothesis 7: x out of 10 users would be willing to leave their homes to use textile containerization

- **Question 10**: Would you be willing to leave your home to use a textile recycling bin?

	All answers		F		M		18- 45 years		45- >65 years	
No	4	1%	1	0%	3	3%	2	1%	2	1%
Yes	300	92%	203	94%	92	88%	140	90%	160	94%
Perhaps	21	6%	11	5%	10	10%	13	8%	8	5%
Total	325	100%	215	100%	105	100%	155	100%	170	100%

✓ Validated? Yes. 92% of users would be willing to leave their homes to use textile containerization.

Additional comments: that 92% might push the remaining ones to reach 100%.

No hypothesis validated. This question was asked to gain more insight from Hypothesis 7 and Question 10.

- **Question 11**: Where would you prefer the textile recycling bin to be located? Several answers are possible.

	All answers		F		M		18- 45 years		45- >65 years	
On the street, such as the yellow or blue container	248	76%	167	78%	81	77%	131	85%	119	70%
At a green point	64	20%	42	20%	22	21%	20	13%	42	25%
At the porter's lodge of my building	61	19%	44	20%	17	16%	40	26%	20	12%
At the clothes shop	69	21%	52	24%	17	16%	38	25%	32	19%
Total	325	136%	215	142%	105	130%	155	148%	170	125%

Additional comments: the most chosen answer was "on the street, such as the yellow or blue container" by all the segments. However, the 2nd most chosen option was different: on one hand, women chose "at the clothes shop" whereas men chose "at a green point". On the other hand, younger people chose "at the porter's lodge of my building" but it was closely followed by "at a clothes shop". Finally, older people chose "at a green point". Note that the percentages do not add up to 100% because more than one answer was possible.

Hypothesis 8: x out of 10 users believe that the general population is willing to leave their homes to use textile containerization

- **Question 12**: Do you think the general public would be willing to leave their homes to use the textile recycling bins?

	All answers		F		M		18- 45 years		45- >65 years	
No	15	5%	12	6%	3	3%	9	6%	6	4%
Yes	220	68%	149	69%	67	64%	96	62%	124	73%
Perhaps	90	28%	54	25%	35	33%	50	32%	40	24%
Total	325	100%	215	100%	105	100%	155	100%	170	100%

✓ Validated? Yes. 68% of users believe that the general population is willing to leave their homes to use textile containerization.

Additional comments: It is interesting to note that although 92% of respondents would be willing to leave their homes to use textile containerization, they considered that only 68% of society would be willing to do so.

Hypothesis 9: Currently, I believe that the user disposes of unwanted and unworn clothes in the following ways: a) Throwing them in the grey bin, b) Throwing them in a HUMANA container, c) Putting them up for sale on the 2nd hand market d) Giving them as an inheritance e) Donating them to NGOs f) Storing them in the cupboard

- **Question 13**: Currently, what do you do with the clothes you don't want and don't wear? Several answers are possible.

	All answers		F		M		18- 45 years		45- >65 years	
Throwing them in the grey bin	44	14%	25	12%	19	18%	24	8%	20	8%
Throwing them in a HUMANA container	111	34%	73	34%	35	33%	52	18%	60	24%
Putting them up for sale on the 2nd hand market (Vinted, Wallapop...)	66	20%	52	24%	14	13%	46	16%	20	8%
Giving them as an inheritance	116	36%	85	40%	31	30%	71	24%	45	18%
Donating them to NGOs	152	47%	110	51%	39	37%	66	22%	86	34%
Nothing, storing them in the cupboard	56	17%	26	12%	29	28%	37	13%	19	8%
Total	325	168%	215	173%	105	159%	296	100%	250	100%

  - ✓ Validated? Partially. However, a new hypothesis was developed together with Question 0: **x users are aware that textile waste is not properly managed and take concrete actions to improve it**. This Hypothesis is named 9* and it was validated since just 14% of answers were positive to throw their unwanted and unworn clothes in the grey bin because the respondents are aware that textile waste is not properly managed and take concrete actions to improve it.

Additional comments: the most chosen answer was "donating them to NGOs" by all the segments except for younger people (where it was their 2nd most chosen answer). Note that the percentages do not add up to 100% because more than one answer was possible.

No hypothesis validated. This question was asked to gain more insight from Hypothesis 9 and Question 13.

- **Question 14**: Regarding the previous question, do you think that the practice(s) you have ticked help to solve the problem of textile waste generation?

	All answers		F		M		18- 45 years		45- >65 years	
No	67	21%	37	17%	28	27%	35	23%	32	19%
Yes	140	43%	97	45%	43	41%	70	45%	70	41%
Perhaps	118	36%	81	38%	34	32%	50	32%	68	40%
Total	325	100%	215	100%	105	100%	155	100%	170	100%

Additional comments: There is a misunderstanding among the respondents when it comes to the end of life of a product because these practices do extend the life of the product but do not reduce textile waste generation. This might explain the high percentage of "perhaps" since it could be read in the comments section that some respondents did not fully believe in NGO's.

Hypothesis 10: x out of 10 users believe that textile recycling could be a solution to the problem of textile waste generation.

- **Question 15**: Do you think that recycling textile material can be a solution to the problem of textile waste generation?

	All answers		F		M		18- 45 years		45- >65 years	
No	6	2%	2	1%	3	3%	2	1%	4	2%
Yes	232	71%	158	73%	71	68%	118	76%	114	67%
Perhaps	87	27%	55	26%	31	30%	35	23%	52	31%
Total	325	1	215	1	105	1	155	1	170	1

✓ Validated? Yes. 71% of users believe that textile recycling could be a solution to the problem of textile waste generation.

Additional comments: Although there seems to be a lot of support for the business idea it would be interesting to explain the advantages of textile recycling to society via a marketing campaign to turn those "perhaps" into "yes".

Hypothesis 11: x out of 10 users would be willing to recycle their clothes to reduce the environmental impact.

- **Question 16**: What would motivate you to recycle clothes? Several answers are possible.

	All answers		F		M		18- 45 years		45- >65 years	
Reduce impact on the environment	273	84%	189	88%	80	76%	131	85%	142	84%
Free up wardrobe space	165	51%	115	53%	48	46%	91	59%	74	44%
Get in-store discount points system	122	38%	84	39%	35	33%	73	47%	49	29%
Get in-store promotions	106	33%	67	31%	38	36%	70	45%	36	21%
Get a reduction in waste collection tax	77	24%	45	21%	30	29%	41	26%	36	21%
Total	325	229%	215	233%	105	220%	155	262%	170	198%

✓ Validated? Yes. 84% of answers were positive to recycle their clothes to reduce the environmental impact.

Additional comments: the fact that "reduce impact on the environment" was chosen by 84% of the respondents, among other answers, matched the high sensitivity observed in Question 0 and 13.

APPENDIX 2.3. Stakeholder's interviews.

EXPERTS

Strategy Sustainability Consultant

1. What characteristics should our service have in order to give added value to the companies that your organisation represents?

2. How would the traceability system add value to the companies that your company represents? Would it improve, for instance, the input of new recycled raw materials?

3. Does your company carry out any traceability initiatives and can you give us some guidance as to implementation time, possible cost, and the main barriers in the implementation of such a system?

4. Do you know of any European initiative on textile traceability?

5. Which indicators do you think would be most representative for this business model? We had considered: materials, recoverability, durability, recyclability, efficiency in the use of resources in the manufacturing process?

6. Regarding indicators, have you carried out any project to measure indicators? If so, how easy is it to measure them?

7. What other type of traceability, which guarantees the inviolability of the information, is there apart from the Blockchain? We are studying alternatives because the high energy consumption is not aligned with sustainable projects.

8. Regarding the practical pilot and divulge project with xxx, can you explain where the cotton that was collected was sent to be recycled and re-incorporated into a new product?

9. Is traceability considered within the practical projects of the students of xxx the business school and xxx university involved?

10. In terms of financing, would our project fit in xxx the business school project, would it be financed by European funds, or would it fit in xxx SMARTX initiative? Can you think of any other form of financing?

11. Regarding the xxx project in alliance with textile factories, can you give us the contact details of the companies that collaborated in it? What would be the traceability potential of this project? Were other outlets for this waste apart from recovery? If so, which ones?

12. Finally, which textile brands do you think would be a good option to start a pilot phase collaboration? Can you give us the contact details?

Sustainability consultant in textile and fashion industry

1. What is the current situation of the companies and what projects are they carrying out?

2. Why are companies taking measures for sustainable manufacturing?

3. Do you know of any international initiatives on textile traceability?

4. What barriers can companies currently encounter in implementing a traceability system?

5. Which indicators do you think would be most representative for this business model? A priori we had considered: materials present, recoverability, durability, recyclability, efficiency in the use of resources in the manufacturing process?

6. Do you think it is possible to provide a consultancy process together with our traceability system?

7. Do you think that companies would be willing to participate in the database and in the consultancy process?

8. Do you know any textile company and recycler contacts?

Technical and operations director / Expert in textile circular economy

1. What are the needs of the service provided by an Integrated Management System (IMS)? Logistics, collection points, included waste management recovery rate, alliances with manufacturers?

2. From your point of view, which system do you think would best suit the needs of a textile IMS: Blockchain or radiofrequency or RFID code or QR code?

3. How much time and cost do you estimate the transition to the new model (textile IMS) could take? For example, for other waste such as tyres it has taken between 3 and 5 years.

4. Would the textile IMS be willing to pay for the traceability service and can you give us a range?

5. How do you stand with the Landfill Directive target (from 1 January 2035 will efforts be made to accept only residual waste in landfills for Extended Producer Responsibility (EPR)? No more than 10% of the waste generated in the previous year will be accepted in EPR landfills)? Traceability would help to confirm whether this target is met.

6. How long did it take to have the first return of the first product in your system?

7. What happens to the products that do not pay for the system?

8. There are costs involved in applying EPR to manage waste. Are these costs 100% charged on consumers?

9. Do you have traceability in your products? If so, could you give us some guidance on the cost and time to implement traceability?

10. What barriers do you see to textile IMS managing waste in a circular way?

11. How do we reward consumer action and does your xxx IMS reward the citizen?

12. Beyond advertising, what actions do you take to incentivise recovery?

Technical manager in an urban waste manager

1. What problems are your clothes causing you? Problems at the landfill, sorting and separation?

2. What measures could be implemented to promote separation?

3. What system should we implement so that it generates less problems for you or does not reach you at all?

4. In the plant, if the clothes are separated manually, what is their destination: electricity generation/landfill?

5. How should the contract be structured? Tender, call for tenders, euros per kilogram of linen?

6. Which technology do you think is best suited to our model? Blockchain or radio frequency

7. Money flows between stakeholders.

8. What barriers does your company face when it comes to managing this flow in a circular way instead of sending it to landfill? Would traceability help your organization?

Textile waste manager and secondary market

1. Where and how do you make the selection of garments that can and cannot be reused? What criteria do you use to make this selection? What do you do with the garments that are not reused? Are they only sold to developing countries or are they also sold to other industries such as construction?

2. Would traceability add value for you?

3. What would motivate you to recycle clothes instead of reselling them, apart from their condition? Would recycling ensure that the recycled fibres stay in Spain?

4. Would traceability avoid sending to landfill? Would traceability help you reduce your carbon footprint?

5. Destination of the clothes: How do you guarantee that these clothes are properly managed in the country of destination, for example, that they do not end up in landfill?

6. Is there no market for recycled textiles at national or European level?

7. What does EPR mean for your operational performance xxx?

8. What do you do with the unsold surplus?

9. Do you plan to use any kind of technologies in the collection containers to identify the clothes?

10. Do you know any contacts of recycling companies?

COMPANIES IN THE TEXTILE SECTOR

1. What are the most important elements that you have problems with today in terms of?

    - Recycling.
    - Production.
    - Current legislation.
    - Compliance with future regulations.

2. What are your decision-making criteria when designing clothes in terms of sustainability?

3. What are your criteria for selecting a supplier and raw materials?

4. Do you consider the transcendence/repercussion that the EPR will have on your brand, mandatory from December 2024? What initiatives are you incorporating?
5. Implementing EPR has costs associated with managing waste. Are these costs going to be passed on to the consumer? Can you tell us approximately how much of this cost is in each garment? Are you aware that EPR can be not only a cost but also a saving if garments are recycled?

6. How are you going to manage the unsold surplus?

7. In your experience, do you consider the environmental impact of the textile industry an emerging consumer need? In our survey of more than 300 people, the impact of the textile industry ranges between 4 and 5 for 40.1 + 42.9 % of the respondents.

8. We have seen that you have a guide to sustainable practices on your website. Have you noticed an increase in sales due to people's environmental awareness? What has led the company to become more sustainable?

9. According to our survey, more than 70% of people believe that recycling textile material could help the impact of the industry. On your website you have guides on

how to care for clothes so that they last longer and generate fewer emissions, and you also inform consumers about the use of recycled materials in the manufacture of clothes such as polyester. Do you buy the recycled polyester you use from an authorised manager who guarantees that it is recycled? Do you make sure that your product has been recycled?

10. We have seen that on your website you have a guide to sustainable practices and our project would help to know where these textile fibres are always in order to incorporate them back into the chain. Have you thought about implementing traceability in your products? Traceability would involve a cost, but in our survey 78% of people would be willing to pay between 5 and 10% more.

11. Do you think that applying a standardised and quantified system is interesting in terms of promoting your garments?

12. What do you do with your employees' uniforms after the end of the season?

13. Do you make sure that your product is recycled at the end of life?

14. What characteristics should our service have?

15. Is it possible textile factories return to Spain?

PUBLIC ADMINISTRATION

Environmental technical assistant in local public administration

1. How many textile bins are distributed, for how many people, and are there any plans to extend them?

2. Are the citizens informed about the existence of the containers and their procedure?

3. How does the municipality ensure that municipal textile waste manager xxx recycles textile waste correctly?

4. How often is the contract renewed and will renovate with the current waste manager xxx?

5. Do the containers have any kind of recognition technology?

6. What is the management of the textile material deposited in the containers? Can you give us a range of the tariff? Does the tariff depend on the amount of textile recovered?

7. How will you encourage the reuse of textile material?

8. If the City Council pays the management fee per tonne of waste it treats, it saves the cost of the textile fraction. Are you aware of the impact of this saving?

9. What characteristics should our service have?

APPENDIX 4.1. Indicators

Textile Exchange Standards

- Organic Content Standard (OCS): it verifies the organically grown content of the products.
- Global Recycled Standard (GRS) and Recycled Claim Standard (RCS): they verify the recycled content in products.
- Responsible Down Standard (RDS): it ensures that down and feathers come from animals that have not been subjected to any unnecessary harm.
- Responsible Wool Standard (RWS): it addresses the welfare of sheep and the land they graze on.
- Responsible Mohair Standard (RMS): it addresses the welfare of goats and the land they graze on.
- Responsible Alpaca Standard (RAS): it addresses the welfare of alpaca and the land they graze on.
- Content Claim Standard (CCS): it verifies that one or more specific input materials are in a final product.

TU Delft sustainability impact metrics

- Eco-costs: measure to express the amount of environmental burden of a product on the basis of prevention of that burden. They are the costs which should be made to reduce the environmental pollution and materials depletion in our world to a level which is in line with the carrying capacity of our earth. As such, the eco-costs are virtual costs, since they are not yet integrated in the real life costs of current production chains. The eco-costs should be regarded as hidden obligations ('external costs').

Figure 4.1.1.: Ecocosts from TU Delft

- Socio-economic costs (s-eco-costs): they monetize the 'external' socio-economic burden for workers. Hence, they are the marginal prevention costs to reach a sustainable level (Performance Reference Point, PRP) for wages and are the

monetary compensation costs beyond the PRP to account for unacceptable exploitation of workers. The s-eco-costs of a product are based on the salaries per working hour, the working conditions and the required time to make a product.

- 'total s-eco-costs of a product'= 'hours to make a product' x 's-eco-costs (€/h)'

The s-eco-costs include five sub-indicators, proposed as a base-line for several social issues:

- Minimum Acceptable Wage:
  - Long term sustainable wage: level of minimum wage in poor countries at which the current unsustainable level of economic migration is likely to vanish, even at 'open borders' (i.e. free flow of workers without strict working permits and without borders with fences). This long term sustainable level is based on statistical data: 5.79 US$/h.
    - s-eco-costs-MAWlt = 0.72 (5.79-Sal) if Sal <5.79
    - s-eco-costs-MAWlt = 0 if Sal >5.79
      - Sal = actual net salary per hour (Int $ PPP/h).
  - Short term decent living wage: it is the so-called 'decent living wage' when available for a country.

- Child Labor (forced labor, not able to attend school): calculated on the basis of the 'lost life years' of a child (age below 15 years), where 2,240 h of work in manufacturing is set equal to 1 DALY as default value, and 1 DALY is valued at 80,000 €.
  - s-eco-costs-CLindustry = 35.71 (h/2,240)
  - s-eco-costs-CLagriculture = 35.71 (h-560)/2,240 for h > 560 h/year
  - s-eco-costs-CLagriculture = 0 for h < 560 h/year
    - s-eco-costs-CLindustry = s-eco-costs of Child Labor in industry (€/h)
    - s-eco-costs-CLagriculture = s-eco-costs of Child Labor in agriculture, services and domestic (€/h)
    - Hr = working hours per child per year (hr/year)

- Extreme Poverty: it is based on the poverty line of the World Bank (2015) of 1,90 US$ per person per day, which is based on the absolute minimum amount of money needed to feed a family, resulting in the absolute minimum net wage that is required: 0,935 Int $ PPP per hour. Since the food price is relatively unchanged, this poverty line has not changed. For a wage of zero (slavery), the indicator is proposed as 1 DALY/year.
  - s-eco-costs-EP = 35.71 (0.96-Sal)/0,935 if Sal <0,935
  - s-eco-costs-EP = 0 if Sal >0,935
    - s-eco-costs-EP = s-eco-costs of Extreme Poverty (€/h)
    - Sal = actual net salary per hour (Int $ PPP/h)

- Excessive Working Hours: at some production sites workers are forced to work more than 48 hr per week, leading to exhaustion. When this is involuntary, it can be regarded as a form of modern slavery. To quantify the Excessive Working Hours the DALY as indicator is proposed, as for Child Labor and Extreme Poverty.
    - s-eco-costs-EWH = 35.71 (h-2240)/2240 only for h >2240
    - s-eco-costs-EWH = s-eco-costs of Excessive Working Hours (€/h)
    - Hr = working hours per year (hr/year)

- Occupational Safety and Health: safety and health in a company:
    - s-eco-costs-OSH = 35.71 [(CA x PA)+(CM x PM)]
        - s-eco-costs-OSH = s-eco-costs of OSH (€/h)
        - PA = number of accidents and work related illness causing over 4 days' absence per year/number of workers
        - PM = number of work related death per year/number of workers
        - CA = average lost life year per case (DALY)
        - CM = average lost life year per calamity (DALY) = average life expectancy in a country – age of the worker

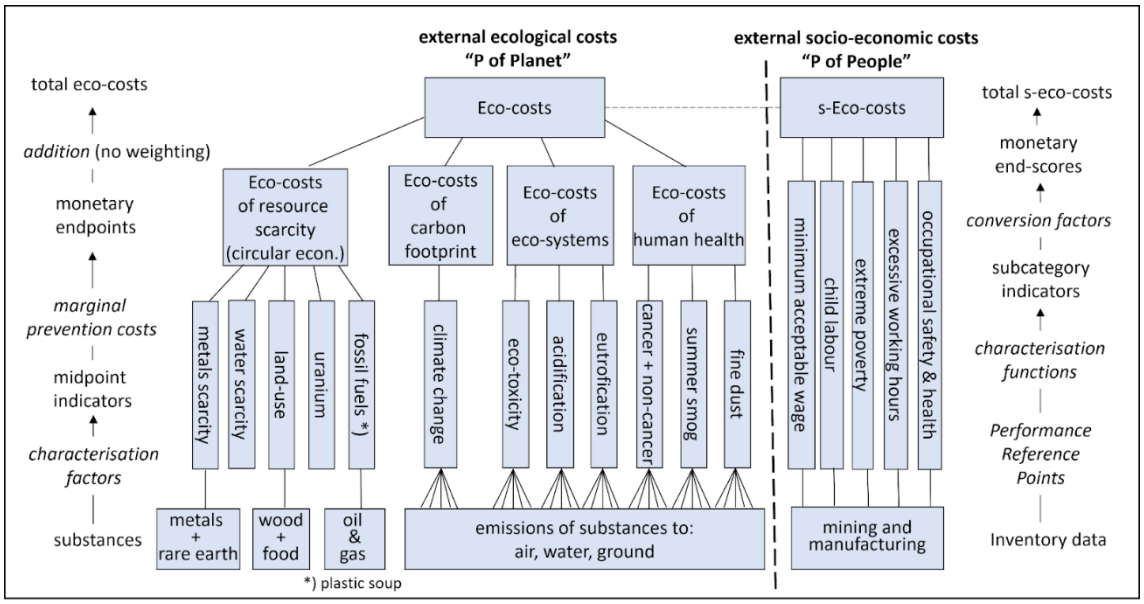

Figure 4.1.1: The Model of the eco-costs and the s-eco-costs for E-LCA and S-LCA.

Cradle to Cradle Certified: Product Circularity

The standard requirements are based on the Cradle to Cradle design principles and provide guidance in five key categories, of which we are interested in Product Circularity (that is, products that are intentionally designed for their next use and are actively cycled in their intended cycling pathway(s)).

material health | product circularity | clean air & climate protection | water & soil stewardship | social fairness

Figure 4.1.2. Key categories

Bronze	Applicant is involved in a circularity education initiative to gain an understanding of relevant cycling infrastructure development.
	Intended cycling pathway(s) for the product and its materials are defined.
	A plan has been created to address challenges with the cycling infrastructure at the end of the product's first use; potential cycling partners have been identified.
	Select product and material types contain cycled and/or renewable content. Alternative: Limitations that prevent achievement of this requirement are publicly reported.
	≥ 50% of materials by weight are compatible with the intended cycling pathway(s) (i.e., recyclable, compostable, or biodegradable).
	Circularity data and cycling instructions are publicly available.
Silver	Partnerships for cycling (recovery and processing) of the product have been initiated. If the product is intended for cycling via municipal systems, materials are compatible with those systems.
	Percentage of cycled and/or renewable content, by weight, is equal to or higher than industry averages and/or is consistent with common practice. Alternative: Limitations that prevent achievement of this requirement are publicly reported.
	≥ 70% of materials by weight are compatible with the intended cycling pathway(s) (i.e., recyclable, compostable, or biodegradable).
	A strategy for improving product circularity is developed including plans for: • Increasing the amount of post-consumer recycled content and/or responsibly sourced renewable material, as relevant to the product type, • Implementing a circular opportunity or innovation, and • Improving the product's design for disassembly (if relevant).

Gold	Percentage of cycled and/or renewable content, by weight, is consistent with values achieved by industry leaders for the product type. Alternative: Limitations that prevent achievement of this requirement are publicly reported.
	≥ 90% of materials by weight are compatible with the intended cycling pathway(s) (i.e., recyclable, compostable, or biodegradable) and support high-value cycling. This means that the materials are of high quality and are likely to retain their value for subsequent use. If relevant, parts containing these materials are designed for easy disassembly.
	The strategy has been implemented including: Increased use of post-consumer and/or responsibly sourced renewable material as relevant to the product type. Alternative: Limitations that prevent increased use are publicly reported. A circular opportunity or innovation that increases product circularity.
	The product is actively cycled (recovered and processed) and/or a program is implemented to increase the cycling rate or quality of the product's materials after use. (Both are required for short-use phase products; one is required for long-use phase products.) For select single-use plastic products, a minimum cycling rate of 50% is achieved.
Platinum	At least two intended cycling pathways are defined for the product and its materials.
	Percentage of cycled and/or renewable content, by weight, has reached the technically feasible maximum.
	≥ 99% of materials by weight are compatible with the intended cycling pathway(s) (i.e., recyclable, compostable, or biodegradable). If relevant, parts containing these materials are designed for easy disassembly.
	The product is actively cycled in an amount consistent with the product's use phase (the shorter the use phase, the higher the minimum percentage required) and a program is implemented to increase the cycling rate or quality of the product's materials after use.
	Cycling rates and quality are monitored over time, and an increase in cumulative cycling rate or quality is demonstrated.

Figure 4.1.3. Product circularity requirements

APPENDIX 5.1. Sensibility analysis

SmarTextil's fees have a huge impact on the financial model. This is why the fees were carefully chosen both to sustain the Company but to keep customers engaged.

10,00%	Year 1	Year 2	Year 3	Year 4	Year 5
Net profit (NP)	-119.256	-92.527	-70.025	3.086	222.403
NPV	-127.782				
IRR	-13,62%				
€/garment	0,54	0,54	0,54	0,54	0,54

10,00%	Mono	Bi	Multi
Fee	0,02	0,02	0,03
Revenues (€/kg)	1,00	1,10	1,21

25,00%	Year 1	Year 2	Year 3	Year 4	Year 5
Net profit (NP)	-109.808	-73.632	-34.454	60.056	328.821
NPV	-45.102				
IRR	7,61%				
€/garment	0,62	0,62	0,62	0,62	0,62

25,00%	Mono	Bi	Multi
Fee	0,02	0,03	0,03
Revenues (€/kg)	1,00	1,25	1,56

40,00%	Year 1	Year 2	Year 3	Year 4	Year 5
Net profit (NP)	-99.580	-53.174	4.056	121.734	444.033
NPV	44.412				
IRR	28,81%				
€/garment	0,70	0,70	0,70	0,70	0,70

40,00%	Mono	Bi	Multi
Fee	0,02	0,03	0,04
Revenues (€/kg)	1,00	1,40	1,95

55,00%	Year 1	Year 2	Year 3	Year 4	Year 5
Net profit (NP)	-88.570	-31.156	45.506	188.120	568.040
NPV	140.759				
IRR	51,37%				
€/garment	0,79	0,79	0,79	0,79	0,79

55,00%	Mono	Bi	Multi
Fee	0,02	0,03	0,05
Revenues (€/kg)	1,00	1,55	2,40

70,00%	Year 1	Year 2	Year 3	Year 4	Year 5
Net profit (NP)	-76.780	-7.575	89.896	259.215	700.842
NPV	243.939				
IRR	76,55%				
€/garment	0,88	0,88	0,88	0,88	0,88

70,00%	Mono	Bi	Multi
Fee	0,02	0,04	0,06
Revenues (€/kg)	1,00	1,70	2,88

Figure 5.1.1. Sensibility analysis

APPENDIX 6.1. SmarTextil fee impact on a T-shirt

If a T-shirt weighs 0.5 kg and the SmarTextil fee is as shown in the Table, then the increase in price is hardly noticeable to the consumer.

$$\frac{0{,}2\,\frac{kg}{T-shit}\,x\,\frac{€}{kg}}{15\,\frac{€}{T-shirt}}$$

FEE RATES			
	Mono	**Bi**	**Multi**
Garment type	37,30%	35,20%	27,50%
Fee	2,20%	3,50%	4,40%
Revenues (€/kg)	1,00	1,59	1,99
€/garment	0,50	0,79	1,00
Revenues (€/garment)	0,50	0,79	1,00
Price impact (-)	0,01	0,02	0,03

Figure 6.1.1. SmarTextil fee impact on a T-shirt

APPENDIX 6.2. Revenue rates of some brands

The revenue per garment of 3 major textile brands has been calculated by taking their net sales and dividing it by the tons of garments they have sold. The revenues are in the same order of magnitude.

	BRAND 1	**BRAND 2**	**BRAND 3**
Garments sold (tonnes/year)	450.146	68.146	9.750
Net sales (€/year)	20.402.000.000	2.193.634.000	589.000.000
Revenue rate (€/kg)	45,32	32,19	60,41

Figure 6.2.1. Revenue rates of major textile brands