

CIRCULAR ECONOMY IN THE TEXTILE AND FOOTWEAR INDUSTRY

SKILLS AND COMPETENCES FOR A SECTOR RENEWAL

DESIGN4CIRCLE

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circular economy
design training
in the textile and
footwear industries



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Innovative design practices for achieving
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1. INTRODUCTION

The fashion and textile industry is one of the most polluting industries in the world. The industry's CO₂ emissions are projected to increase by more than 60% to nearly 2.8 billion tons per year by 2030. The European Commission estimates that the EU textile industry generates 16 million tons of waste every year.

It seems obvious to move away from our current linear model to a new circular textile model. In this direction, design is a key element to support the transition to a circular model. Around 80% of a product's environmental impact is locked in at design stage. The 2017 report from Ellen Mac Arthur foundation "A new textile economy" highlights design as strategic action towards a circular textile sector, taking into account that "designing and producing clothes of higher quality and providing access to them via new business models would help shift the perception of clothing from being a disposable item to being a durable product".

Consequently, it is deemed necessary to equip current and future designers with the necessary skills and competences to fully engage in circular design and innovative business models.

For that reason, Design4Circle aims to cover the skills gap in circular design

and innovation to support European designers in the textile and fashion sector.

Design4Circle aims to create an innovative learning curriculum in line with the needs of designers of the textile and fashion industry to transition towards circular business models, products and services.

This report provides an overview on how the circular economy is currently being implemented within the Textile and Fashion sector. By focusing on existing practices, challenges and opportunities at the micro-level, the main objective of this report is to identify the necessary skills and competences needed to support the transformation of fashion companies towards a circular economy.

Following an overview of alarming trends currently touching the textile industry, the report introduces how circular economy thinking can become a relevant answer to these challenges. The second half of the report introduced the skillsets that should be developed by existing and future professionals in the textile industry.



2. TEXTILE INDUSTRY: ALARMING TRENDS

The global fashion industry is believed to account for one-tenth of the world's annual carbon emissions and to employ more than half a billion people, with the majority being women in textile supply chains. In addition, with consumer demand for new clothing growing exponentially, experts have predicted that the fashion industry could account for a quarter of global emissions by 2040 without ambitious action.

Our current system for producing, distributing, and using clothing is mainly based on a linear, take-make-dispose model. High volumes of non-renewable resources are extracted to produce clothes that are often used for only a short period, after which the materials are largely lost to landfill or incineration.

Consultancy bureau McKinsey (2016) estimates that more than half of 'fast fashion' produced is disposed of in under a year. This linear system, puts pressure on resources, pollutes and degrades ecosystems, and creates significant societal impacts at local, regional, and global scales, while leaving out economic opportunities untapped. The following sections provide a synthetic overview of the main issues at stake.



2.1 WASTE ISSUES

The textile industry is a major waste generating industry.

Low recycling

Of the total fibre input used for clothing, 87% is landfilled or incinerated, 10% is lost during garment production (e.g. as offcuts), 2% is sent to landfill or incineration from garments that are produced, never make it to market 73% of material going into the clothing system is lost after final garment use while an additional 2% loss occurs in the collection and sorting of discarded clothing

Less than 1% of material used to produce clothing is recycled into new clothing. This includes recycling clothing after use, as well as the recycling of factory offcuts. Only 13% of the total material input is in some way recycled after clothing use. The majority of this recycling consists of cascading into lower-value applications such as insulation material, wiping cloths, and mattress stuffing. After being used in these applications, currently, the materials are difficult to recapture and therefore are usually discarded.

Low reuse rate

Globally, around 25% of garments are collected for reuse or recycling through a variety of systems. Clothes collected for reuse in high-income countries are mainly exported to low income countries (in Africa and Asia).

Underutilisation

Underutilisation of clothing is a key issue. Customers purchase more clothing than they will use and are quick to throw garments away after use. Worldwide, clothing utilisation - the average number of times a garment is worn before it ceases to be used - has decreased by 36% compared to 15 years ago, according to the International Apparel and footwear. It is also estimated that some garments are discarded after just seven to ten wears.



2.2 ENVIRONMENTAL ISSUES

Our current system, with low recycling, low reuse, and underutilisation patterns leads to considerable and ever-expanding pressure on resources and causes high levels of pollution.

2.2.1 Climate change

Textiles production accounts for significant greenhouse gas. In 2015, greenhouse gas (GHG) emissions from textiles production totalled 1.2 billion tonnes of CO₂ equivalent (emissions (Circular Fibres Initiative, 2017), more than those of all international flights and maritime shipping combined.

2.2.2 Water

Textiles production (including cotton farming) uses around 93 billion cubic metres of water annually, representing 4% of global freshwater withdrawal (Maxwell et al, 2015). Beyond production, washing clothing using washing machines is estimated to require an additional 20 billion cubic metres of water per year globally (Pacula, 2009).

2.2.3 Hazardous substances

Hazardous substances affect the health of both textile workers and the wearers of clothes; plastic microfibers are released into the environment, often ending up in the ocean... In recent years, plastic microfibers from the washing of plastic-based textiles, such as polyester, nylon, and acrylic, have

been identified as a major contributor to this issue.

2.2.4 Extensive use of non-renewable resources

The textiles industry is highly reliant on non-renewable resources across all stages of the value chain.

98 million tonnes of non-renewable resources are used every year. Producing plastic-based fibres for textiles requires an estimated 342 million barrels of oil every year, The production of cotton is estimated to require 200,000 tonnes of pesticides and 8 million tonnes of fertilisers annually. Similarly, chemicals used in the production processes for fibres and textiles (dyes or finishing treatments) account for a significant amount of resource use - around 43 million tonnes in total.

2.2.5 Unfit materials

The materials currently used have significant drawbacks, making them unfit for a circular system.

For instance, polyester uses large quantities of non-renewable resources and fossil energy to produce. Growing cotton requires high volumes of fertilisers and pesticides (unless farmed using regenerative agriculture), as well as significant volumes of water. These commonly-used materials have various negative impacts for people and the environment, leaving room for significant innovation in materials.



2.3 SOCIAL IMPACTS

The textile industry also has multiple negative societal implications.

2.3.1 Working conditions

The increasing pressure on manufacturers to deliver on shorter lead times and lower pricing lead to garment workers suffering poor working conditions with long hours and low pay, with evidence, in some instances, of modern slavery and child labour (Bureau of international labor affairs, 2013).



3 CIRCULAR ECONOMY: NEW OPPORTUNITIES TO TRANSFORM THE TEXTILE SECTOR

3.1 CIRCULAR ECONOMY IN A NUTSHELL

Given the unsustainability of our current take-make-dispose extractive industrial model, a circular economy offers an inspiring alternative.

The concept aims to rethink our growth patterns, focusing on positive society-wide benefits. It seeks to decouple economic activity from the consumption of finite resources, while designing waste out of the system. Fuelled by renewable energy sources, the circular economy model seeks to rebuild economic, natural, and social capital.

The model is built upon three principles:

- **Design out waste:** A circular economy aims to design out the negative impacts of economic activity that cause damage to human health and natural systems. This includes the release of greenhouse gases and hazardous substances, the pollution of air, land, and water, as well as structural waste such as traffic congestion.
- **Keep products and materials in use:** A circular economy favours activities that preserve more value in the form of energy, labour, and materials. This means designing for durability, reuse, remanufacturing, and recycling to keep products, components, and

materials circulating in the economy. Circular systems make effective use of biologically-based materials by encouraging many different uses before nutrients are returned to natural systems.

- **Regenerate natural systems:** A circular economy avoids the use of non-renewable resources and preserves renewable ones, for instance by returning valuable nutrients to the soil to support regeneration, or using renewable energy as opposed to relying on fossil fuels.

Transitioning to a circular economy goes further than just reducing the negative impacts of the linear economy. It represents a systemic shift that builds long-term resilience, generates business and economic opportunities, and provides environmental and societal benefits.

The model is strongly inspired by Cradle-to-cradle thinking, which distinguishes between technical and biological cycles. Consumption happens only in biological cycles, where food and biologically-based materials (such as cotton or wood) are designed to feed back into the system through processes like composting and anaerobic digestion. These cycles regenerate living systems, such as soil, which



provide renewable resources for the economy.

Technical cycles recover and restore products, components, and materials through strategies like reuse, repair, remanufacture or (in the last resort) recycling.



Associated benefits of circular economy

Transitioning to a circular economy can provide specific benefits, for the environment, the economy, and society at large.

Environmental benefits

- Less carbon emissions Using low-carbon materials and production processes (including renewable energy and energy-efficiency measures) can reduce the GHG emissions of the sector
- Reduced consumption of virgin, non-renewable materials and of energy through higher rates of clothing utilisation, improved recycling, and reduced waste in production
- Less leakage of hazardous substances into the environment through the phasing out of substances of concerns.

Economic benefits

- Material cost savings and reduced exposure to resource price volatility, by reducing the use of raw virgin materials and promoting the use of recycled materials.
- Additional profit opportunities for businesses through new services such as rental or subscription services.
- Improved brand image and reduction of reputational risks

Societal benefits

- Reduced obsolescence through longer lasting and higher quality products
- Positive health impacts through the reduction of hazardous substances
- Better working conditions for employees throughout the value chain.



3.2 PRINCIPLES FOR A CIRCULAR FASHION INDUSTRY

Several circular principles should be applied throughout the life cycle of textile and fashion products, in order to become circular economy, fit. Specific choices in the design of products, in the selection of resources, in the production, retailing and consumption phases and ultimately in the end of life of the products, can facilitate the development of a circular economy.

3.2.1 Design principles

Design for zero Waste

In a circular economy, waste is regarded as a product of bad design. Traditionally, waste has always been considered a necessary evil of production. Today, we are seeing a shift from this point of view to, for example, cradle-to-cradle thinking, in which waste is designed out and everything that was ever made has to return either to nature or the industry without damaging the environment.

This strategy encourages designers to minimise and even eliminate the waste that is created in the textile industry, both pre and post-consumer. It includes zero waste pattern cutting, recycling or reusing leftovers, on demand design or 3d virtual prototyping.

Design for Circularity

In a circular economy, all products should be designed so as to be either biodegradable, recyclable or a combination of both (by separating individual parts). Through recycling,

all materials and components in a product are recovered for use in new products or processes.

Products suitable for recycling are those made out of plastics, metals or other non-renewable materials (such as minerals or raw oil). As some parts of a product may be biodegradable, it is important that the non-biodegradable, recyclable parts are separated, recovered and possibly reconditioned. Instead of biodegradation, these should be made accessible and useful for new products or processes in society. In the fashion, apparel, outdoor and sportswear industry, many products are either totally or partly made of polyester, nylon, acrylic, plastic, metal or similar material. All this material should be recovered at the product's end of use. Thus, careful consideration should be given at the design stage to how these recyclable parts can be separated from the product, if necessary, and then recovered through various steps for material recycling.

Design for recycling, Design for mono materiality or Design for disassembly are necessary approaches to allow for future cycling of the materials.

Design for zero toxicity

In order to minimize the risk for any harmful compounds to be released into our environment, it is crucial to design products that are 100 percent safe and effective to both biodegrade or incinerate.



For safe and effective biodegradation, all components of a product must be non-toxic and effective to biodegrade. This means that natural fibers, such as cotton, flax (linnen), wool, silk, bamboo, viscose (tencel), and wood should be prioritised. Thread, buttons and laces should also be made out of natural materials, such as cotton or silk and wood, respectively. If some parts are made out of non-biodegradable materials, for example the zipper, this must be easily separated from the other components before biodegradation.

For safe and effective incineration, all components must be combustible and free from non-toxic substances or compounds. Also the products must be produced with rigorous consideration to all relevant chemical regulations and legislations worldwide (such as REACH).

Design for energy and resource efficiency

Energy consumption and water usage in the textile industry are extremely high and occur at each stage of the lifecycle of textiles - at the production stage, in the use phase (where consumers use and care for textiles and garments) and at the end stage (which covers either disposal and/or re use of the material).

In this strategy, design choices are made to reduce energy and resource consumption. Examples include in the production phase the use of dry patterning systems, Air-dyeing. *In the use phase*, alternatives such as design for no/low laundry, or technical coatings to reduce washing can be privileged.

Design inspired by Nature

This strategy is about how much textile designers can find inspiration and information for future sustainable design from studying and reflecting upon

Examples include shape-memory polymers to mimic natural movement, 'Lotus effect' nano-coatings, Velcro...

Design for sufficiency

This strategy is about making stuff that lasts, stuff that we really want and want to keep and look after, and the design and production of textiles and products which adapt and change with age.

Examples include design with enhanced aesthetic value, emotionally durable design, slow design.



3.2.2 Resources principles

Choose low impact materials

Each material has its own strengths and weaknesses and it is sometimes difficult to assess the overall environmental impact of a material throughout its life cycle. When trying to establish which has the lowest impact, the following principles should be pursued. Resources should be derived from natural products (bio-waste), biodegradable, renewable or that quickly recovers/regrows.

Choose recycled or recyclable fibres

Using recycled fabrics scores well in terms of environmental impact because the process requires less energy, less resources and less chemical products than the production of new textile. Turning to existing yarn and textile, moreover, means reducing the need to make fabrics from virgin (raw) materials like cotton, wool or synthetic yarn. This saves energy and avoids the pollution that takes place during traditional dyeing, washing and harvesting processes.

3.2.3 Production principles

Ethical production

This strategy focuses on ethical production which supports and values workers' rights, and the sourcing of fair trade materials. It questions what ethical production means, and how it differs for each scale of production and manufacture.

Examples include Sourcing fair trade materials, engaging suppliers who abide by codes of conduct, vertical supply chains, consideration of local resources

Clean technologies production

New technologies are developing rapidly which allow to rethink our traditional production processes, thereby helping to reduce the ecological footprint associated with production. The aim of this strategy is to replace systems of production with less energy consuming and smarter technologies to reduce environmental impacts. Some techniques are already well developed such as

Digital printing/finishing: while conventional printing techniques involve large quantities of chemicals and dyes, digital printing can do without those.

Laser cutting: by using a laser rather than a blade to cut into a surface, the technics allow for a cleaner, more accurate cut, as well as a higher quality of finish.

Other examples include 3-D printing, Water-jet, Sonic cutting and welding, 'Re-surfacing' of polyester, etc...



3.2.4 Retail and consumption

Circular business models in the fashion industry may focus on developing product-service systems which extend the useful life of clothes. *Systems & services design illustrates how consumer's needs can be met with services as opposed to tangible products, and at the same time provide economic and environmental benefits*" (Manzini, E. 2001) Through leasing, sharing, repairing services, the clothes are circulating longer, thus avoiding the production of additional garments.

Leasing models

Customers simply pay a small fee up front, and then a regular fee for each month that they wanted to lease the clothes. When they grew tired of their rental clothes, they can just send them back and stop paying.

Clothing libraries

This strategy adapts the concept of book libraries to clothing items. Various subscription options are available: you can lend clothes that you simply swap for others again after a while.

Swapping

The strategy creates a space (pop-up event for instance) where you can leave your clothes behind in exchange for coupons. These coupons, in turn, can be used to buy someone else's clothes.

Online second hand marketplace

The internet is a huge facilitator, providing previously unseen possibilities for giving away, swapping and selling/buying second-hand. Various

sites and apps bring suppliers and demanders together (sometimes for a fee). When products are shared or sold on, we don't have to make as much new stuff, meaning fewer resources are used. In addition, borrowing and sharing saves money. It costs the recipient a lot less than buying something new.

3.2.5 End of life

Biodegradability

Making sure the product has been designed with biodegradability in mind is an essential aspect to allow for the material to disappear back safely into the earth. Choosing natural textiles that easily break down, like cotton, silk, wool, cashmere and hemp is a must, as synthetic fabrics like polyester, spandex, nylon will eventually break down in a very long time (between 20 to 200 years depending on the material).

Upcycling

The strategy focuses on reusing discarded pieces of fabric to create new products with additional value. Discarded textile is creatively reused and can re-enter the market as a new, upcycled product. The process comes down to making new clothes from old pieces or fabrics. This closed-loop system often requires intermediaries such as thrift shops or other organizations that collect clothes

Take back systems

Several manufacturers and clothing chains have already started to collect clothes. To encourage consumers to return unwanted items, they often offer a discount on the next purchase. Brands

can team up with ngo's: the collected clothes are donated to fair trade organization and in exchange the customer gets a discount. Others retailers directly place collecting boxes in their own stores.

Recycling

Recycling natural materials (like cotton and wool) happens mechanically: it's a process of stripping and shredding fabrics into smaller particles; fibres. The fibres that emerge from this process have been broken and torn, making them very short. Using (only) these kinds of fibres would threaten the quality of the fabric; the product would not be strong enough and would disintegrate quickly. To achieve a better quality, the short fibres are mixed with long (new) and less fragile fibres. It also matters whether your fabric is dark or light. After all, the fabrics have to be decolorized, with darker fabrics obviously calling for more bleach.

While this is the only way to recycle natural materials, there are more options for synthetic fabrics. The latter can be recycled both mechanically and chemically. Polyester, for instance, is pulverized, melted and then spun into new fibers.

4 SKILLS AND COMPETENCES TO SUPPORT THE TRANSFORMATION TOWARDS A CIRCULAR TEXTILE AND FASHION ECONOMY

Educational programmes are key to support companies on their transformation to circular economy. New skills, competences and capabilities are needed in order to implement circular economy principles and circular business models in the textile industry. In the framework of the Design 4 Circle project, we have identified throughout Europe 29 textile and fashion companies active in the circular economy. Interviews, held between January and April 2019 in Belgium, Spain, Portugal, Macedonia, Romania, Latvia, Bulgaria and Finland, allowed us to gather insights on the necessary skills and competences needed to develop and run circular business models relevant for the textile industry.

In parallel, we interviewed Higher Education institutes, VET providers and circular economy experts active in developing circular economy related trainings and curriculums to identify the relevant skills gaps between the industry and the educational sector.

This chapter highlights the learnings of this research.

4.1 RESEARCH METHODOLOGY

The following section summarizes the research design, data collection and analysis that support the production of results described in the next section.

4.1.1 Research design

First, in order to comprehend the relevant challenges relevant to the textile and fashion sectors, we conducted a literature review. Reports from grey literature and a selection of academic publications were included in the framework of analysis. The overview allowed us to get a big picture on current issues, barriers and opportunities associated with circular economy in the fashion and textile sector.

Second, we identified at national and European levels, 46 best cases of companies engaging in circular economy practices. The selection led to the development of a database of best practices, classified according to the focus related to circular economy (material, design, manufacture, business model, recycling). The database highlights new processes, use of key materials, as well as business model innovations that fit with the principles of circular economy.

Following this desk research, we favoured a dual approach to gather additional empirical data combining qualitative and quantitative methods. On one hand, we designed a semi-directive interview template to be used with company representatives active in circular fashion and textile practices. The template addresses key questions related to the circular business model of the company (value proposition, key resources, key activities, key partners, customer

segments, customer relationships, costs a profit equations), as well as drivers leading to the implementation of circular economy practices. The interview was complemented by a short quantitative survey asking representatives to assess the importance of a selection of skills associated with circular economy transformation. Through the survey, informants were asked to assess to what extent their company possesses those skills. The outcome of the survey allowed us to identify and prioritize key skills and competences associated with circular business model innovation, while at the same time clarify the importance-performance gap related to the addressed skills.

In parallel, we designed a second interview template to gather information related to training providers active in circular economy related courses. The template was also complemented by a quantitative survey in order to identify and assess the importance of key skills and competences in the circular textile economy.

4.1.2 Data collection

First, 30 companies were contacted and interviewed in the framework of this research. The companies were selected by national partners as they are nationally renowned for being active in circular economy ventures. Companies interviewed are implementing various business models for circular economy in the textile and fashion industry, focusing either on innovative materials or technologies, alternative retailing practices (i.e.: clothing as a service) or closing the loop practices to reprocess used textiles as raw material.

Second, 37 higher education institutes and training providers in circular economy were selected and interviewed. Informants range from university programme managers, to technical fashion schools to federations and experts active in providing trainings associated with circular economy.

Table 1 and 2 provide an overview of the organizations interviewed.

Table 1: Overview of Companies interviewed

#	Country	Company name
1	Belgium	Isatio
2	Belgium	Bonjour Maurice
3	Belgium	Resortecs
4	Finland	Lovia
5	Belgium	Coucou
6	Romania	SC Cottontex SRL- Timisoara
7	Romania	SC Caremil SRL-Roman
8	Romania	SC Sofiaman Impex SRL- Tg Neamt
9	Romania	SC Pandora Prod SRL- Focsani
10	Romania	SC Inedit SRL- Satu Mare
11	Romania	SC ADINA SRL- Galati
12	Romania	SC Siorom SRL- Iasi
13	Romania	SC Ariesul Conf SA- Baia de Aries
14	Romania	SC Katty Fashion SRL- Iasi
15	Romania	SC SimizFashion SRL- Focsani
16	Macedonia	Danitex
17	Macedonia	Moda
18	Macedonia	Pirin-tex
19	Macedonia	Revestia
20	Macedonia	Atelier Irina Tosheva
21	Latvia	ZĪLE
22	Latvia	Anna Elizabete fashion
23	Latvia	Aspect
24	Latvia	Petra
25	Spain	Sancal
26	Spain	Strambótica
27	Spain	Antecuir
28	Spain	Textiles Athenea
29	Portugal	Cindicalfe
30	Portugal	Klaveness
31	Portugal	Nimco

Table 2: Overview of HEI and VET providers

#	Country	Institution
1	Belgium	MAD Brussels
2	Belgium	Flanders DC for fashion
3	Romania	"Gh Lazar" Technical College, Plopeni, County Prahova
4	Romania	"M. Bacescu" Technical College, Falticeni, County Suceava
5	Romania	"Gh. Asachi" Technical College, Focsani, County Vrancea
6	Romania	"Gh. Cartianu" Technical College, Piatra Neamt, County Neamt
7	Romania	"Danubiana " Technical College, P. Neamt, Count Neamt
8	Romania	"Dimitrie Leonida" High School of Technology, P. Neamt, County Neamt
9	Romania	School of Technology, Adjudeni, County Neamt
10	Romania	School of Technology, Nisiporesti, County Neamt
11	Romania	School of Technology, Petricani, County Neamt
12	Macedonia	Fashion Designer Irina Tosheva
13	Macedonia	High school Dimitar Mirasciev, Shtip
14	Macedonia	High school Gjorche Petrov, Prilep
15	Macedonia	High school Vanco Prke, Vinica
16	Macedonia	High school Bogdanci, Bogdanci
17	Macedonia	Institute of Textiles, Faculty of Technology and Metallurgy - Skopje, University of Cyril and Methodius
18	Macedonia	High school Aco Ruskovski, Berovo
19	Spain	Universidad de Murcia
20	Spain	Centro Tecnológico del Mueble y la Madera de la Región de Murcia
21	Spain	Asociación Regional de Empresarios de la Madera
22	Spain	Fundació Centre de Difusió Tecnológica Fusta I Moble de Catalunya
23	Spain	Universidad Politécnica de Cartagena
24	Spain	Centro Europeo de Empresas e Innovación de Murcia
25	Spain	Universidad de Zaragoza
26	Latvia	Rezekne Academy of Technology
27	Latvia	Valmiera Secondary School of Design and Art
28	Latvia	Vocational Education Competence Center "Liepāja Technical School"
29	Latvia	Rezekne High School of Art and Design
30	Latvia	Riga Technical University, Institute of Design Technologies
31	Portugal	CFPIC -Centro de Formação Profissional da Industria do Calçado
32	Portugal	CITEVE - Centro Tecnológico das Indústrias Texteis e Vestuário
33	Portugal	GFS - Escola de Moda Gudi
34	Portugal	LSD - Lisbon Fashoon School
35	Portugal	APICCAPS - Portuguese Association of Footwear, Components and Leather Goods Industries
36	Portugal	Instituto Politécnico do Porto
37	Portugal	Escola Profissional de Felgueiras

4.1.3 Data analysis and validation

First, individual surveys were integrated to develop an initial image of the importance of skills and competences associated with circular economy from a practitioner's perspective (company representatives) as well as an educator perspective. Second, the transcripts from the interviews were analyzed in light of the identified skills and competences sets in order to construct a more comprehensive perception of how these skills relate to the implementation of circular economy practices at company level. The results are analyzed in light of existing literature around circular economy in the textile industry.

Finally, in order to validate the accuracy of the findings, a set of workshops were organized between May and June 2019 with major stakeholders from the sector in Latvia, Romania, Macedonia and Spain. The feedbacks allowed the research team to fine-tune the recommendations related to the development of the future training curriculum Design4circle.



4.2 RESULTS

First, we present insights from the company representative interviews. We highlight key skills and competences associated with circular business model innovation and address the importance and performance of these skillsets.

Second, we synthesize learnings from higher education institutes and expert trainers active in circular economy.

4.2.1 Insights from companies active in circular textile business models

In order to provide a clear overview of the necessary skillsets needed for a successful transformation to a circular business model, we first classify these competences according to the various circular economy strategies available alongside the circular value chain of companies. Secondly, we take a look at transversal competences that support both the frontstage and backstage of business model innovation in a circular economy context.

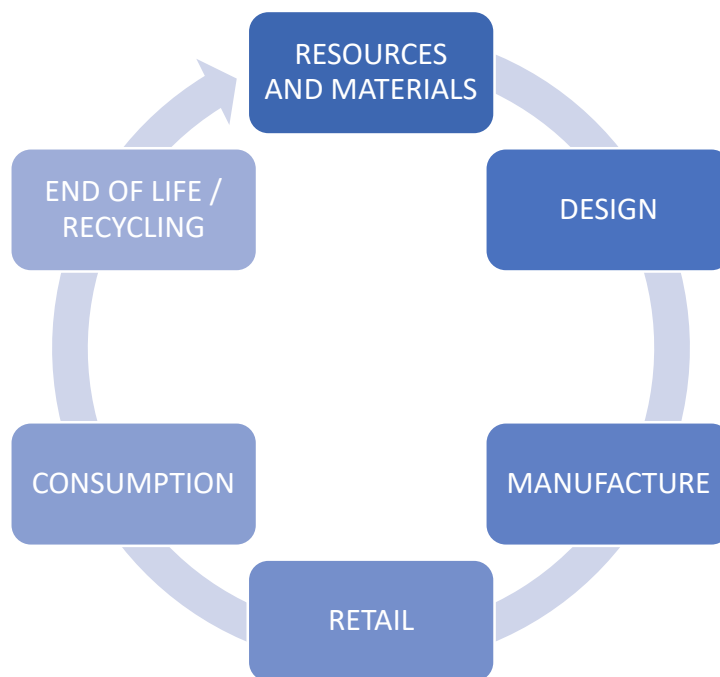


Figure 1: Circular value chain

Resources and materials skills

Resources are the main inputs that a company uses to develop its value proposition. They are usually based on a combination of tangible and intangible resources. These assets support the creation of the end product and deal with the operational end of the business spectrum. They highlight the type of materials needed, the equipment required and the type of knowledge held by the staff employed. In the business models analyzed focusing on companies applying circular economy principles in the textile sector, the following skills associated with resource management were identified: 1) sourcing the right eco-material 2) acquiring new knowledge to process reclaimed material.

Knowledge and skills in finding the right suppliers of ecological materials

As they are driven by a strong ecological purpose, the circular companies interviewed strive to use more ecological products in their design and manufacturing processes. Knowledge and skills in sourcing the right material are essential.

Aspect, CEO, a sportswear company from Latvia highlights the importance of finding the right suppliers: "Having great relationship with supplier of sustainable fabric OceanBalance and combining it with craftsmanship of our seamstresses allows us to create the industry leading

garments, which look great and promote the ideas of sustainability. Our partner OceanBalance continuously expanding their fabrics range, helping us to offer sustainable solutions for wider range of garments and approach new industries."

Skills in acquiring new knowledge to process reclaimed material

SIA ZILE ZILE highlights the need for new knowledge to know how to process used materials: "In order to develop and expand the range of products, it is also necessary to use other materials created from clothing (yarn for example), it requires new, creative people, whose thinking is directed to the reuse of products". Using used materials as raw materials also has an impact on traditional supply management.

Bonjour Maurice from Belgium explains: "When you want to produce a certain amount of pieces of a cloth, you know how many meters of textile you will need and you order this amount. When recovering scraps of fabric, you don't know exactly how many metres you will have from one or another tissue, so it leaves fuzzier areas for which you have to adapt. You never know exactly what to expect: will I have the equipment to make 50 aprons, or 100? That's the big difference with what we used to do before."

Figure 2 below describes the level of importance of skills associated with materials and resources management. Answers show that 82,75% of respondents consider those skills fairly to extremely important. **Asking about the perception of companies between the importance of the skills and the current performance associated with the skills, we notice a 15,4% gap with skills related to resource and material management as shown on figure 3.**

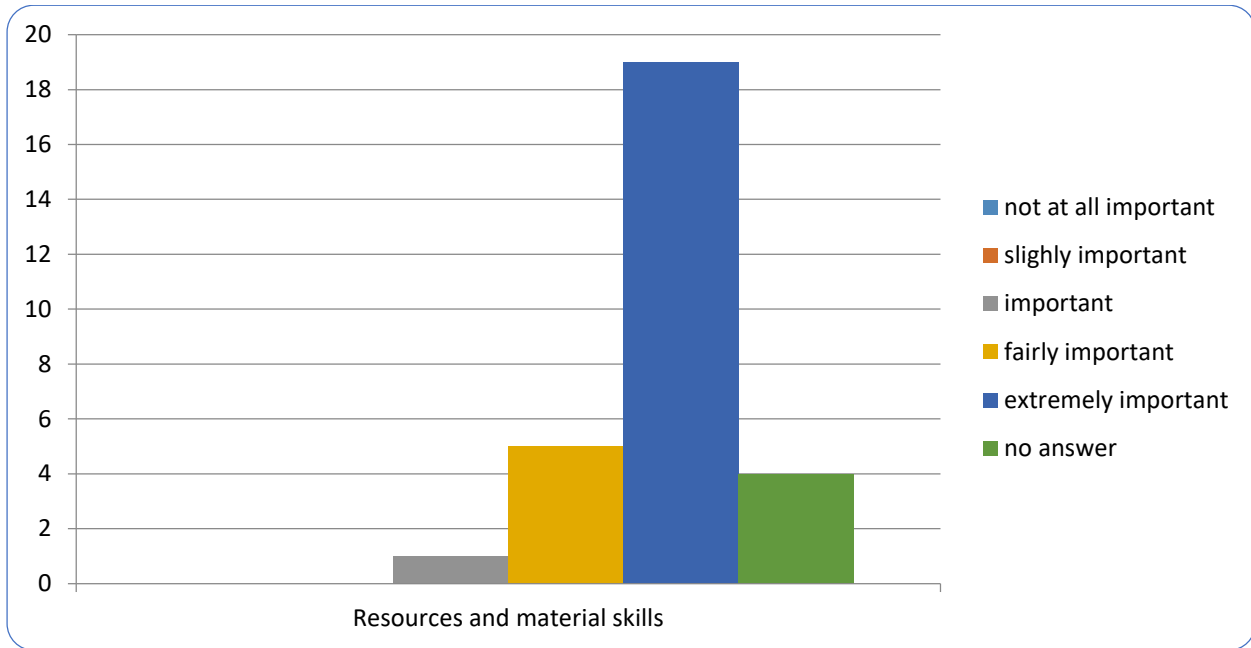


Figure 2: Importance of resource and material skills

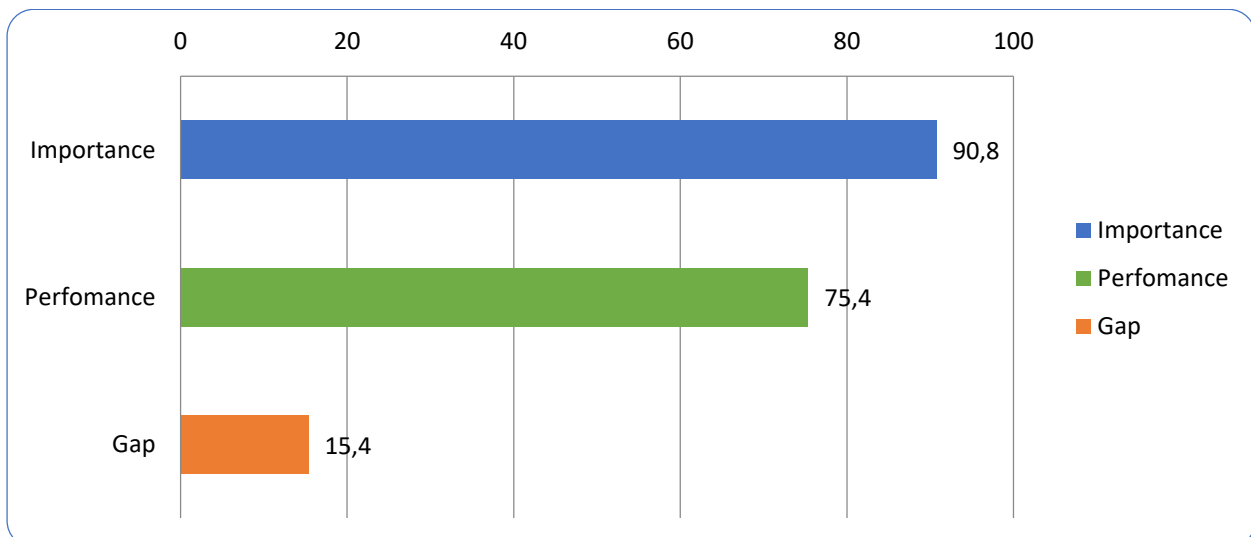


Figure 3: Importance-performance gap associated to resources skills

Eco design skills

Eco-design strategies are multiple and encompass various interventions throughout the life cycles of a product/service. Strategies such as design for environment, design for modularity, design for recycling (design for material recovery), design for reuse, design for reliability, design for maintainability, and design for end-of-life allow companies to increase the sustainability and circularity of their products to limit their impact on the environment in the various life-cycle phases. Circular textile and fashion companies highlight the importance of these *Designs for X* strategies.

Adopting, mastering and implementing eco-design skills

Design for X approaches are multiple and their relevance will depend on the company's overall strategy. Design for instance can help increase longevity in two fundamental ways - by focusing on quality so garments last for longer, and by enabling consumers to wear items more frequently and so get more use out of them before discard. Garments can be designed to be worn in more than one way -or have detachable parts so that the design can be simplified or worn on less formal occasions.

Bonjour Maurice, for instance applied eco-design skills as a strategy to create longevity and additional functionality: *"We wanted to put more than only a garment in our collections, to be able to "compete" with fast fashion in another field that price. That's why there are 2 clothes in 1, they are mixed (for boys and girls), they are worn longer, they are evolutive (they can be turned upside down)"*.

Figure 4 below describes the level of importance of skills associated with eco-design. Answers show that 79,3% of respondents consider those skills fairly to extremely important. **Asking about the perception of companies between the importance of the skills and the current performance associated with the skills, we notice a 25,2% gap with skills related eco-design strategies, as shown on figure 5.**

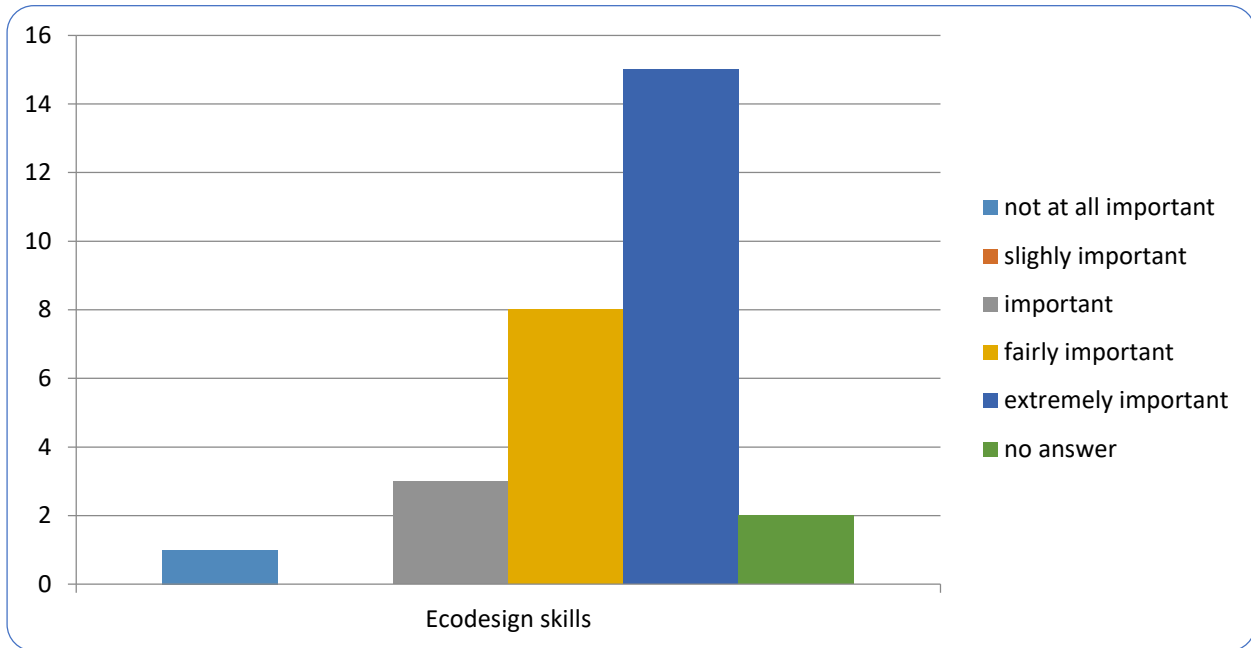


Figure 4: Importance of Ecodesign skills

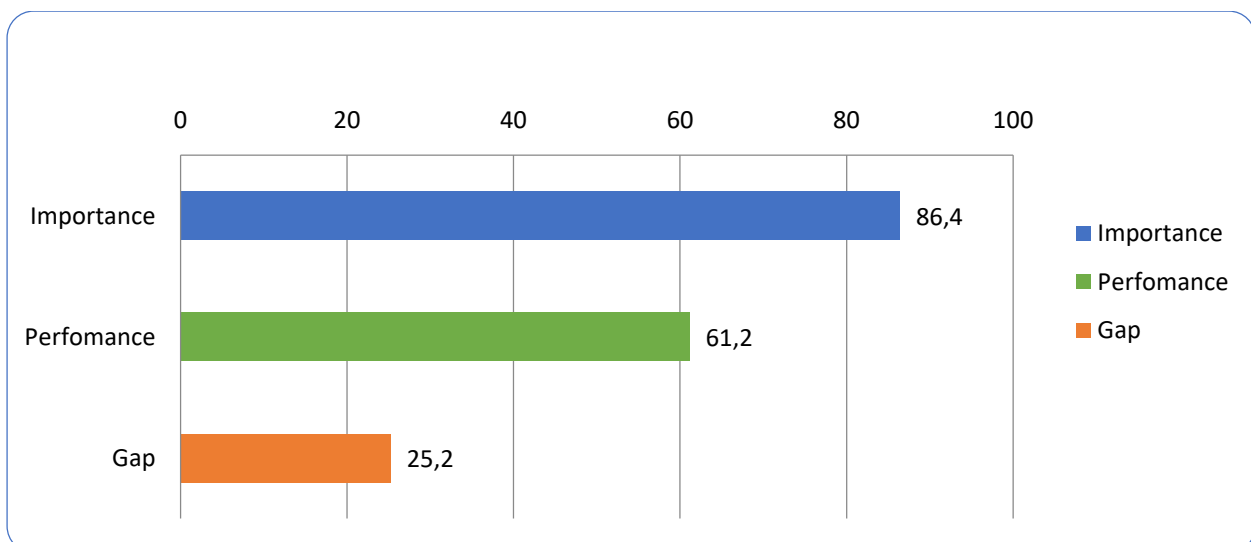


Figure 5: Importance-performance gap for eco-design skills

Manufacturing and recycling skills

Working with material which has previously been has consequences on the way to handle and reprocess the resource: new skills need to be acquired throughout the production cycle (from design to manufacture) as the type of textile that is supplied generally comes in various batches and has different origins, different properties, and different conditions. This needs to be analyzed, case by case. However, to make the transition successful, company's staff needs to be aware of its limitations and search for new knowledge. This is often done through trials and errors in a process that is more timely than working with stable supplies. New IT skills can also be necessary to engage in digital solutions.

Some circular companies active in the sector focus on developing specific technological solutions for other manufacturers of the sector, as explained by **Resortecs**: *"We develop technologies that allow large fashion firms to begin the transition to circularity in a way that is technically and economically reliable. We have developed a technology that consists in creating a sewing thread that, visually, is the same as the others, and that can be sewn with any existing machine, which does not imply any change in the way designing and producing is made. The difference is that the yarn can be dissolved with heat, using a 180 C temperature. This gives the possibility to massively dismantle the products by putting them in ovens, but also to do it more locally with a heat gun by heating a part and thus removing what is of interests. This gives a modularity that eliminates hard points in the recycling*

or/and repair process. In fact, this makes it possible to solve small aspects of the circular economy in the textile sector."

Skills in zero waste manufacturing

Katty Fashion: *"Our challenge is to make our product development and manufacturing services more sustainable not only by proposing to our customers, as much as possible, sustainable materials and trimmings for their collections, but also by approaching the zero waste systemic thinking in our product development and manufacturing processes, so as to offer them effective solutions to avoid the accumulation of waste from their orders design and production. Our proposal refers to a new approach in garment development and manufacturing by combining advanced pattern-making tools and 3D virtual prototyping with a systemic and sustainable thinking, aiming at developing an eco-innovative and collaborative product development service addressed to fashion designers and producers facing major challenge of making their processes more ethical and sustainable."*

Reverse thinking skills

Typical to circular business models is the necessity to think about reverse supply chain, in other words implementing strategies to get products back to the manufacturer and develop multi-user solutions. As Resortecs points out, *"often the product is made for end-user, and often the person who has to recycle or repair is not considered enough. It is important, but we must take into account the "multiple"-users, or stakeholders who are involved in the chain of use and reconditioning"*.

As shown on figure 6 below, reverse thinking skills are considered fairly to extremely important by 48 % of respondents. **Asking about the perception of companies between the importance of the skills and the current performance associated with the skills, we notice a 19,2% gap with skills related eco-design strategies, as shown on figure 7.**

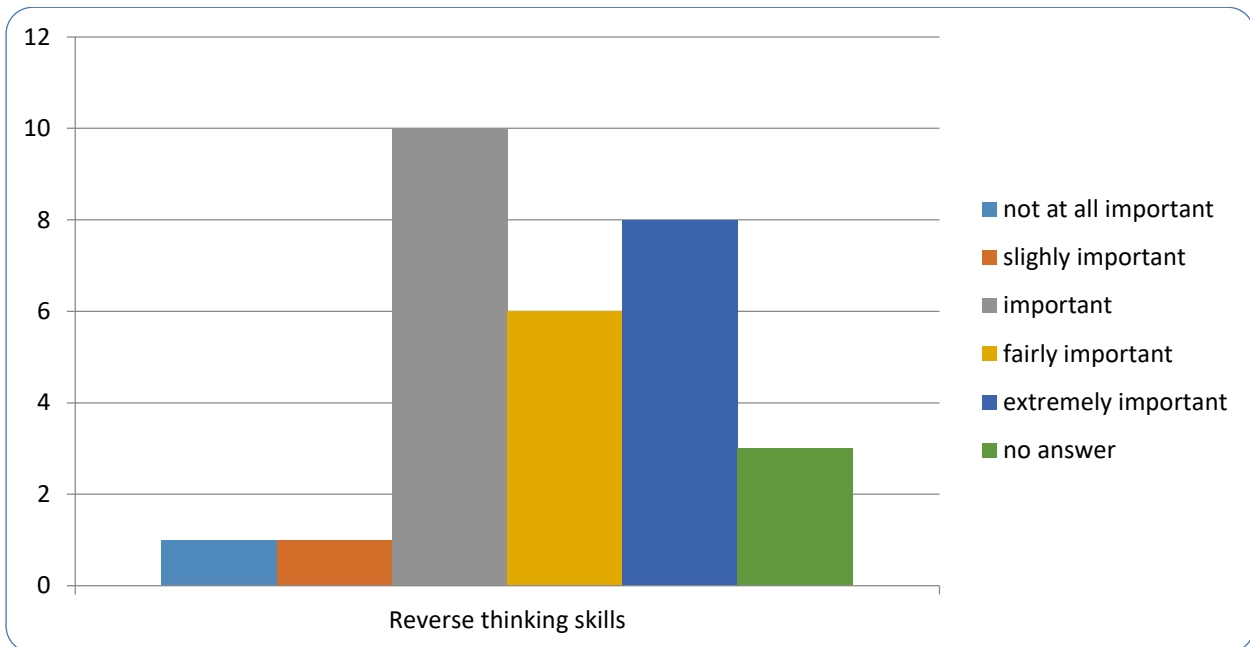


Figure 6: Importance of reverse thinking skills

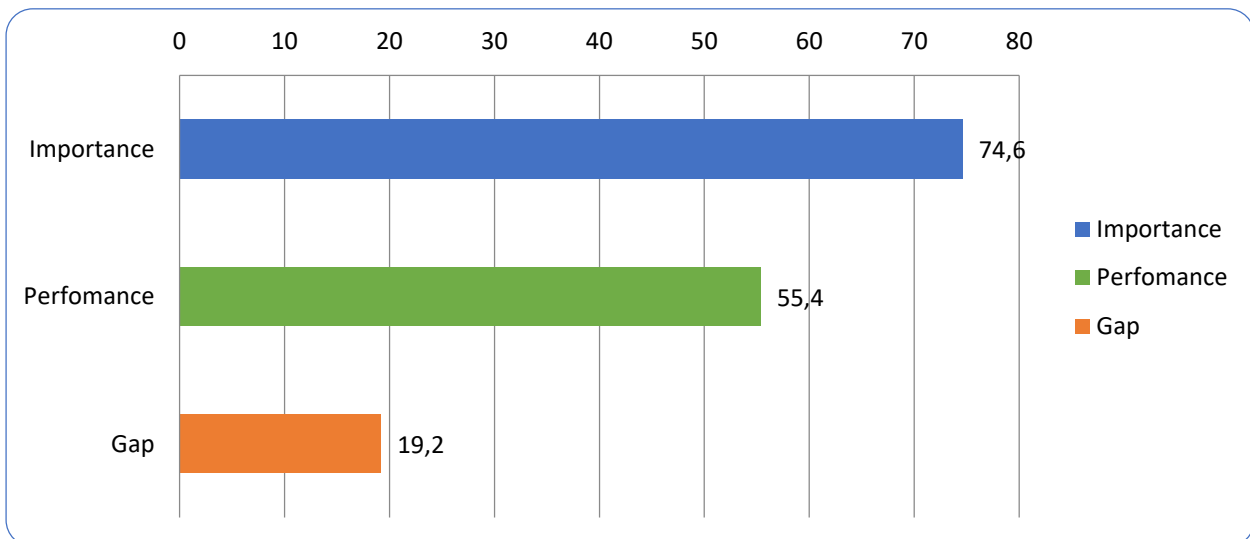


Figure 7: Importance- performance gap on reverse thinking skills



*Applying new technologies to support
ecofriendly and circular manufacturing*

In parallel with zero waste manufacturing processes, developing new skills in new IT technologies can support the implementation of circular economy strategies.

This is illustrated by Spanish company **Athenea**: "We are at the forefront in the field of digital printing technology and have now accumulated experience that has given Athenea a competitive advantage: we digitally print more than 150,000 meters per week. We recently participated in the European project *LIFE TEXTILEATHER*, based on the application of Multiple Laser Technology (MLSE) as surface treatment of textiles and leathers, in order to give them functional properties. The proposed MLSE technology is a continuous dry process, which can significantly reduce the environmental impact of conventional leather and textile finishing operations, especially in the case of water repellent, flame retardant and antibacterial treatments. The reduction of environmental impact, in terms of greenhouse gas emissions, consumption of chemicals and water, as well as energy consumption, affects not only the finishing process itself, but also additional waste management processes".

Figure 8 below describes the level of importance of skills associated with It technologies. Answers show that 41,3% of respondents consider those skills fairly to extremely important. **Asking about the perception of companies between the importance of IT skills and the current performance associated with the skills, we notice a 16,9% gap with skills related to new IT technologies, as shown on figure 9.**

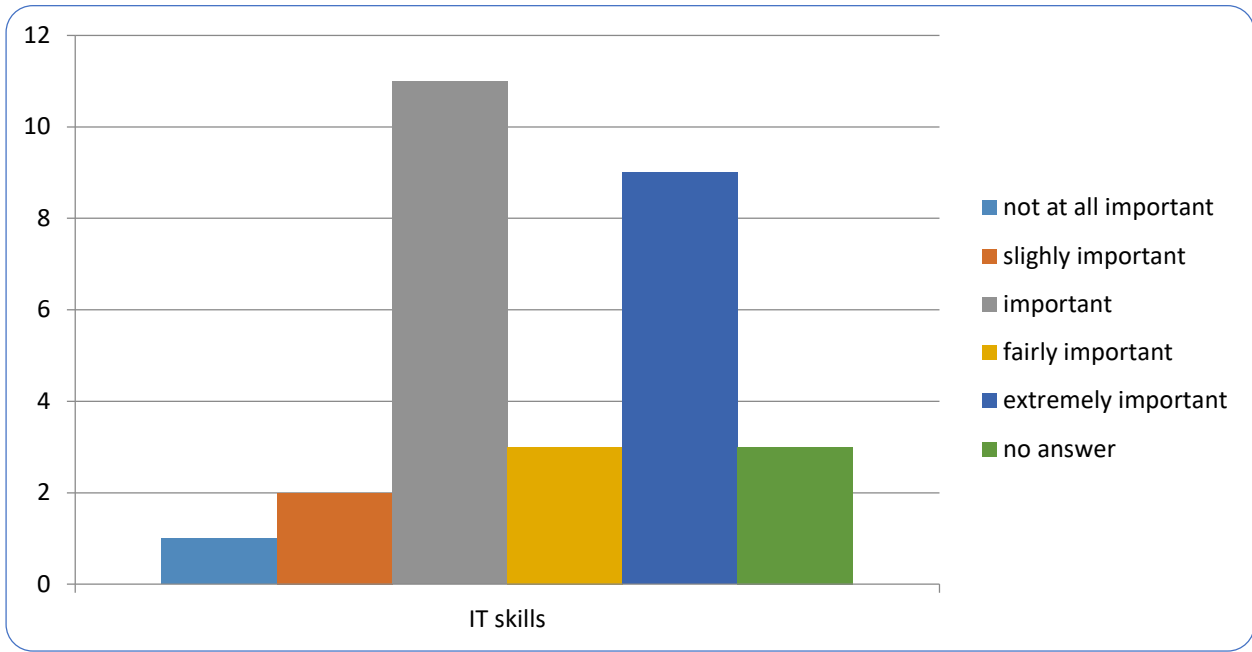


Figure 8: Importance of IT skills

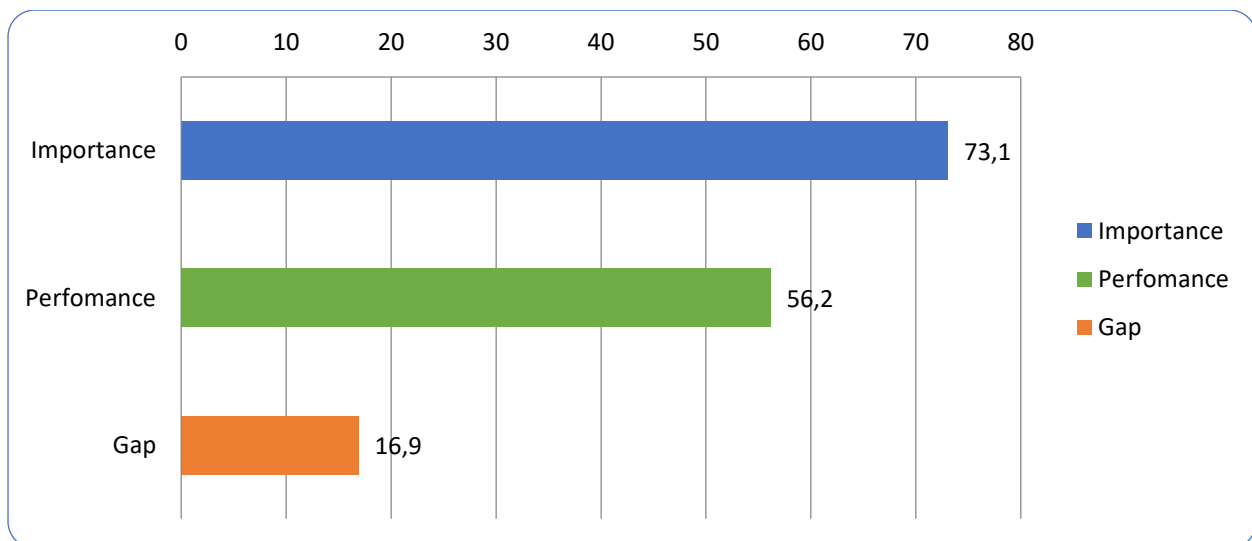


Figure 9: Importance-performance gap associated with It skills

Retail and consumption skills

When operating in the b2c segment, **it** is essential to offer a unique combination of products and services which provide unique value to the customer. In the textile sector, if the conventional value proposition in the sector is to offer new, up to date functional and unique designs, circular businesses highlight the emotional dimension of the product, translated in a strong responsible and sustainable ethos, combined to the functional and aesthetic dimensions generally promoted in the sector. In that respect, circular textile and fashion companies need to develop skills and competences associated to the *sustainable value* associated with their offerings, while responding to their customer needs.

One way to create additional value is to offer improved services to extend the lifetime of products or to shift business models to offer clothing-as-a-service solutions, which provide access to a certain fashion item without necessarily shifting ownership from the retailer to the end customer

New Skills on servicizing

Offering clothing-as-a-service requires to take a wider perspective on the customer needs and the associated solution. In Belgium, **Coucoushop** has developed a rental service for fashion items that goes beyond the mere rental: *"We make sure to make the life of the products as long as possible through a good maintenance. We also wash clothes through an eco-pressing and we resell what will no longer be in the store"*.

Skills on choosing the right customer segment

Customer segments are the community of customers or businesses that a company is aiming to sell its product or services to. In order to remain viable, the product or service offerings must appeal to its target customer segment. In the circular fashion sector, customer segments are generally perceived as a niche market. Niche market refers to a customer segment with extremely defined characteristics and very particular needs. This in turn has a strong effect on the value propositions, distribution channels and customer relationships, all closely defined according to the preferences of this particular customer segment. Companies applying circular economy principles in their business model and in their value proposition therefore directly target consumer driven by high green and sustainable values. In the B2C market, targeted segments are sensitive to the environmental and or social dimensions of the products or services offered. In that respect, companies offering solutions fitting with circular economy principles do need to understand green consumption motives and behaviors and adapt their value proposition accordingly. Green



certifications on one hand, or a compelling storytelling supports the customer in choosing a product close to its values. A large number of companies active in the circular fashion sphere are willing to tap into this new customer segment, as **Isatio** explains: *Our customers are people of a certain economic level, generally over 30 years old, even if we are also starting to have younger people who are aware of how our products are made and are therefore ready to pay the price. This change also corresponds to a change that society is gradually experiencing, where individuals also think about adding their grain of sand and one of the ways to do this is through their way of consuming"*

Figure 10 below describes the level of importance of skills associated with servicizing skills. Answers show that 68,9% of respondents consider those skills fairly to extremely important. **Asking about the perception of companies between the importance of servicizing skills and the current performance associated with the skills, we notice a 22,4% gap with skills related to servicizing, as shown on figure 11.**

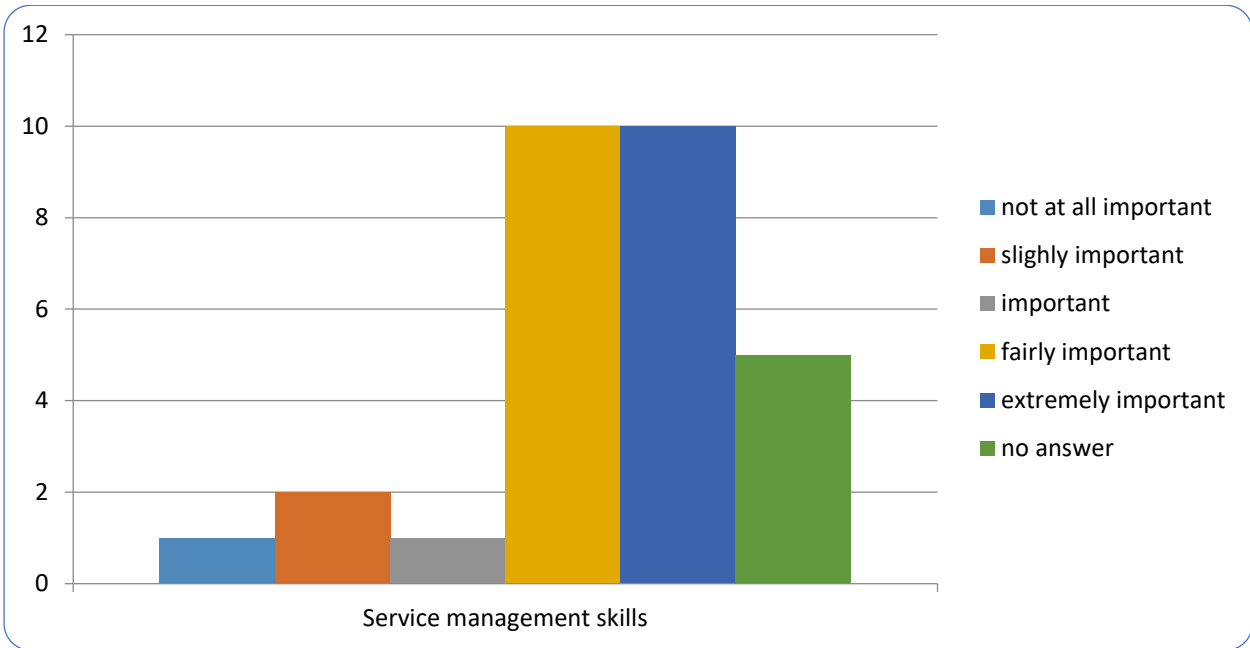


Figure 10: Importance of Service management skills

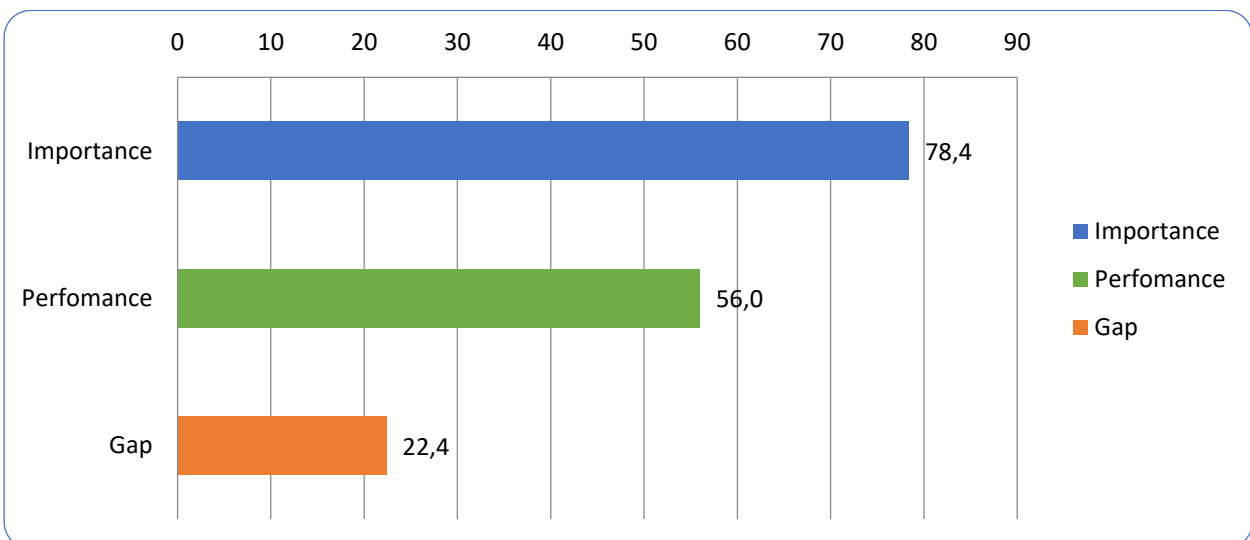


Figure 11: Service management skills

Transversal skills and competences

Beyond the different dimensions of the circular value chain and the associated skills analyzed in the previous section, it is possible to identify recurring skillsets that have helped shape the circular business model success of the companies interviewed.

These transversal skills and competences influence and bridge several dimensions of the business models of these companies. Four transversal competences are presented below: *sustainability competences (1)*, *entrepreneurial competences (2)*, *systems thinking competences (3)* and *user-centered competences (4)*.

**Sustainability competences:
Translating personal sustainable
values into a new value
proposition..**

All informants are driven by strong personal values in relation to environmental challenges. **Coucoushop** for instance details their relationship with sustainability: *"For us, the main driver to start the business was sustainability. I wasn't an entrepreneur at heart, so if the project didn't have that meaning, I wouldn't go ahead. We would never have given so much energy to this project if it had not the sustainable aspect. The idea was to work on another way of consuming fashion and to offer an accessible alternative to consumers. Now that we are growing, we must always keep our values in mind. Sometimes it is really tempting to abandon certain sustainable aspects, for example ecological cleaning, which represents a significant part of the costs.*

These values also extend beyond the awareness of the environmental challenges and take into account social and territorial dimensions.

Isatio in Belgium explains: *"For producing, we use social inclusion's ateliers, adapted work companies and independents. Everything happens within a 20 km radius of our workplace. Our ecological footprint is very low, all the relationships between our workshop here (in the house on the first floor) and our various producers are done by bike.*

Translating a social purpose into a business model is what drives the companies who have added a social component (professional reinsertion of people with working disabilities) in their business model. These values are anchored in the company's DNA from the start due to the personal conviction of their founders. Companies with a longer business lifetime engaged in a transformation to realign their initial purpose with their current values.

Translating personal values into a renewed business model comes from the capability to be future-oriented and embrace a long term orientation. **Bonjour Maurice:** *"We started Bonjour Maurice because we wanted to create a project that had values, that we would be proud of and that we could talk to our children about. The more we move forward in the business, the more we will try to improve, from an environmental point of view. This is not always easy since it is more difficult for the moment to find recycled textiles than non-recycled ones. It is not easy, it is more expensive, and customers are not necessarily ready to pay more. But yes, values of sustainability are at the heart of our motivation from the very beginning."*

Managing sustainability through environmental management practices seems very common between larger companies active in circular textile practices.

Figure 12 below describes the level of importance of skills associated with sustainability and environmental management practices. Answers show that 82,7% of respondents consider those skills fairly to extremely important. **Asking about the perception of companies between the importance of Environment management skills and the current performance associated with the skills, we notice a 19,8% gap with skills related to environmental management, as shown on figure 13.**

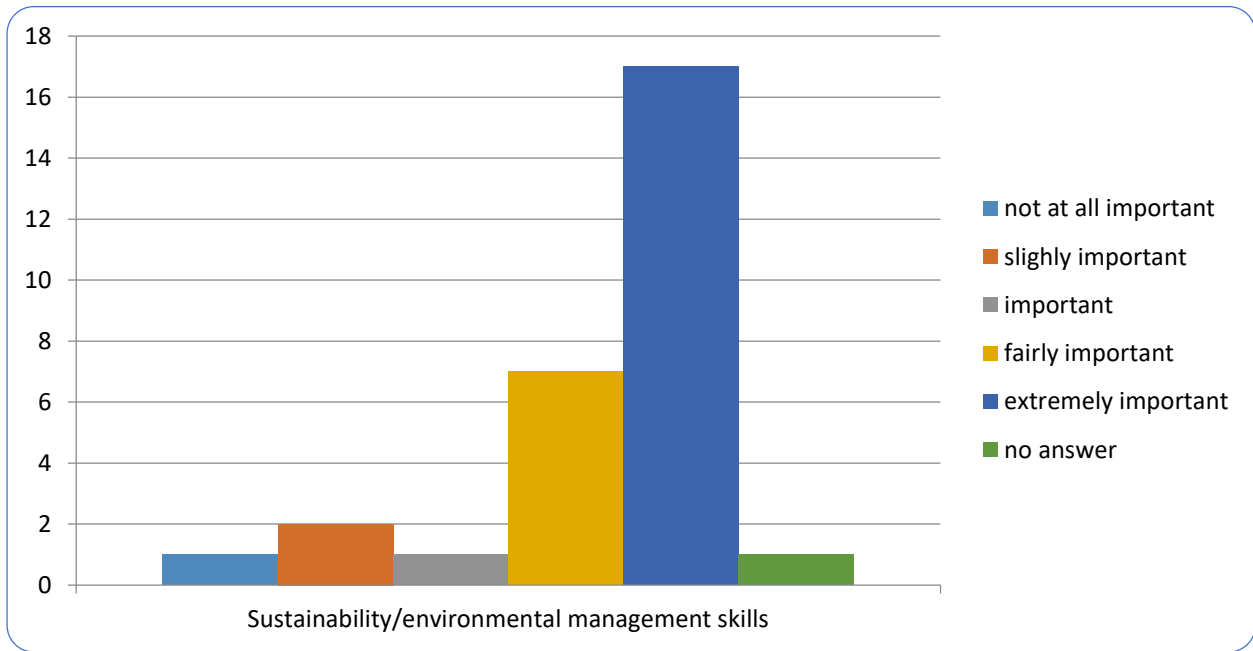


Figure 12: Importance of sustainability skills

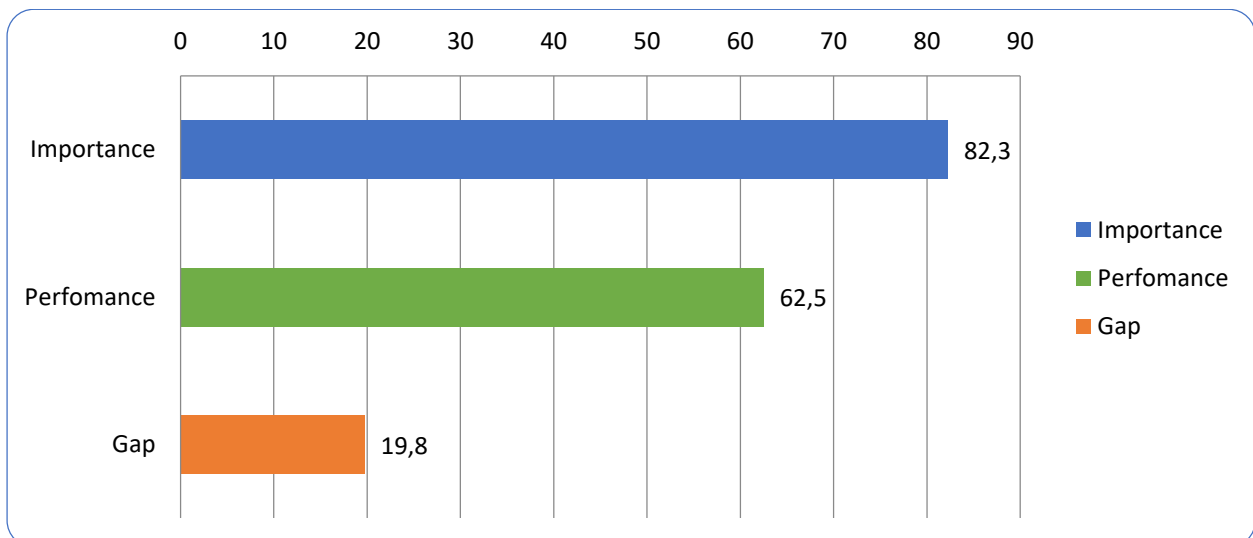


Figure 13: Importance-performance gap related to Sustainability and environmental management skills

Entrepreneurial competences

Engaging in the circular economy does not come without bump. As the approach defies current businesses practices in the sector, it is therefore necessary to adopt an *Entrepreneurial mindset* to overcome all the unexpected challenges coming along, from the building of new supply chains, the adoption of different manufacturing processes and the utter complexity to convince consumers to purchase a product that might be perceived as “not new”.

Before even grasping the challenges ahead, the idea leading to a renewed business model comes from a strong sensing of opportunities. Seizing the opportunity

behind a circular business model however requires to understand the necessity of a *trial and error* approach, a feature shared by the majority of informants. This mindset is present in the young companies entering the market as completely circular, but also among the companies who went to a gradual transformation. As part of the entrepreneurial mindset often comes a *bricolage* skillset. In this make-do approach, often constrained to low investment and limited resources, time and personal conviction are the driving force to try out new ways to work with the wood.

Figure 14 below describes the level of importance of skills associated with entrepreneurship. Answers show that 86,2% of respondents consider those skills fairly to extremely important. **Asking about the perception of companies between the importance of entrepreneurship skills and the current performance associated with the skills, we notice a 16,1% gap with skills related to entrepreneurship, as shown on figure 15.**

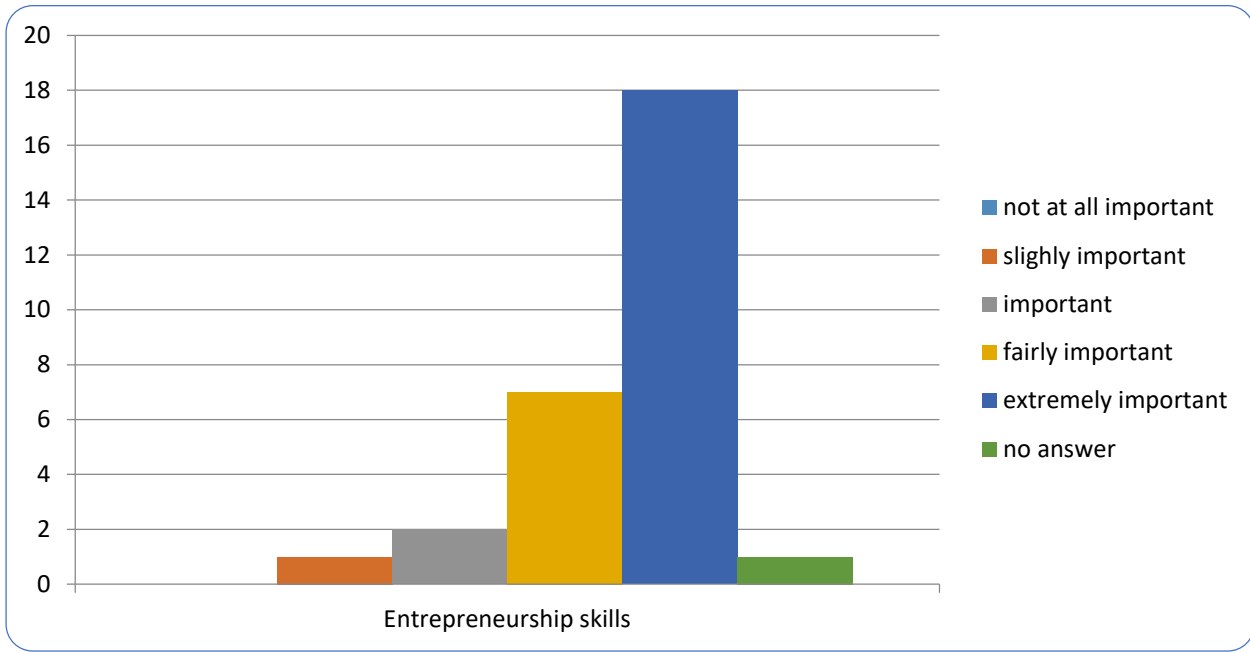


Figure 14: Importance of entrepreneurship skills

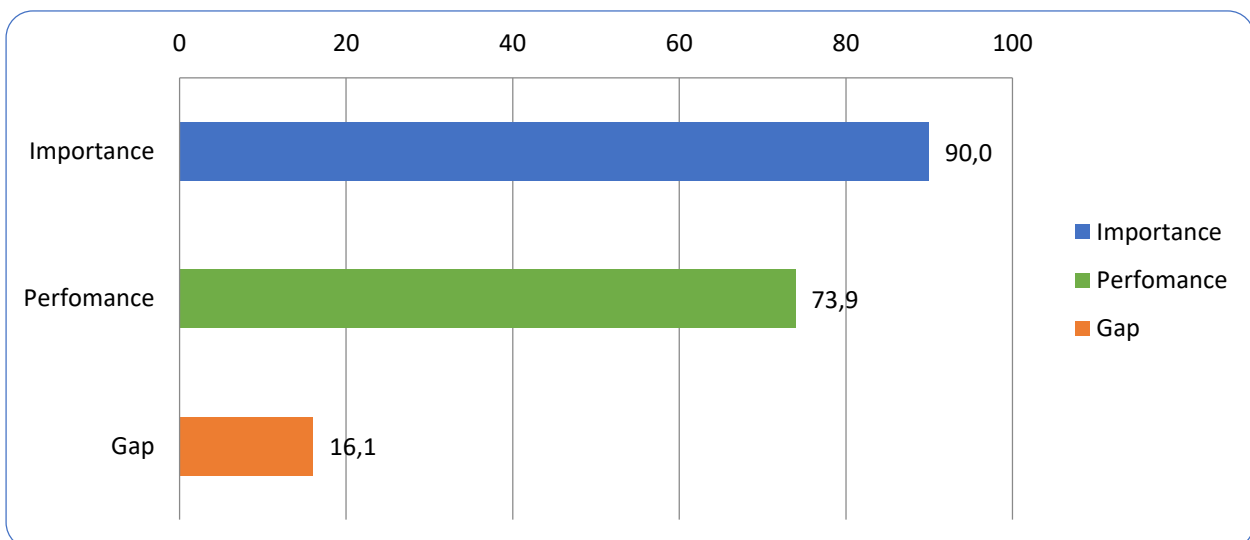


Figure 15: Importance-performance gap related to entrepreneurship skills

User-centered competences

User-centered design tries to optimize the product around how users can, want, or need to use the product, rather than forcing the users to change their behavior to accommodate the product. This skillset is translated in practice by engaging the customer in a *co-creation process*, offering an *integrated customer value creation process* and *meeting customer needs*. In many customer-supplier relationships today, customers engage in dialog with suppliers during each and every stage of product design and product delivery. In this interactive process of learning together, firms and their customers have the opportunity to create value through customized, co-produced offerings. This co-creation process can assist firms in highlighting the customer's point of view and in improving the front-end process of identifying customers' needs and wants. This pattern is preponderant in the circular business models from the textile industry.

Coucoushop: *"At first we followed our feeling, but now we have much more knowledge about what the customer needs are. The girls don't necessarily come because we do Circular Economy, but rather because they want to look pretty for their event, and/or because someone told them that we had beautiful dresses and the concept of renting is always more affordable for customers. Once they rent,*

however, they are more aware of the meaning and purpose of Circular Economy."

Customer relationships define the nature of the relationships that an organization develops with its customer segments. The customer relationships that a company opts for are based on their overall business model and directly impacts the customer experience. Companies active in circular fashion tend to create and maintain a strong personal relationship with their active clients. This has direct impact on customer acquisition, customer retention and sales increase. These personal relationships development requires specific dedicated skills which focus on engaging the customer through *trust and transparency* and *personal approaches*.

Building trust and confidence requires a high level of *transparency*. Finnish company **Lovia** for instance has organized its communication around strong transparency principles, inviting customers to discover the origin of materials and the people who designed the fashion accessories sold by the company.

Taking a Personal approach is also highlighted. According to **Aspect**, "Our customers appreciate personal approach and custom solutions to achieve their goals, fit their business model and offer the value to their target customer groups. Our quality and competitiveness allow us to enjoy long term business relationships".

Figure 16 below describes the level of importance of skills associated with user-centered approaches. Answers show that 82,7% of respondents consider those skills fairly to extremely important. **Asking about the perception of companies between the importance of user-centered skills and the current performance associated with the skills, we notice a 14,1% gap with skills related to user-centered approaches, as shown on figure 17.**

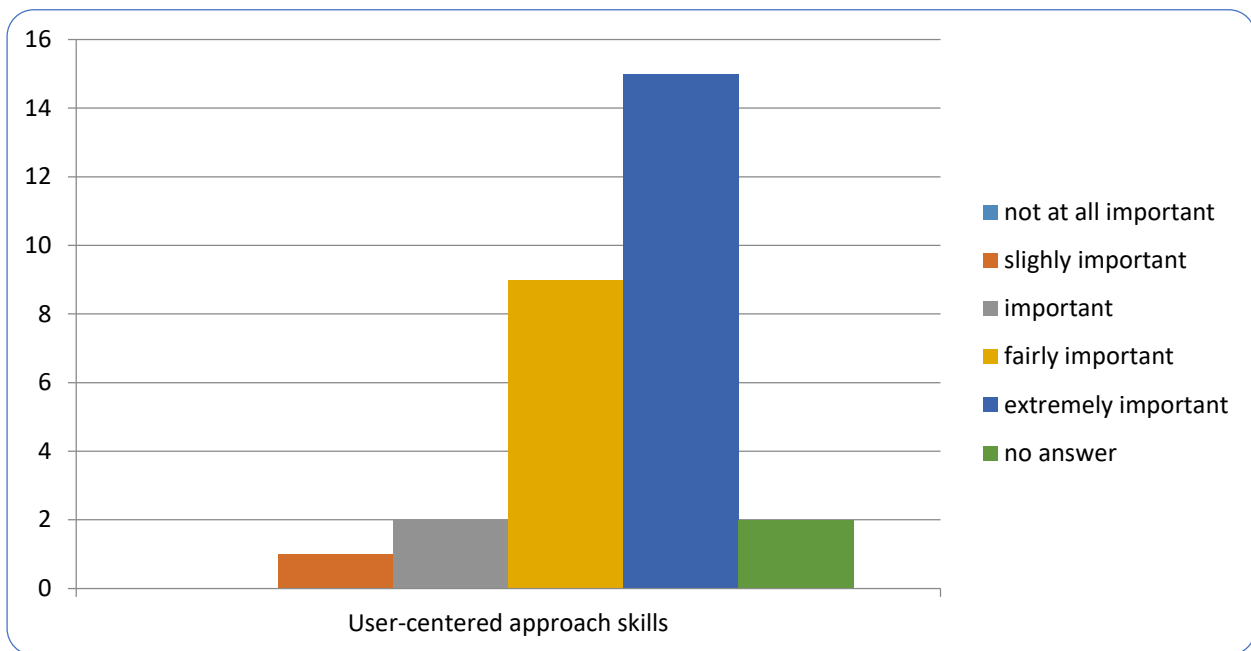


Figure 13: Importance of user-centered approach skills

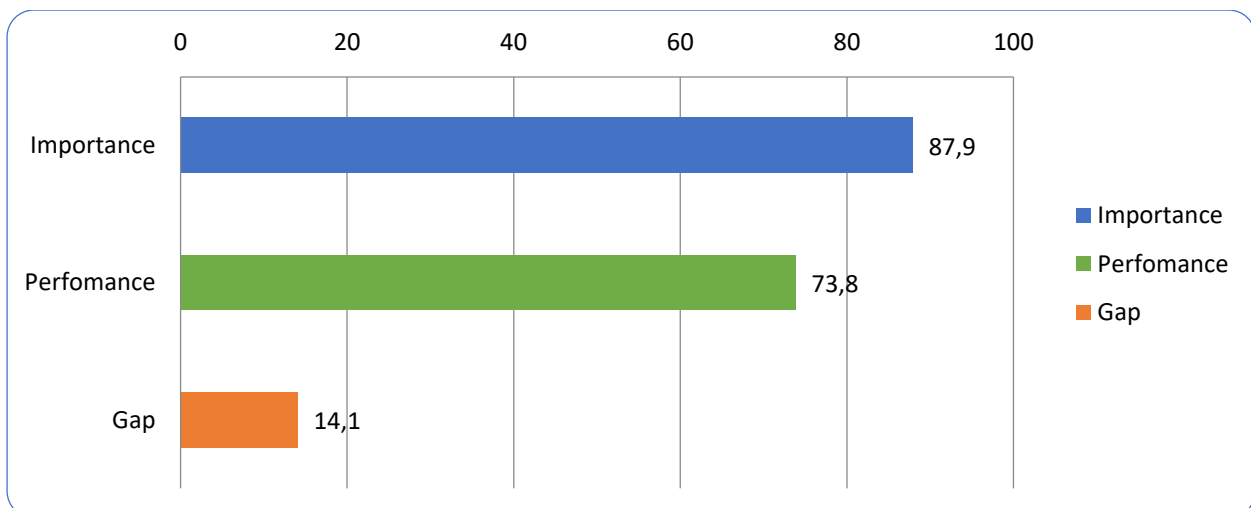


Figure 17: Importance-performance gap associated with user-centered approach skills



Beyond the importance of putting the future users at the center of the design process, new skills in marketing management are also necessary to develop. Marketing circular textile and fashion products that are made from used or recycled materials may sometimes be more challenging than selling brand new textiles. Focusing on developing new narratives around the origin and previous lives of materials that are part of the sold product require an in-depth understanding of customer value creation processes, which are at the core of marketing strategies.

Figure 18 below describes the level of importance of skills associated with marketing approaches. Answers show that 79,3% of respondents consider those skills fairly to extremely important. **Asking about the perception of companies between the importance of user-centered skills and the current performance associated with the skills, we notice a 21,2% gap with skills related to user-centered approaches, as shown on figure 19.**

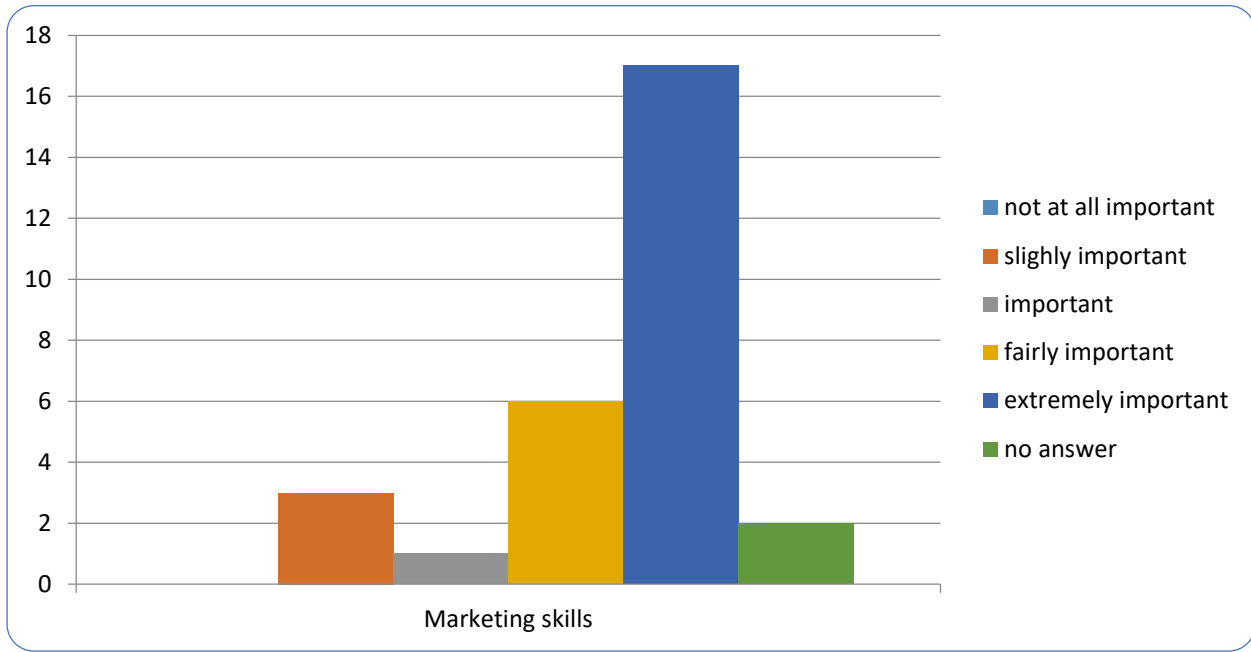


Figure 18: Importance of marketing skills

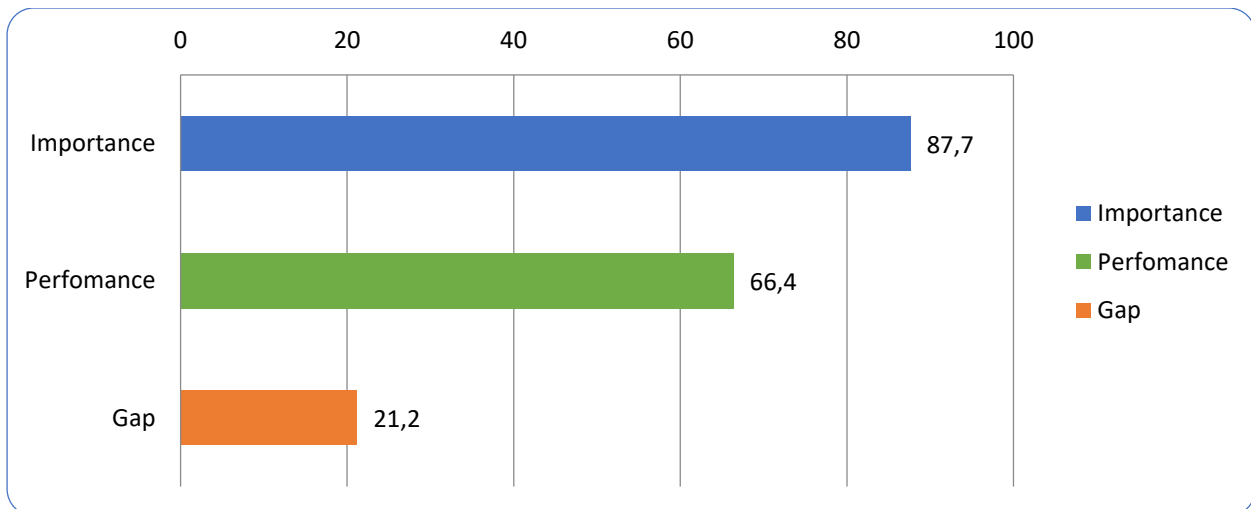


Figure 19: Importance-performance gap with marketing skills

Systems thinking and network competences

Sustainability challenges are complex and interconnected in their nature. However, they are often approached through single issues and technical dimensions rather than seeing it as a systemic challenge. In order to overcome the challenges associated with a circular transformation, taking a systems approach and looking at these challenges in a holistic way, having a broad understanding of sustainability whilst also using tools such as systems thinking and systems mapping can facilitate the transformation of companies toward a circular economy. In that respect taking a systems perspective can also strengthen the value proposition of the business model.

Creating a relevant value network of suppliers and partners is essential to make the business model effective. Opting for the right partnership is instrumental

in making a business success or a failure. Reasons for partnership and collaboration may involve create new resource streams, access new skills or competences, create new markets presence or pooling resources to offer an integrated solution.

If not all partnerships are key to the business, *the capacity to identify key actors and generate long-lasting collaboration* is an essential feature of a successful business model innovation. In order to close the loop or reinforce the sustainability of the final product/service offered to the customer, collaboration skills and the ability to use external expertise are of high importance. Collaboration skills also provide access to new projects and resources. Long term commitment and trust in partnership development is also perceived as key.

Figure 20 below describes the level of importance of skills associated with systems thinking approaches. Answers show that 72,4% of respondents consider those skills fairly to extremely important. Figure 21 below summarizes the importance-performance gap associated with systems thinking skills. **Asking about the perception of companies between the importance of systems thinking skills and the current performance associated with those skills, we notice a 23,6% gap with skills related to systems and network approaches, as shown on figure 21.**

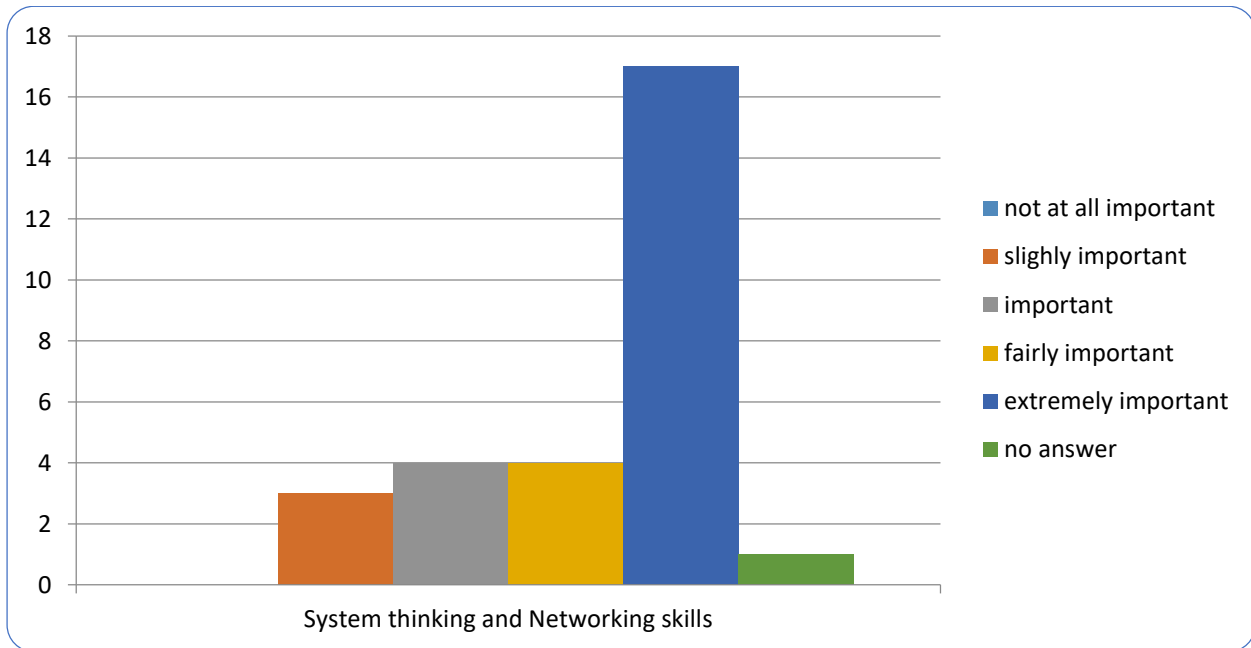


Figure 20: Importance of system thinking skills

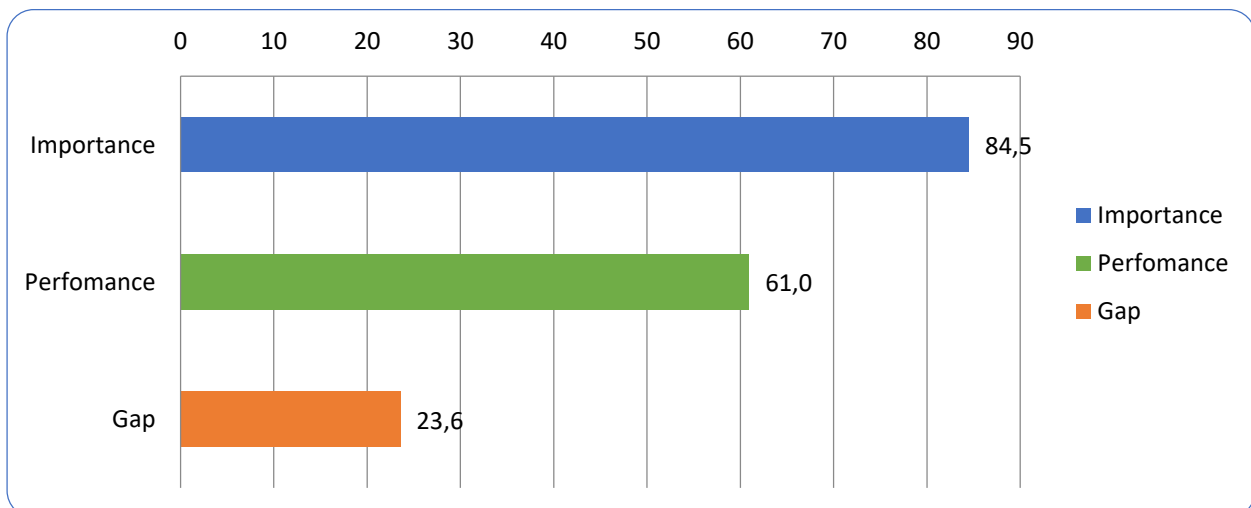


Figure 21: systems thinking and networking skills

3.2.1 Insights from higher education institutes and circular economy training experts

37 organizations active at national level in the development of courses and trainings addressing some of the challenges of circular economy in the textile and fashion sector were interviewed in Belgium, Macedonia, Romania, Spain, Portugal and Latvia.

The table 2 below summarizes the competences highlighted as key to include in circular economy related training.

Table 2: Key themes and competences for circular economy training in the textile industry

KEY THEMES	SKILLS AND COMPETENCES
General knowledge around CE	<ul style="list-style-type: none"> • Use the vocabulary and specific terminology of Circular Economy • Apply the principles of Circular Economy management • Apply the legal requisites for the implementation of Circular Economy
Materials/resource	<ul style="list-style-type: none"> • Take decisions on the applicability of certain materials based on their ecological impact • Select suppliers of materials and components with ecological characteristics • Educate students in the spirit of creative reuse of recyclable materials. • Analyze recoverable materials • Design, plan and develop materials that can be later reused. • Applying techniques for the recovery of recoverable materials • Manufacturing products from recoverable materials • The formation of recycling and manufacturing habits of reusable materials products.



	<ul style="list-style-type: none"> • forming models on extending the lifecycle of products and keeping materials within the economy as much as possible. • Analyzing recoverable materials for the purpose of their valorisation in a creative way; • conducting creative processes for textile confections made of recyclable materials • Applying techniques for the recovery of recoverable materials; • Reusing of raw materials that are currently disposed of as waste • Optimizing the use of resources by circulating products
<p>Ecodesign</p>	<ul style="list-style-type: none"> • Understand the life cycle and eco-design fundamentals • Promote an “environment friendly” view toward the entire lifecycle of the product • Being able to create durable and long-lasting products (the creation of products that can be repaired, modernised, reassembled, with a high value). • Improve the design of circular products so that it is easier to repair materials; • Zero waste design
	<ul style="list-style-type: none"> • Understand the natural and technical cycles of matter and energy • Describe the issues outlined by different kinds of waste and minimization techniques • Being aware on the adverse effects on the environment of non-use of recyclable materials • Training of professional competences based on reducing the environmental impact of pollution. • People health and safety • Identification of the waste that can be recovered.

<p>Sustainability and environmental management</p>	<ul style="list-style-type: none"> • Increasing interest in maintaining a clean environment. • Supervise the environmental practices of the company in order to comply with the national and EU • Apply critical success actions and best practices in CSR on key topics: involvement in communities, relations with employees, relations with suppliers and clients, responsibility on the environment issues • Develop and to implement a CSR plan. • Demonstrate capacity and responsibility for selecting, adopting and implementing the environment friendly packaging solutions. • Control the compliance with the mandatory environmental legislation about: hazardous substances, dust in work environment, water restrictions, level of noise inside and outside the factory and management of wastes legislations
<p>Systems thinking and networking</p>	<ul style="list-style-type: none"> • Analyze systematically socio-economical activities • Create and maintain cooperative and teamwork relationships; • Structure the network and partnership between producers and users. • Ability to think in casual relationships; • a multidisciplinary approach to problem-solving; • Ability to work in interdisciplinary groups;
<p>Entrepreneurship and new business</p>	<ul style="list-style-type: none"> • Formulate proposals in order to facilitate the transition from Linear to Circular Economy • Support Recovery and recycling schemes. • Develop "industrial symbiosis" thinking • Create strategic plans for management that applies the principles of the circular economy.



<p>models for circular economy</p>	<ul style="list-style-type: none"> • Formulate innovative solutions in order to expand the durability of products, to protect the environment. • Integrate eco-designs into the business model of the company
<p>Marketing and user centered approaches</p>	<ul style="list-style-type: none"> • Incorporate sustainable marketing strategies and principles in own company by reformulating the • Marketing mix tool. • Training of communication skills for the marketing of manufactured products
<p>Technology</p>	<ul style="list-style-type: none"> • Adapts manufacturing technologies to recyclable materials used in product manufacturing; • Manufactures products from recoverable materials; • Mroduce designs and collections that fulfil environment criteria by using 3D CAD tools for virtual prototyping

Importance of skills according to training institutions

Figure 22 below summarizes the importance of skills associated to circular economy as perceived by the interviewed institutions. Resource and material management skills, sustainability skills, and user centered approaches are the 3 most relevant skills to possess in the context of a circular textile economy. The awareness of necessary skills and competences may vary depending on the focus taken by interviewed education institutes. A strong outcome of the analysis though stresses the need to extend the skillsets and competences beyond design practices to include a systems perspective from material selection to marketing practices.

Perception difference between circular economy companies and training institution

Figure 23 addresses the difference of perceptions related to skills and competences that needs to be mastered when engaging in circular economy. Unsurprisingly marketing, entrepreneurship and systems thinking skills are more value by companies than education institutes. New technology skills and sustainability skills are considered more important by education institutes than company representatives.

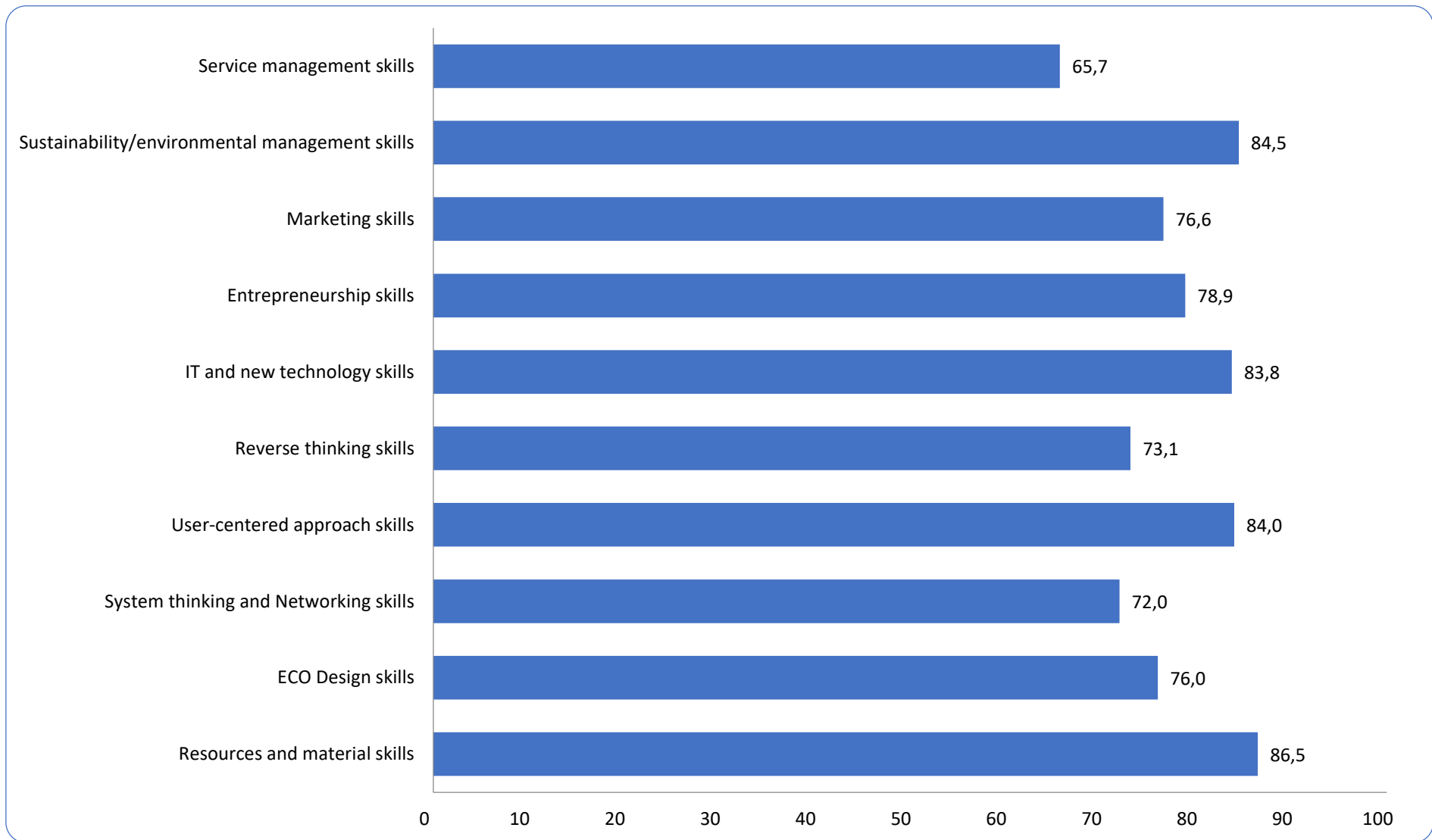


Figure 22: Importance of skills to possess for circular economy according to education institutes

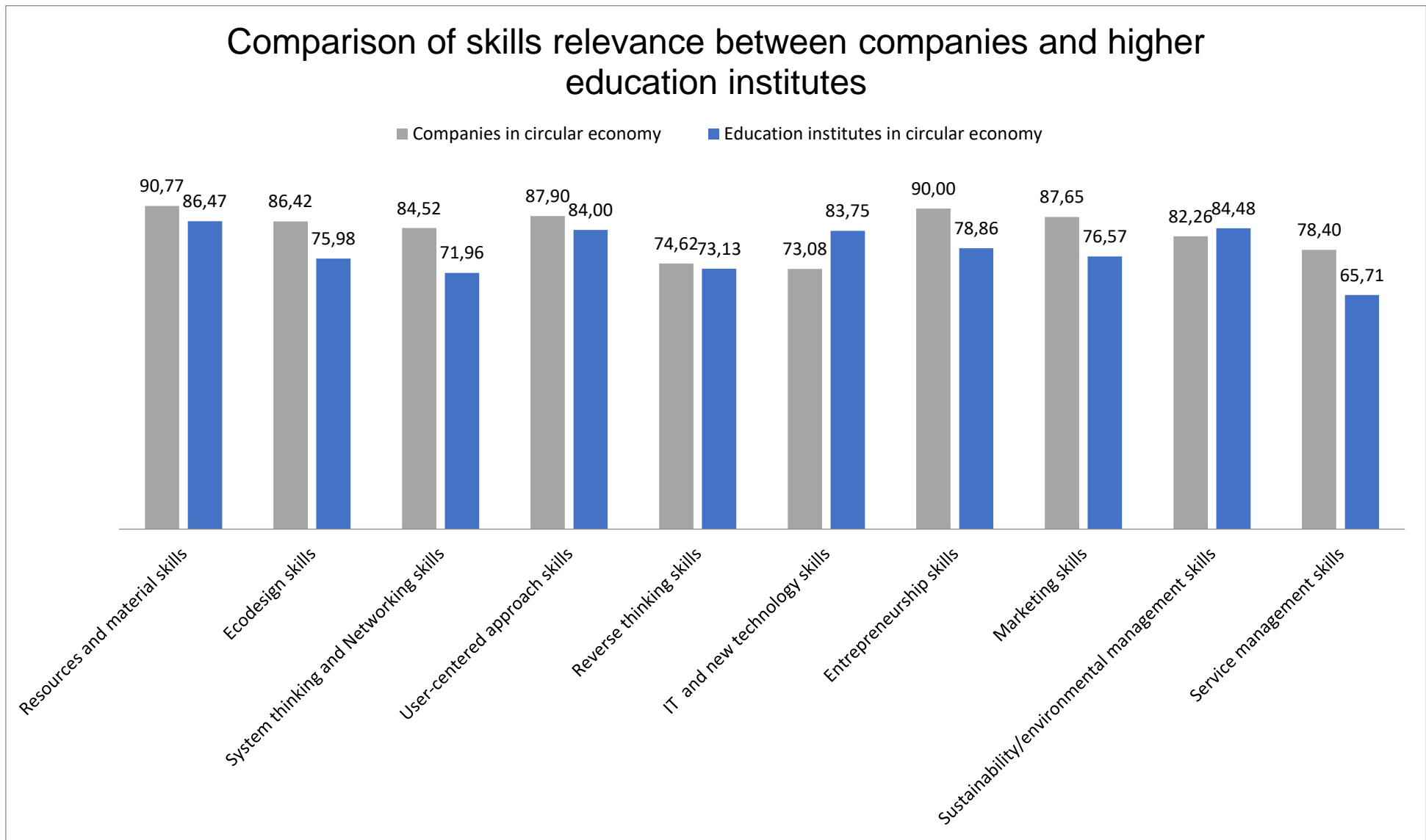


Figure 23: Comparison between companies and education institutes perception of key skills

4 CONCLUSIONS AND RECOMMENDATIONS

The textile industry is one of the most polluting industry in the world. In order to depart from our current take, make dispose linear economy, it is essential to start designing and producing textile and clothes of higher quality and providing access to them via new business models to shift the perception of clothing from being a disposable item to being a durable product.

This report provided an overview on how the circular economy is currently being implemented within the Textile and Fashion sector. By focusing on existing practices, challenges and opportunities at the micro-level, the main objective of this report was to identify the necessary skills and competences needed to support the transformation of fashion companies towards a circular economy.

The research allowed us to identify and frame a set of skills and competences that are perceived key to possess in order to transition to a more circular economy.

Table 3 below summarizes the necessary skills to master when engaging in circular economy practices in the textile industry.

Table 3: overview of major skills for a circular textile economy

Themes and focuses	Skills and competences
CIRCULAR VALUE CHAIN	
- Materials and resources	<ul style="list-style-type: none"> • Finding the right suppliers of ecological materials • Acquiring new knowledge to process reclaimed material
- Ecodesign	<ul style="list-style-type: none"> • Adopting, mastering and implementing eco-design skills
- Manufacturing and recycling	<ul style="list-style-type: none"> • Zero waste manufacturing • Reverse thinking • Applying new technologies to support ecofriendly and circular (re)manufacturing
- Retail and consumption	<ul style="list-style-type: none"> • New business models • Servicizing • Green marketing skills
TRANSVERSAL COMPETENCES	
- Sustainability and environmental management	<ul style="list-style-type: none"> • Sustainability • Environmental management
- User centered approach	<ul style="list-style-type: none"> • Cocreation • Trust and transparency • Personalization
- Entrepreneurship	<ul style="list-style-type: none"> • Creativity • Innovation
- Systems thinking	<ul style="list-style-type: none"> • Collaboration and networking

Recommendation for a course structure around Circular economy in the textile industry

This research is framed within the Erasmus project Design4circle, which aims to develop an innovative training curriculum aimed at equipping designers in the textile and fashion sector with the necessary knowledge and know-how on how to thrive in a circular economy.

The results of the research suggest that on one hand we should address the skills gap following a circular value chain approach, addressing issues at the materials and resources base, at the design stage, at the manufacturing stage, while offering a business foundation on how to create shared value in the sector without harming the environment.

Circular economy is rooted in complex systems and requires to take a holistic approach encompassing various dimensions. Translated into skills and competences, training curriculums in circular economy should emphasize whole systems thinking, embracing materials and resource knowledge, sustainability management skills throughout the life cycle of products while offering business and marketing foundations for implementing successful innovations meeting user needs.

We therefore recommend to first transmit a general body of knowledge related to circular economy thinking (module 1) and clarify how this new paradigm is answering sustainability challenges in the industry (module 2). Second, we recommend a life cycle approach to address the necessary skills needed to implement this circular thinking into the various stages of textile production and consumption: material and resources selection (module 3), design and manufacturing (module 4), supporting technology for circular manufacturing and recycling (module 5). The last module (module 6) - circular business management - provides skills related to circular business model innovation and circular marketing while providing a systems thinking perspective.

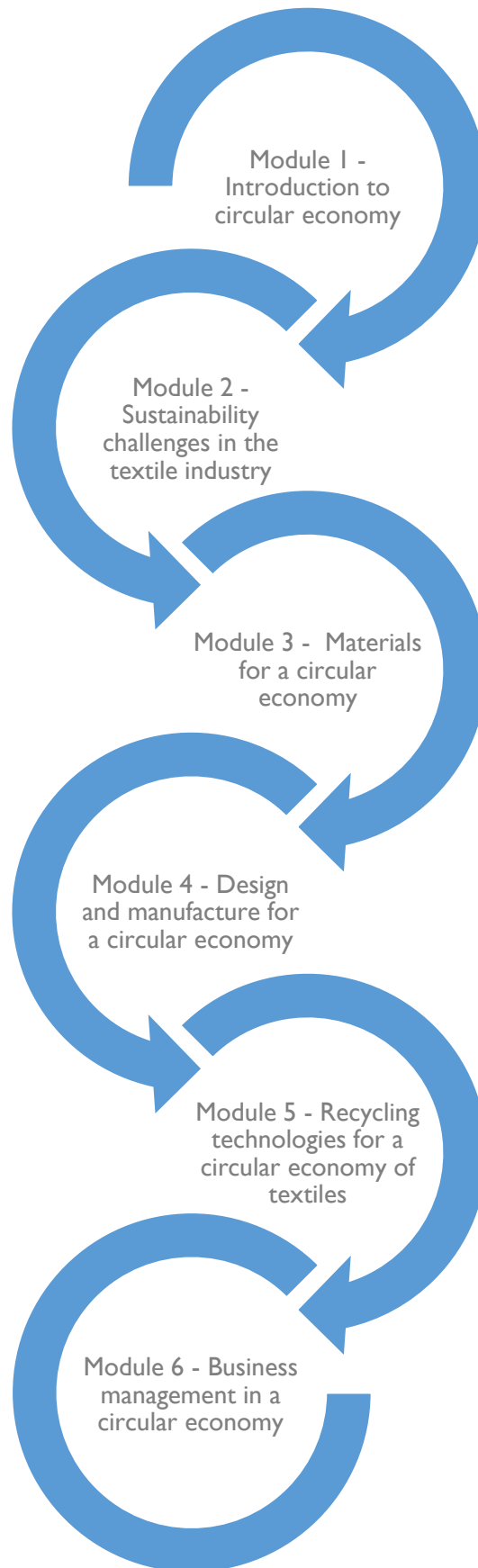


Figure 4: Curriculum development for a circular textile economy



5 ANNEXES

Annex 1: Interview template for company managers

Annex 2: Interview template for HEI and VET providers

ANNEX 1: DESIGN 4 CIRCLE - TEMPLATE FOR COMPANIES INTERVIEWS

This template provides generic question to hold the interview.

1. General questions

- Name of company:
- Location:
- Annual turnover (if available):
- Date of creation:
- Number of employees:

- Name of informant:
- Position in the company:
- Date of interview:

2. The company circular business model

- ✓ How is your company associated with circular economy?
- ✓ What is your value proposition in a nutshell?
- ✓ What are the main activities of your company to apply circular economy principles?
- ✓ What are the main resources used in your business model?
- ✓ Which are the key actors in your value network (suppliers, partners...)?
- ✓ What are your main target groups (customers)?
- ✓ What kind of customer relationship did you develop?
- ✓ What is your Profit/costs equations?

3. Transition process

- ✓ What were the drivers to experiment with circular business model?
 - o Limits in current business model (loss of profit, competition, etc.)?

- o Will to adapt business models to sustainability values (being more responsible/green-oriented)?
- o Strategic decision from leadership?
- o Other?

Please explain:

- ✓ What were the existing resources in your company that made it possible to transform your business model?
 - o People skills (specific knowledge/competences...?)
 - o Existing untapped resources (technology, unused materials.)
 - o Other:

Please explain:

- ✓ What new resources did you have to acquire?
 - o New technology
 - o New talents?
 - o Other

Please Explain:

Skills to enable circular business models

Circular skills: the knowledge, abilities, values and attitudes needed to live in, develop and support a society that slows and reduces the impact of business activity on natural resources while creating value throughout the life cycle of products and services.

- ✓ Can you evaluate the following skills? According to you, how important are those skills and how much do you possess these skills in your company?

Skills	Importance of the skills to facilitate the transformation?					How much your company possess that skill?					Description/Comment
	1	2	3	4	5	1	2	3	4	5	
Resources skills: skills related to the knowledge of materials											



Eco-design skills ¹ : skills focusing on developing a new product service that is based on circular economy principles <ul style="list-style-type: none"> - Design for Environment - Design for Supply chain - Design for Quality - Design for Reliability - Design for Reuse - Design for Maintenance - Design for Remanufacture - Design for Upgradeability - Design for Assembly/Disassembly/Reassembly - Design for Recycling 	1	2	3	4	5	1	2	3	4	5	
System thinking and Networking skills: skills supporting a whole system view allowing to develop complex business models involving multiple parties. <ul style="list-style-type: none"> - network mapping skills - alliance and partnership skills - collaboration skills 	1	2	3	4	5	1	2	3	4	5	
User-centered approach skills: skills focusing on meeting the customer needs starting from a user issue/challenge/need/ <ul style="list-style-type: none"> -design thinking -user experience -cocreation 	1	2	3	4	5	1	2	3	4	5	
Reverse thinking skills: skills related to reverse supply chain <ul style="list-style-type: none"> -Reverse Logistics 	1	2	3	4	5	1	2	3	4	5	
IT skills: skills in information technology allowing to develop new resources/information to be monetarized.	1	2	3	4	5	1	2	3	4	5	
Entrepreneurship skills: skills focusing on new venture creation <ul style="list-style-type: none"> -creativity -Business innovation 	1	2	3	4	5	1	2	3	4	5	
Marketing skills: skills focusing on	1	2	3	4	5	1	2	3	4	5	

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https://www.researchgate.net/publication/303749441_SKILLS_AND_CAPABILITIES_FOR_A_SUSTAINABLE_AND_CIRCULAR_ECONOMY_THE_CHANGING_ROLE_OF_DESIGN



Communication Customer segmentation skills Customer relationships development skills Communication skills										
Sustainability/environmental management skills: skills allowing the company to take into account the environmental and social impact of the new product services throughout its life cycle. -knowledge on life cycle analysis -CSR -environmental management (waste, energy.)	1	2	3	4	5	1	2	3	4	5
Service management skills: skills allowing to develop a business model focusing on delivering value from servicizing instead of selling a product.	1	2	3	4	5	1	2	3	4	5

Are there any Other skills you think are important to possess to become circular?

DESIGN4CIRCLE - interview template for HE/VET providers

Name of the provider:

Name of informant:

Time of interview:

1. EXISTING CE EDUCATION

Please describe the current practices related to CE education in your organization

Description of training/courses

Level of education

Target groups

Which aspects of Circular economy are emphasized in the training?



Prerequisites for the training

Number of ECVET/ECTS related to the
completion of the course

Have you formulated a set of competences to be required to the completion of the course? Is so what are they?

2. RELEVANT SKILLS AND COMPETENCES

Skills	Importance of the skills to facilitate the transformation to circular economy?					Description/Comment
	1	2	3	4	5	
Resources skills: skills related to the knowledge of materials	1	2	3	4	5	
Eco-design skills ² : skills focusing on developing a new product service that is based on circular economy principles	1	2	3	4	5	
<ul style="list-style-type: none"> - Design for Environment - Design for Supply chain - Design for Quality - Design for Reliability - Design for Reuse - Design for Maintenance - Design for Remanufacture - Design for Upgradeability - Design for Assembly/Disassembly/Reassembly - Design for Recycling 						
System thinking and Networking skills: skills supporting a whole system view allowing to develop complex business models involving multiple parties.	1	2	3	4	5	
<ul style="list-style-type: none"> - network mapping skills - alliance and partnership skills - collaboration skills 						
User-centered approach skills: skills focusing on meeting the customer needs starting from a user issue/challenge/need/	1	2	3	4	5	
<ul style="list-style-type: none"> -design thinking -user experience -cocreation 						
Reverse thinking skills: skills related to reverse supply chain	1	2	3	4	5	
-Reverse Logistics						
IT skills: skills in information technology allowing to develop new	1	2	3	4	5	

2

https://www.researchgate.net/publication/303749441_SKILLS_AND_CAPABILITIES_FOR_A_SUSTAINABLE_AND_CIRCULAR_ECONOMY_THE_CHANGING_ROLE_OF_DESIGN



resources/information to be monetarized.

Entrepreneurship skills: skills focusing on new venture creation	1	2	3	4	5
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- creativity
- Business innovation

Marketing skills: skills focusing on Communication	1	2	3	4	5
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- Customer segmentation skills
- Customer relationships development skills
- Communication skills

Sustainability/environmental management skills: skills allowing the company to take into account the environmental and social impact of the new product services throughout its life cycle.	1	2	3	4	5
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- knowledge on life cycle analysis
- CSR
- environmental management (waste, energy.)

Service management skills: skills allowing to develop a business model focusing on delivering value from servicizing instead of selling a product.	1	2	3	4	5
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