



Advancing industrial digital and green innovations
in the advanced textile industry through innovation
in learning and training

WP2 Italian National Report



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1. Introduction

The research was carried out to identify the current situation of the Italian advanced textile materials industry and education systems, the main challenges of innovation, the difficulties, opportunities and strengths to face the challenges generated by the green, smart and digital transition, COVID-19.

In particular, the survey aimed to identify the most significant skills needs for the advanced textile industry, mainly in relation to technologies, changes and innovation (materials, processes, products) in order to know also the responses and gaps related to the textile sector. Another important aim was to identify priority topics for the training of current and future employees in the textile industry.

The starting point of the analysis was to translate the guidelines provided by the project leader into a model contextualised to the Italian reality in order to get more information. The research methods and methodological approach used for the state-of-the-art needs analysis in Italy were designed and shared in August between the two Italian partners (PIN and CIAPE). The result of this sharing was to use a methodology that could be inspired by marketing research techniques, in particular by the empathy map and SWOT analysis models, in order to create a hybrid model that could comply with the task's requirements at best.

In September, a desk analysis was carried out to understand the analysis of the current situation of the advanced textile industry and education systems, the status and content of educational programmes in Italy, as well as the analysis of the results obtained in European or national projects, all from the perspective of the green, smart and digital transition. In this phase the researchers consulted studies, trends and market research, surveys, websites, strategic plans and press releases of textile and VET companies, strategies for the textile industry, plans for the circular economy, strategies for the development of vocational training. The data of this phase of the research was collected and discussed with two stakeholder groups ("VET" and "companies"), the main results of which are summarised in chapter 2; while the main initiatives (documents, strategies, tools) in the textile sector which resulted from this desk research phase are described in chapter 3: these two chapters form the basis for the next steps of the research.

In mid-October, PIN and CIAPE thought about structuring the organisational aspects to promote a meetup at the beginning of November and a workshop at the end of November to obtain the necessary information for the project objectives, involving companies, education systems and research centres.

The field activities concerned two Meetups and a living lab, both with companies, VETs and HEIs. A total of **16 companies, 10 VETs and 4 HEIs** were involved, distributed as follows:

- **Meetup with 6 companies** - held in one online session (07.11.2022). The Meet up started with a preparation phase in which we shared the project's activities and objectives, bringing the companies into the project's dynamics from the beginning of the project. A short presentation was spotted that helped to facilitate a common language and understanding about the project's topics. The second part of the meet up stimulated the participation of all companies. A set of questions were submitted to the participants. Each of them replied in an online board, adding posts. The methodology facilitated the participation and the collection of qualitative data in an easy and fast way. Then, the researchers analysed the results having represented precious inputs for the living lab activity.
- **Meetup with 3 VETs and 2 HEIs** - held in one online session (03.11.2022). We involved different textile departments of the Institutions: design, engineering, chemistry, materials. The reason is to obtain different perspectives of the evolution of the sector and a full representation of the ongoing trends and skills gap. The meet up was set up in the same way of the companies' one.
- **Living Lab** that gathered **10 companies, 7 VETs and 2 HEIs**. The living lab was set up in Milan on November 24th. Considering the important of the textile sector for the Italian fashion industry, the main idea was to involve more than one textile districts with different features in order to have a broader view of the entire sector. In

fact, while the central area of Italy is mainly composed by small companies, in the northern area there are medium companies too with different manufacturing processes. It was important to represent an holistic vision of the Italian situation.

After a presentation of the ADD.TEX objectives, the participants were divided into three groups according to the three areas of the research: green, digital and smart transitions. At least one expert per group moderated the panel. Experts were trained about the desk research and field research results in order to conduct better the labs and stimulate the discovering of the impact of the innovations and the skills needs. The aim was to identify the main contents that companies would like to see addressed in training offer, as well as to understand the challenges that stakeholders face in green, digital and smart transitions. The experts matched the inputs with the results of the previous field research, trying to merge the results and obtain more details. At the end of the panel, the experts gathered to analyse the results that were presented in plenary session. Once more, the participants contributed using a web instant pool for grading the results according to the importance of the topic / priorities of intervenes.

In chapter 4, the results of Meetups and living lab are summarised.

Chapter four talks about what green, digital and smart innovation means for companies, and where process innovation is implemented. A list is also presented with a proposal of the themes that companies and educational institutions would like to see addressed in a training offer. For this analysis the companies' functional areas were the basis of analysis.

Finally, in chapter 5, an analysis of existing green, smart and digital knowledge in vocational and continuing education curricula in the advanced textile industry, higher education institutions and vocational training providers was carried out.

2. Technologies / innovation /documents /tools

This part of the research was divided into two parts. In the first part, all information about advanced textile technologies, tools and innovations in the digital, smart and green sector was collected. In this step, articles, trade magazines, market studies and trends, surveys, final project reports, websites and articles on the internet, material from textile companies, training courses were consulted. The PIN and CIAPE researchers collected and selected the most significant data, summarising it in slides that were presented to two groups of stakeholders, one consisting of companies and the other of VET/HEI, representing the subject of the second part .

During these two sessions, the partial results of the desk research were presented and discussed with the two groups, in order to complete and refine the research. Before starting the discussion and presentation of the results, the definitions of green transition, digital transition and smart transition were introduced, to help them subsequently complete conceptual maps, each for each theme (green, smart, digital) explaining what could be the most important trends and technologies in the Italian textiles sector.

In the green section, research into green materials for producing textiles, derived from regenerated plastics, citrus juices, sugar fermentation and other regenerated materials, which will have a major impact on business processes, was considered more relentless. In this first step, textile certifications (e.g. GOTS Oeko tex[®] STeP, Fairtrade Textile Standard, etc.) were not considered as technologies or elements of innovation, but nearly as requirements to accomplish specific parameters, and not as factors determining a state of technological advancement.

In the digital section, new technologies such as NFTs as well as new business models and new tools for making virtual showrooms were highlighted.

In the smart part, innovations that can create new fabrics or new technological wear were important.

This phase of the research was useful to strengthen the project, share the desk research and have further input before the meetup and living lab with stakeholders. The following tables summarise the main results of this step.

2.1.1 Green transition

Table 1. Green

| Technology/innovation/changes | Description | Processes impacted by the technology | Examples (links...) |
|--|--|---|---|
| Cõeo – A new type of eco-friendly fabric | Cõeo is a fabric by CDC (Cristina di Carlo), a start-up that recycles and regenerates fibres for glamorous waterproof garments. This start-up has created a technology to produce a genderless and body-positive collection with unsold fabrics and regenerated plastics, patenting a new technology to recover post-consumer polyethylene plastic waste, such as the classic black rubbish bag, and use it in combination with defective fabrics or textile stock. The main fabric is Cõeo, created by a new patented technology that recovers unsold and unsalable textiles and regenerated plastics that would otherwise end up in landfills. The | The patented process joins the components mechanically without chemical processes, thanks to a partnership with a spin-off from the Chemistry Department of the University of Pisa so that the final material can be recycled again. In addition to being used for collections, the fabric is offered as technology to textile companies that have stock they want to dispose of: with Cõeo it is possible to reuse defective or no longer usable fabrics and put them back on the market, avoiding the creation of new fabrics, reducing CO2 emissions into the atmosphere by 50% and considerably reducing the waste of | https://www.coeoproject.com/ |

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| | fabrics used come mainly from deadstock or regenerated fibres. Even the labels applied to the garments are made from a yarn derived from recycled plastic bottles while the buttons are made from recycled zamak with sustainable electroplating. Every garment is practically produced zero kilometer. | water for which the textile industry is unfortunately notorious. | |
| Plant-based nylon-6 | The Aquafil group in Trentino Alto Adige, with Texan biotech company Geno, has developed a technology to derive organic-based nylon from caprolactam, but from the fermentation of sugars and not from petroleum-derived products. Aquafil and Genomatica, who signed their partnership four years ago, produced the first tonnes of caprolactam from raw material, converted it into nylon 6 polymer. | This bio-nylon is set to revolutionise the entire industry, which is globally worth \$22 billion, by providing brands with new sustainable materials for daily use, from clothing to automotive and carpets. The material will be used in classical applications, such as yarns for textiles, carpets and plastic components. This new material can have three advantages: 1) This bio-nylon will help make entire supply chains more sustainable. 2) raw material nylon can be integrated into our depolymerisation process of end-of-life nylon products, creating full circularity. 3) It will facilitate the transition to more sustainable materials. | https://www.aquafil.com/it/products/filo-per-abbigliamento/ |
| Orange Fiber-textiles from citrus juices | Italian company Orange Fiber is the first company in the world to produce sustainable textiles from by-products of the citrus processing industry through an innovative process patented in Italy and later extended to major citrus juice-producing countries around the world. In addition, Orange Fiber and the Lenzing Group, the world's leading manufacturer of specialty textile fibers from wood, are collaborating to produce the first TENCEL™ branded lyocell fiber composed of cellulose from orange and cellulose from wood. Produced using the same award-winning closed-loop production process as standard TENCEL™ Lyocell fibers, TENCEL™ Limited Edition x Orange Fiber helps promote sustainability in the textile and apparel supply chain and redefine the boundaries of innovation in cellulosic fiber production. | The creation of these sustainable and innovative textile fashion materials from by-products of the citrus juice industry uses innovative and patented processes, requiring collaboration with leading textile companies. The company creates good circular practices throughout the fashion textile supply chain, helping to shape a new concept of luxury based on an ethical and sustainable lifestyle. | https://orangefiber.it/it/processo/ |
| Q-NOVA® | Q-NOVA is an environmentally sustainable nylon 6,6 fibre made from regenerated raw materials. It is a highly ecological product that aims to | The process uses a mechanical regeneration system, which does not involve the use of chemical materials that would compromise the | |

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| | achieve a reduction in CO2 emissions, a lower consumption of water resources and the use of energy from renewable sources. | sustainability of the final product. Q-NOVA® is a product with an impact on production because more than half of it consists of waste: these materials could not be reused in any other way and would have to be disposed of externally as waste. The selected waste material is remelted through a mechanical process that regenerates it and returns it to the manufacturing company in the form of polymer for further manufacturing. | |
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2.1.2 Digital transition

Table 2. Digital

| Technology/innovations/changes | Description | Processes impacted by the technology | Examples (links...) |
|--------------------------------|--|---|--|
| Bsampley | <p>It is a B2B sales platform, created by the Italians Andrea Fiume and Federico Bianchi, which allows online display of collections through the creation of private showrooms, as well as requesting samples and sending orders. The platform presents three virtual showrooms for the fashion B2B industry.</p> <p>Thanks to 3D technology, it will be possible to visualise fabrics in motion on the screen of one's smartphone, checking their characteristics such as their fall, which is difficult to perceive without the aid of a third dimension. Some companies, such as Marzotto Lab have already used it to digitise their collections.</p> | <p>With the platform, it will be possible to order samples or place orders online via the virtual showroom; while with the augmented reality app ICatalog, customers will be able to view the fabrics in 3D. It can be used at trade fairs and allow customers of textile companies to consult specifications and order fabrics seen at their stands via the web. In addition, through meeting rooms, the buyer can talk to the seller by appointment, and it is possible to make the purchase in total autonomy, buying fabrics already known or chosen in the past.</p> | <p>https://app.bsamplify.com/home</p> |
| DressYouCan | <p>The fashion start-up DressYouCan is the first to offer a fashion rental service: haute couture dresses by leading designers, unique looks created by up-and-coming designers, vintage garments and modern cut garments. It offers a rental service for innovative high fashion garments and women's accessories.</p> <p>This service is based on an online platform and a physical shop in the centre of Milan. The platform provides a stylist who accompanies users in</p> | <p>The strength of this fashion startup is to combine the sharing economy with the convenience of the Pay-As-You-Go business model, while offering a unique experience to all users who favour pragmatism over ownership. This platform, the first in Italy, can be the pioneer of a new business model in the textile/clothing world, involving production processes (will less be produced?) and especially the marketing & sales department.</p> | <p>https://www.dressyoucan.com/</p> |

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| | choosing not only the dress but also the right accessories and details. | | |
| NFT | NFTs, non-fungible tokens, are cryptographic assets whose authenticity and ownership are verified on blockchain and are bought, sold and traded in the metaverse, often with cryptocurrencies. Many fashion companies are showing clothes and digital works, for example Gucci presented the Gucci Vault project, announcing a new collaboration with SUPERPLASTIC, a leading creator of digital works, to create a limited edition series. | In the fashion world, NFTs are used to authenticate products and identify collectibles. Shoppers, particularly those in Gen Z, spend more time online and experience the infinite possibilities of the metaverse, creating a hyperactive digital environment where people work, play, socialise and shop. Therefore, NFTs could turn the world of textile and clothing companies upside down in the coming years: boundaries blur, the intangible tries to integrate, without destroying them but partly dismantling them, into the mechanisms of fashion. This technology will mainly involve the Design & Styling department. | https://vault.gucci.com/it-story/metaverse |

2.1.3 Smart transition

Table 3. Smart

| Technology/innovations/changes | Description | Processes impacted by the technology | Examples (links...) |
|---------------------------------|---|---|---|
| Cuore di Maglia (Knitted Heart) | 'Cuore di Maglia' is a smart T-shirt that tracks breaths and heartbeats. 'Cuore di Maglia' is made of a special conductive fabric equipped with high-tech sensors capable of detecting breaths, heartbeats and other body stimuli, information that is then transmitted to electronic applications. The direct connection with the clinical centres in charge of monitoring thus makes it possible to send real-time notifications on the state of health of the subjects, with the possibility to intervene promptly in case of need. The project is signed by the Its Textile Clothing Fashion of Biella, and was awarded at the new edition of Its 4.0 promoted by Miur and in collaboration with the Department of Management of the Ca' Foscari University of Venice. In fact, the aim of the initiative is to offer technical high schools a new vocational training programme that brings schools and companies closer | The product can open up new markets, in fact it can be aimed at the elderly, people suffering from particular pathologies such as sleep disorders, but also more simply at athletes and those practising physical activity. This T-shirt may be a pioneer for other types of fabrics or garments. | https://www.ilbiellese.it/attualita/il-tam-eccellenza-its-4-0-consegna-al-ministro-bianchi-la-t-shirt-smart-cuore-di-maglia/ |

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| | together on the topics of the industry of the future. | | |
| Reflective Textiles | <p>They can be reflective, hot reactive, water reactive, glow in the dark. Reflective (or "reflex") fabrics react to direct light sources in the night. The special reflective pigments in these fabrics have been enhanced by new pigmentations that can reflect not only in gray, but also the entire color spectrum with a holographic result.</p> <p>Recent technologies applied to textiles have resulted in fabrics with reflective, holographic patterns and on a holographic black base. Heat reactives are a major innovation in the textile industry. Special molecules used as coatings on the fabric react to sunlight and heat sources, thus changing the basic color of the fabric. Water reactive fabrics react similarly to "heat reactive" fabrics, except that their activator is water: these fabrics make patterns and pigments appear on prints when they come in contact with water. "Glow in the dark" or "phosphorescent" fabrics are charged by natural or artificial light sources and release stored light at night or in dark environments.</p> | <p>Technology and the textile industry have always blended together in a union that could provide innovative new proposals in textiles.</p> <p>These fabrics could open new frontiers of collaboration between tech and textile, creating proposals that could represent the pinnacle of textile technological innovation: for example, fabrics that can change their color depending on the influences of the external environment. TC companies should use these fabrics more, given the frequent changes in consumer tastes. They could also embrace the dictates of sustainability, as it would slow down the fast fashion phenomenon by directly involving production and R&D departments.</p> | <p>https://www.akiraurope.it/it/collezioni/innovazione-tessile/</p> |
| Smart Jacket | <p>Smart Jacket was created by the company Allix (specializing in IoT and Industry 4.0) as part of the TRAME Project, and is an innovative vest that aims to prevent accidents at work. The Project, as mentioned, involves the creation of a workplace protective device that does not replace existing PPE but rather adds to it to achieve a much higher level of safety. The vest looks like a high-visibility vest, but it is internally equipped with sensors that can analyze the worker's movements, learn them and gradually go about predicting possible falls by securing the employee, first alerting him or her with an alarm and then activating a built-in airbag.</p> | <p>The product transcends the concept of a garment only to be worn, but can perform several functions. Thanks to a central control unit and integrated inertial sensors, this vest is able through an algorithm to detect and anticipate the fall even before the impact occurs. In addition, it can examine and go to analyze the employee's behavior, being able to reprocess useful information for the study of the most commonly made mistakes in such a way as to go step by step preventing the injury and making the whole working day safer. This technology will involve R&D and marketing at first, and in a second phase also the design department to create more and more aesthetically pleasing models.</p> | <p>https://www.openinnovation.regione.lombardia.it/news/news/view?id=5846</p> |

3. Existing Initiatives (Projects/strategies/documents/tools)

An important part of the desk research was dedicated to identifying projects and documents at a national and regional level with a focus on advanced materials aimed at green, smart, digital aspects and the impact of COVID 19 on the adoption of new working methods in the advanced textile industry.

In Italy, the most significant initiatives concern the aspects of green transition, considered a crucial element for the strategies of textile companies, especially from 1 January 2022, as established by legislative decree no. 116/2020, because in Italy the obligation of separate collection of textile waste has been implemented, anticipating the European regulations that envisage the activation of separate collection of this type of waste from 2025.

In Italy, specific measures have been introduced in some high value-added sectors, including textiles with special recycling targets. In this context, the measure aims to strengthen the recycling collection network and the treatment and recycling facilities, contributing to the achievement of the ambitious 100% recovery target in the textile sector through *Textile Hubs*. Within the NRRP (The National Recovery and Resilience Plan), in Mission 2 “Green Revolution and Ecological Transition”, one of the tasks is to “make the waste management system efficient, focusing on the production of secondary raw materials that reduce waste disposal in industrial sectors”. With this aim, Mission 2 - Component 1 of the NRRP includes among the measures the so-called *Flagship Projects* of the circular economy, to which it allocates a total of EUR 600 million to be invested in highly innovative projects¹. The EUR 600 million will be distributed over four lines for recycling and collection of WEEE, improvement of paper and plastic waste collection, and finally, line D is dedicated to *Flagship Projects* in the textile sector. These will have to provide for the infrastructuring of the collection of pre- and post-consumer textile waste fractions, the modernisation of plant engineering and new recycling facilities for textile waste fractions with a systemic view of *Textile Hubs*. Of the 150 million euros earmarked to Line D, 60 million are allocated to northern Italy.

Connected to the NRRP, there are initiatives involving some textile districts, for example, the Municipality of Prato has decided to set up its strategic document called “Next Generation Prato”², in which strategies are outlined for the coming years to respond to the enormous opportunities that will arise thanks to the NRRP to develop the territory and the production system. This document represents the outcome of an intense process of reflection, sharing and dialogue with the main stakeholders on the strategy that Prato intends to adopt in the near future, addressing issues and proposing projects that will ensure an ecological transition and new economic models able to produce positive impacts on the territory. At the same time, it represents the starting point that will guide the city's future activities. The document aims to counter and overcome the heavy economic and social consequences of the Covid-19 pandemic with determination and strategic vision. Thanks to the resources that will be allocated with the national NRRP, Prato becomes an area in which changelling project ideas represent an important step for the development of the city and the territory. The strategic document envisages six fundamental points (Digitalisation, innovation, competitiveness; Green revolution and ecological transition; Infrastructure for sustainable mobility; Education and research; Inclusion and cohesion; Health), including the goal of locating the main national textile hub in Prato and consolidating the district's role as a technological and operational hub of textile recycling at European level. The realisation of the hub will raise the level of awareness on the possibilities of textile material recovery and recycling within the production-industrial context. Technological equipment will be increased and qualified through new facilities and machinery dedicated to recycling. For the screening of material, advanced automatic systems will be designed and implemented at the new hub for the sorting of recycled material or incoming waste.

The focus of textile companies is on renewable raw materials or materials from textile recovery and recycling, circular economy in Made in Italy fashion. In this regard, an important report has published, entitled “100 Italian Circular

¹https://www.mite.gov.it/sites/default/files/archivio/allegati/PNRR/2022_02_15_Avviso_proroga_termini_1.2_LineaD.pdf

² <https://www.pratocircularcity.it/it/next-generation-prato/pagina1942.html>

Economy Stories"³, the result of a collaboration between the Symbola Foundation and Enel, in which the 100 excellent stories collected include 13 companies/best practices in the fashion industry and some in the textiles sector. The research highlights other data related to the circular economy: Italy is the European country with the highest percentage of recycling on all waste at 79.4%, almost double the EU average (49%); thanks to this virtuous process, Italy manages to save 23 million tonnes of oil per year and about 63 million tonnes of CO2 equivalent. Among the most relevant textile companies mentioned in the document are:

- **Aquafil**, a leading manufacturer of synthetic fibres. In particular, their ECONYL[®] yarn is a nylon obtained by recycling discarded carpets, disused fishing nets and fabric scraps. The company has also developed a technology to separate nylon 6 from copper oxide in aquaculture nets: it is a circular process, where each component of the fishing net finds an industrial destination and not landfill. ECONYL[®] is used by many brands in both the fashion and carpet industries.
- **Manteco** is a textile company in Prato that has patented MWool[®], the new generation of recycled wool, obtained both from manufacturing waste and from pre- and post-consumer garments. It is a wool with more than 1000 colours obtained thanks to the exclusive Recype[®] process that combines recycled fibres of different shades without the use of chemicals.
- **RadiciGroup** is a chemical company that has developed a collaboration with the Italian International Fashion Group to create 50 denier tights made from recycled post-consumer plastic. In addition, together with the company Macron, it made sports socks with Renycle, a recycled nylon 6 yarn.
- **Atelier Riforma**, a Turin-based start-up with a strong social vocation that, in about a year and a half, has collected more than 8,000 garments, saving them from landfill. The collection supply chain is transparent and all garments are catalogued and traced. The garments are processed by the start-up's network of artisans: a network of professional tailors, mostly young women, as well as social tailors. Collaborations also include fashion schools: an opportunity to train the professionals of the future on upcycling in textiles.
- **Blue of a Kind** produces haute couture garments from pre-existing garments. It is no coincidence that the brand's slogan reads "(re)made in Italy". Blue of a Kind has organised its production in this way: the company reclaims high-quality vintage garments in France and Italy, through a dense network of suppliers, and then ships them to the production plant. Here they are stripped down piece-by-piece, and recreated into new garments, including jeans.
- **Dyloan** is a company that, with D-refashion lab, aims to solve the problem of overproduction in the fashion industry by upcycling stocks.
- **Rifò** in Prato creates new garments from yarns obtained from regenerated old clothes. All garments produced by the company are made from regenerated textile fibres and production takes place within a range of 30 km from Prato. Moreover, with the pre-sale system, Rifò adapts to the real needs of the market, avoiding generating overproduction, typical of fast fashion. The company has set up several services to have used cotton denim, wool and cashmere garments delivered to customers to be regenerated and used in their own production cycle.

Other documents emphasise the use of sustainable fibres in the coming years. In particular, according to the report "Re-fiber: the future of textile fibres is sustainable"⁴, sustainable fibres will maintain the growth trend of recent years, it is estimated that by 2025, 50% of cotton will come from sustainable sources, as per the target set in 2017 as part of the 2025 Sustainable Cotton Challenge, a challenge overseen by the non-profit organisation Textile Exchange. The use of recycled fibres, in particular, is destined to become mainstream, thanks to the continuous evolution of the textile waste collection system, rapidly advancing mechanical and chemical recycling technologies, and clothing brands that are increasingly interested in using recycled materials in their collections. According to the report, one of the objectives of the textile industry in the coming years will be to reduce the price gap between sustainable fibres and virgin fibres; not only that, but recycled fibres, if not suitable for textile reuse, should be destined for different sectors (automotive, construction, acoustic/thermal insulation, etc.).

³ https://circulareconomy.europa.eu/platform/sites/default/files/100storie_def_web_pag_singole_25-05-18_1527247969.pdf

⁴ <https://www.pwc.com/it/it/industries/retail-consumer/assets/docs/pwc-ReFiber-sostenibile.pdf>

There are initiatives such as SFIS5 (Sustainable Fashion Innovation Society) that constitute a platform for the green transition with more than 2000 brands, where fashion sustainability joins technology. The platform's objectives are to enhance fashion and Made in Italy, promote the sustainability of the textile production process, facilitate innovation in the related supply chain, increase the circular economy, publicise respect for the planet and raise consumer awareness. The initiative includes the set-up of a platform that creates a community of companies, connects textile and clothing companies to sign up for the initiative to be supported, the possibility of patronage and the creation of roadmaps for special projects. SFIS supports textile and fashion SMEs in their delicate process of green transition. Thanks to this platform of sustainable fashion experts, Italian SMEs, micro SMEs, artisans and fashion and design start-ups are supported in the transformation of their supply chain to Green by introducing one or more elements for sustainable innovation in this segment; but also to support textiles brands that intend to convert their supply chain to sustainability, both of process and product, by adopting more responsible production formulas that comply with the SDGs, the sustainable development goals of the United Nations' Agenda 2030.

A key requirement for the systematic adoption of the green transition concept is to adopt new models that adhere to the principles of the circular economy, and this is where the issue of digitisation comes in. Many studies claim that digitisation can provide the right input for a transformation to a circular economy that is as sustainable as possible⁶. Digitalisation can help to close material loops by tracking information, it can enable more efficient processes in companies by minimising waste and promoting a longer life of textile products. Nowadays, the topic of digitalisation and digital technologies is increasingly discussed in connection with the empowerment of new business models of the circular economy. For this reason, a part of the research was also dedicated to digitalisation in the textile industry, considering that the digitalisation of production processes is an essential and unavoidable condition for remaining internationally competitive. In fact, digitalisation is part of the #nextgenerationitalia project of the Italian Government's National Recovery and Resilience Plan⁷ (specifically in Mission 1 of the Plan, which mainly concerns technological upgrades in production processes and infrastructures), which aims to boost the system's competitiveness and productivity.

In the digital area, there are some initiatives, for example that of ACIMIT, which supports its member companies in the digital transition process. The project involved the creation of Digital Ready⁸, a model that in collaboration with the Manufacturing Group of the Milan Polytechnic (PoliMi) envisages the standardisation of production and management data of Italian textile machinery in a digital key.

Another initiative has been realised by the Reda Group, which has developed a SaaS (Software-as-a-Service) platform that allows the digitalisation of the collection process at 360°, from the creation of the fabric to the sale of the finished garment: this offers a phygital experience, combining physical and virtual, which is guaranteed by a high-performance 3D configuration engine, and allows the exploitation of Web 3.0 and Metaverse market opportunities⁹. The Tailoor initiative was launched in September 2022, and is part of the Reda Group's technological innovation strategy and its industrial plan to increase and develop new digital services for the textile and fashion industry: the aim is to start a real digital revolution in the textile sector, which is strategic for the Italian economy, thanks to open innovation and continuous research.

In the Prato textile district, a project called "Prato Phygital" has recently been launched, which is at the service of textile and clothing manufacturing, benefiting from a EUR 1 million grant from the Mise announcement, which Fondazione Sistema Toscana was awarded, as the leader of a group of national institutions and companies. The project is the result of the contamination of several sectors, such as audiovisual, textiles and fashion with 5G technology. The starting point of the project, which will last one year, will be the digitalisation of a series of fabrics selected from the archives of Marini Industrie and the Museo del Tessuto in Prato, as well as some headgear chosen from the collection of Renaissance costumes of Manifatture Digitali Cinema of the Toscana Film Commission. The project aims to be a model for textile industries and creative enterprises in the local and national territory: the challenge is to create a new model, exportable in all sectors of the Made in Italy; not only that, but also the possibility of using new technologies such as 5G. Prato Phygital was created to strengthen the services to Prato's textile enterprises through an audiovisual production centre

⁵ <https://www.sustainablefashioninnovation.org/?lang=it>

⁶ M. Perona, G. Bressanelli, N. Sacconi. (2021). Perché è necessario digitalizzare l'Economia Circolare? Sfide e opportunità in questo nuovo settore. Creare nuovi sistemi economici sostenibili è il vero obiettivo della Digital Circular Economy, un settore che sfrutta le innovazioni tecnologiche per salvaguardare l'ambiente. Sfrido News. <https://www.sfrido.com/2021/03/22/economia-circolare/perche-necessariodigitalizzare-economia-circolare-sfide-e-opportunita/>

⁷ <https://www.governo.it/sites/governo.it/files/PNRR.pdf>

⁸ <https://www.acimit.it/i-nostri-servizi/centro-studi/digitalizzazione/digital-label/>

⁹ https://www.smau.it/FRONTEND/Casi%20Successo%20PDF/REDA_Premio%20Innovazione%20Smau%202022.pdf

at the forefront of the European scene, but also to boost the creation of a Campus, where future technicians can be trained to implement new technologies, with positive effects on the employment of new generations.

In the smart area, there are still few Italian initiatives and the focus is on individual projects rather than synergetic action between Italian textile companies. Initiatives are aimed at the realisation of patents by individual companies, such as Saluzzo Yarns, which has patented the Newlife™ fabric¹⁰, which is a certified system of recycled polyester yarns obtained entirely from post-consumer bottles, which are transformed into a polymer through a mechanical process, and not a chemical one, until the yarn is produced. This method allows for many end-uses and high-performance yarns of similar quality to virgin polyester, while ensuring considerable savings in terms of resources and costs for the environment. Newlife fabric can be used in fashion, sportswear and technical clothing, underwear, workwear, medical and outdoor wear, furniture and accident prevention fabrics.

Another example is provided by the company AK Europe of Padua, which has created an entire line called “Reflective”, which has opened up the new frontiers of collaboration between tech and textile, and which represent the pinnacle of textile technological innovation, i.e. fabrics that can change their colour according to the influences of the external environment.

Other initiatives were influenced by the Covid-19 pandemic, such as the company Cifra, which launched its own line of garments made of antimicrobial smart fabrics. Using the Q-Skin antimicrobial fabric¹¹ from Amni Virus Bac-Off, Cifra made an athleisure collection from this fabric to make clothing for personal protection. In addition, they made a sportswear line that protects and limits cross-contamination by viruses, as this can remain on textile surfaces for up to three days. Garments made from this yarn have silver ion technology that neutralises the virus within minutes. This principle is permanent in the garments, i.e. it is not linked to the number of washes. Their main use will be in gyms, but could be a pioneer for many textile companies, especially in fast-growing sports such as yoga, biking and running. Not only that, the year of the pandemic has seen a boom in comfortable and versatile clothing, suitable for a very smart and very domestic life, tracksuits, leggings, athleisure garments: a growing market that is changing the strategic production lines of many textile companies.

¹⁰ https://www.researchgate.net/publication/267642969_Tessuti_innovativi_e_smart_per_la_protezione_solare

¹¹ https://www.ilsole24ore.com/art/senza-cuciture-smart-ed-ecologici-cifra-porta-tessuti-il-futuro-AD64rFPB?refresh_ce

4. Impact of the Green, Digital and Smart processes in the industry

The focus of the research was to analyse the impact that the green transition, the digital transition and the smart transition have and could have in the future on the processes of Italian textile companies. In order to realise this investigation, a Meetup was organised in early November with companies, VET providers & HEIs representatives, in order to share the activities and objectives of the project, bringing the different stakeholders into the dynamics of the project from the beginning. This moment also stimulated networking and the exchange of knowledge and experience between the different areas of activity, as well as being instrumental in setting up the basis for a functional network of partners for communication, the implementation of individual tasks and the subsequent dissemination of project results. Then, at the end of November (24th November) a workshop was organised in Milan with representatives of 10 companies, 2 HEIs and 7 VETs, involving them in a participative activity by adopting a hybrid methodology between an Empathy Map technique and the World Café Dialogue, involving the creation of visual maps for each thematic area (digital, smart, green) in order to understand what innovations exist and how they influence specific business processes of textile companies.

In the green area, the most relevant innovations reported were: adoption of certifications (e.g. GRS), extended LCAs, supply chain integration, traceability of all production processes and control of supply chain relations, eco-design, reduction of patterns and promotion of mono-compositions, new technologies to recycle, new machinery to recycle, research on sustainable chemistry to improve products, environmental impact assessment metrics, measuring the environmental impact of dyeing processes (with consequent changes in the production system), research on sustainable raw materials, digital product passport, new bio-based and bio-nylon fabrics, new fabrics made from unsold and defective textiles, new fabrics made from regenerated plastics, new fabrics made from fermented sugars and not from petroleum-based products, compostable instead of recyclable fabrics, creation of sustainable brands or sub-brands (such as Lenzing), communication of own sustainable practices and giving more transparency, increased sustainability awareness by users, customers seek more stringent supply chain certifications (e.g. RWS virgin wool from Patagonia), platforms with professionals helping companies to green transition, raw materials from sustainable agriculture or recycled sources, replacement of plastic with mycelium, use of biotechnology, 3D printing of sustainable textiles. Other innovations concerned processes more closely, i.e. the adaptation of production facilities to standards and protocols or the adoption of alternative processes to reduce the use of resources. Other innovations suggested concerned business models and corporate strategy such as investments in social sustainability, certifications to protect the environment and animals (e.g. wool), clothing of the future for the metaverse, sustainability plan with specific information on traceability and cross-industry collaborations. In this area, great importance was attributed to 3 opportunities and threats:

- Working on the generational transition in textile companies
- The lack of continuous training in textiles
- Advantages such as tax breaks for companies that anticipate (e.g. apply earlier what will become legislation) for textile waste.

In the digital area, the most relevant innovations reported were: new CAD tools, 3D digital collections and digital pattern books (saving fabric costs), virtual reality for showrooms (virtual showrooms), metaverse, Artificial Intelligence applications, blockchain, e-commerce, 3D printing, big data analysts to facilitate decisions, digital tools for measuring production performance and assessing impacts, advanced sensor technology to avoid production waste, technologies to customise fabrics/yarns/ garments shared with customers (also to reduce waste), QR code technologies on garments with information on the production chain, fashion renting (garment rental), NFT (Non Fungible Token) to create unique digital products, phygital activities to digitalise fabrics, digital marketing tools to increase the visibility of products and companies (social media, Google campaigns, SEO, etc.), virtual model prints, platforms to share the supply chain, software to study the dyeing process to avoid wastage of water and pollution, digital models in gaming, apps with product preview options, art spaces, digital sample/clothing apps, designers who photograph textures and put them in digital/3D to create fabrics for digital fashion shows and prints.

Other innovations concerned processes more closely, i.e. the use of augmented reality in the use of textile machinery, new ways of smart working by cleverly integrating the right technologies, software that produces changes in logistics and in the relationship between supplier and company, simulations and digital sales, a greater link between craft and

digital activities, greater implementation of robotics and the precepts of Industry 4.0, new production processes to save energy.

In the smart area, the most relevant innovations reported were: materials that can manage our thermal equilibrium, RFID technologies in fibres, technologies to measure product durability and usability, technologies to understand whether a garment comes from an upcycling process, garments and fabrics to monitor breathing and heartbeats, reflective fabrics (able to change colour with light. E.g. photochromic t-shirt), hot reactive fabrics (able to change colour with heat), water reactive fabrics (able to change colour with water), glow in the dark or phosphorescent fabrics (able to light up at night), fabrics with protective sensors able to analyse the wearer's movements, antimicrobial fabrics for health protection, shape memory fabrics, waterproof and breathable fabrics, fabrics for sun protection, adoption of nanotechnology, integration and miniaturisation of sensors in fabrics such as barometers and accelerometers, fabrics with sensors analysing vital functions, grasshoppers sensors sewn onto the fabric. Other innovations concerned processes more closely, i.e. the choice of raw materials, the integration of some company functions (R&D and marketing), and the adoption of new triboelectric accumulators. This is the most challenging of the three areas, as problems arise such as: product durability, resistance of products to washing, lack of knowledge and scarce resources in the industry, how to manage the flow of data, how to combine the production of smart products with green aspects.

The following paragraphs summarise the areas most affected by innovations in the textile sector in tables, presented one for each thematic area (green, digital, smart).

4.1.1 Green

Table 4. Green

| Functional areas of the company | Technology/innovation/Changes | Knowledge needed to perform the process | Priority Training Topics to be addressed |
|---------------------------------|----------------------------------|---|---|
| Design & Styling | Eco-design | New eco-friendly materials, sustainability assessment of the raw materials and chemical products involved in production processes | Product design (e.g. CAD), LCA, 3D printing |
| Research & Development | New Materials and Reuse of Waste | New technologies to recycle, new machinery to recycle, new fabrics, new legislative framework | Environmental impact assessment metrics, the recycling system, lean production, certifications, fabric types (e.g. bio-based and bio-nylon) |
| Production | Traceability | Process and product life cycle knowledge, supply chain traceability | Blockchain, certifications, sustainable supply chain management |

4.1.2 Digital

Table 5. Digital

| Functional areas of the company | Technology/innovation/changes | Knowledge needed to perform the process | Priority Training Topics to be addressed |
|---------------------------------|---|--|--|
| R&D – Design | 3D and virtual reality, NFT, QR Code technologies | Use of software to create virtual showrooms, creation of digital samples, digital design | CAD, metaverse, 3D modelling |

| | | | |
|------------|--|---|--|
| | | software (e.g. Clo3d, Optitex, Marvelous) | |
| Marketing | Digital marketing, app creation for product previews, e-commerce, new business models (e.g. fashion renting) | Marketing techniques, SEO and SEM, online sales techniques (e-sales), social networks, new business models | Social media marketing, online advertising, tools and software for digital marketing (Google Ads, Google Analytics, Meta ADS, etc.). |
| Production | 3D printing, blockchain, digital tools for measuring production performance, technologies for customisation, big data analysts (to facilitate decision-making), advanced sensing in processes to avoid waste | Fabric customisation, use of 3D printing machinery, knowledge of material types and characteristics for 3D printing, predictive data analysis | 3D printing techniques, big data, blockchain |

4.1.3 Smart

Table 6. Smart

| Functional areas of the company | Technology/innovation/changes | Knowledge needed to perform the process | Priority Training Topics to be addressed |
|--|---|---|---|
| Design & Styling | New technological fabrics | Knowledge of smart materials (e.g. reactive), digital techniques applied to fashion fabrics | Innovative textile design |
| Research & Development - Marketing | Data collection | Knowledge of automatic product traceability methods from supplier to consumer (weaving machines) with verifiable quality reporting, marketing techniques (creation of a product line and brand) | Traceability, Branding |
| Research & Development - Product Engineering | Sensor technology applied to textiles, adoption of nanotechnology | Knowledge of innovative technologies used in design, applications in different sectors (Clothing, Construction, Architecture, Medical...), electronic applications | New smart technologies: integration between textiles and electronics, RFID technologies in fibres |

5. Initial and further education on advanced textiles

In Italy, existing training on advanced fabrics is very much focused on digital and green rather than smart knowledge. The training programmes do not consider much the innovations or technologies illustrated in the previous chapters, but consider an outgoing profession that is usually a classic profession enhanced by a few skills related to the green transition, digital transition and smart transition.

As far as the green area is concerned, meetups and workshops with companies have highlighted the need for workers who know how to use tools to implement the dictates of the circular economy in practice and not only in theory, who have knowledge of the process and product life cycle, how to recycle discarded or defective fabrics, with a complete vision of the processes and the entire supply chain in a sustainable way. Companies are also required to have knowledge of communication and marketing in order to be transparent to consumers and avoid cases of green washing. Finally, engineering/IT knowledge is needed for the traceability of textile products. Today, the education world is very focused on eco-design and the design of sustainable products: the label “sustainable fashion design” is very trendy, but the topics are generally approached in a very theoretical way, in contrast to the needs expressed by companies. The other topics highlighted in the previous paragraphs are hardly ever considered in training programmes, except in short modules. The main difficulty is that new green materials and textiles, certifications and new regulations on textile waste are very new topics, which are little or not at all known by current trainers in education systems.

For the digital part, there are many courses especially on CAD and 3D modelling, often associated together, and on graphic product design. It is very trendy to use the word '4.0', used to label courses such as 'Tailoring 4.0', 'Craftsman 4.0', 'Textile 4.0', used to connote learning about technologies related to Industry 4.0 or to label it as a modern course. There are also many digital marketing courses, but they are often generalist and almost never contextualised to the textile sector. There are often courses that combine elements of digital and green, such as the course organised by ITS TAM for Technician of Sustainability and Technological Innovation of Textile Processes, which focuses on the technological processes of the textile supply chain, including key concepts such as LEAN and ADDITIVE manufacturing, but also providing an insight into sustainable aspects such as products and technologies with a low environmental impact aimed at saving energy.

As with the green part, the education system has a substantial gap with the needs of businesses, which require skills regarding the digitalisation of the supply chain, technicians who know how to use software to make business processes and production control activities more efficient, cyber security activities to protect production activities and sensitive data (especially new samples or new materials), skills to make prototypes, products in virtual/augmented reality and in the metaverse, which are factors that are revolutionizing the textile world.

For the SMART section, courses in Italy are still few and not completely focused on smart topics. Often these courses are not "pure," as they also collect digital and green topics. However, there are some VETs (e.g., Centrocot) or ITS foundations (e.g., ITS MITA, ITS SMART ACADEMY or ITS Machina Lonati) that offer innovative courses with topics on new technologies for the Made in Italy fashion system or that illustrate the innovative potential of the integration of Textiles and Electronics.

According to surveys and meetups with VET/HEIs, there is still a lack of training courses that illustrate on a practical level the types of smart textiles and workshop activities that can teach how to make these smart textiles, especially contextualizing to different application fields - e.g., Apparel, Construction, Architecture, Medical. In this section, business stakeholders suggest that, in contrast to digital and green, more training should be organised to focus on research and technical characteristics of advanced fabrics (e.g., working on the concepts of thermal insulation, water repellency, elasticity, sensor tools, ways to collect biometric information such as heart rate or detection of fabric tension, localised muscle strain, and respiration).

Among the three areas, this is the one with the largest training lag, partly because the companies themselves have invested less on smart activities, focusing more on digital and green activities: this gap is reflected in the education and training system.

6. Conclusions

The research results show that Italian textile companies are aware that important changes are ongoing and they will have to rethink their business processes and products in order not to become obsolete and non-performing for their customers. New technologies, new digitalised processes, and new smart and sustainable materials all emerged from the survey and are revolutionising the textiles industry.

The smart area was the most complex in the survey, because representatives of textile companies had difficulty identifying smart innovations in the textile industry, often confusing them with green or digital innovations, while those that are properly smart are currently seen as a type of innovation that is not totally applicable at this moment in the Italian textile industry. This view is amplified in the educational system, where skills are still anchored to traditional skills, but they are beginning to interface with the green field (circular economy activities, although still in a too theory-based way) and the digital field especially for the use of CAD. For many textile managers, the real challenge of the future will be the introduction of the textile world into the metaverse.

The research also tells us that there is a double gap. The results of the desk research revealed innovations and trends on the 3 thematic areas (digital, green, and smart) that some textiles companies did not even know about, while a good part knew about them but did not think of applying them in the short term in their own businesses, and only a small part of the companies involved applied them. Therefore, the first gap is the average technological level of Italian textile companies still far from some innovations already applied in other national or other international textile industries. The second gap is created by the companies (aware of the existence of innovations in the 3 fields and know what they need to raise their technological level) and the educational system that is still anchored to classical figures and timidly trying to update their educational curricula and courses.

In conclusion, the overall impression that resulted after the 4 tasks is that Italian textile companies are aware that they should change their business processes to accommodate the challenges of the 3 transitions (digital, green, smart), but they are slowed down by a lack of knowledge about innovations in the industry and a general climate of uncertainty, triggered by both the post pandemic effects of Covid-19 and rising energy costs, which have put some relevant strategic decisions, which are considered critical for survival in the global market.

7. Annexes

| Country | Title of resource | Type of resource | Level | Education level | Area | Curricula title | Main topics |
|---------|-------------------|------------------|--------|-----------------|--|--|---|
| Italy | Centrocot | ITS | 5° EQF | Green | Technology sustainability manager | Eco-design for sustainable products; sustainability assessment of raw materials and chemicals involved in production processes; sustainability reporting; technological solutions and cross-sectoral collaborations for the reuse of waste and end-of-life products | https://www.centrocot.it/portfolio/technology_sustainability_manager/ |
| Italy | Centrocot | IFTS | 4° EQF | Green | Textile Innovation & New Materials | Sustainable innovation, innovative textile materials | https://www.centrocot.it/portfolio/corso-ifts-textile-innovation-new-materials-anno-formativo-2022-2023/ |
| Italy | Formodena | IFTS | 4° EQF | Digital | High specialised technician in digital graphic design of fashion | Digital fashion collection design, product trend research and textile merceology, digital graphics, fashion product communication. | https://www.formodena.it/courses/corso-ifts-tecnico-per-la-progettazione-grafico-digitale-del-prodotto-modanuova-approvazione/ |
| Italy | Formodena | ITS | 5° EQF | Digital/Green | High specialised technician in process and product of the fashion system 4.0 - Fashion Product Manager | Collection design, collection marketing techniques, retail management and organisation, e-commerce operating chain, industry regulations with a view to environmental sustainability, principles of circularity and sustainability at the creative and design levels | https://www.formodena.it/courses/bienno-its-fashion-product-manager/ |
| Italy | Formodena | Master | 4° EQF | Digital | CAD Design Course - Advanced Level | Use of CAD modelling programmes to graphically represent the model of the collection garment (software: Lectra Modaris). | https://www.formodena.it/courses/corso-modellistica-cad-livello-avanzato/ |



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| Country | Title of resource | Type of resource | Level | Education level | Area | Curricula title | Main topics |
|---------|-------------------|------------------|--------|-----------------|---|--|---|
| Italy | ITS TAM | ITS | 5° EQF | Green | High specialised technician in Sustainability and Technological Innovation in Textile Processes | LEAN and ADDITIVE manufacturing, product traceability, sustainability strategies, eco-friendly products and technologies | https://www.its-tessileabbigliamento.com/corsi/tecnico-superiore-dei-processi-tecnologici/ |
| Italy | ITS TAM | ITS | 5° EQF | Green/Digital | High specialised technician in Product, Design, Marketing and Communication for Textiles | Circular and sustainable economy in textiles, sustainable raw materials, ecodesign, web marketing | https://www.its-tessileabbigliamento.com/corsi/tecnico-superiore-di-prodotto-progettazione-e-design/ |
| Italy | ITS MITA | ITS | 5° EQF | Green/Digital | ARTIST-Advanced Revolution process Technician in Innovation Sustainability Textile | Digitalisation of manufacturing, textile innovation, circular economy and sustainability, traceability and data analysis | https://mitacademy.it/corsi/corso-artist/ |
| Italy | ITS MITA | ITS | 5° EQF | Digital | D.B. MITA-Web Marketing and Digital Brand manager for Made in Italy | Web Marketing, Digital Branding for Made in Italy | https://mitacademy.it/corsi/corso-d-b-mita/ |
| Italy | ITS MITA | ITS | 5° EQF | Digital | P.R.I.M.O.-High Specialised technician in Prototypes and Innovative Materials | Innovative Textile Materials, Fashion Product Patterns-Prototypes | https://mitacademy.it/corsi/corso-primo/ |

| Country | Title of resource | Type of resource | Level | Education level | Area | Curricula title | Main topics |
|---------|-----------------------------|------------------|--------|-----------------|--|--|---|
| Italy | Starting Work | IFTS | 4° EQF | Green | SUSTAINABLE MADE IN ITALY | Sustainability; Textile supply chain, production clusters and fashion system; Sustainable product trace, Textile design/graphics, from material to digital. Recycling, reuse, upcycling, creative recycling. Neuro-ecomarketing. | https://www.master-ifts.it/moda-made-in-italy-ifts/ |
| Italy | LA FABBRICA DELLE IDEE SRL | IFTS | 4° EQF | Digital/Green | Fashion Designer 5.0 | Design of 3D and 4D textiles models, marketing, prototyping, elements of ecology and sustainability of raw materials. | https://www.fondazioneisio.org/it/cultura/eventi-cultura-tessile/nuovo-corso-ifts-gratuito/ |
| Italy | Accademia professionale Pbs | IFTS | 4° EQF | Digital | Fashion design and business management techniques for craft 4.0 in Made in Italy | Technological innovations, process and product innovations, brand positioning in real and virtual markets, tools for craftsman 4.0 | https://www.accademiapbs.it/course/ifts-fashion-design/ |
| Italy | ITS MACHINA LONATI | IFTS | 4° EQF | Digital | High Specialised technician in promotion of Made in Italy for fashion, design and events | Software and techniques prototyping, 2D and 3D design | https://www.cfplonati.it/uploads/allegati/Brochure_IFTS_MadeInItaly_2021.pdf |

| Country | Title of resource | Type of resource | Level | Education level | Area | Curricula title | Main topics |
|---------|---------------------------|------------------|--------|-----------------|--|---|---|
| Italy | Società umanitaria | IFTS | 4° EQF | Digital | Master's degree fashion & design - Technician in communication, commercialisation and marketing of the fashion and design supply chain | Marketing and communication, retail, brand management, IT, new technologies; industry 4.0; artificial intelligence; sustainability. | https://www.umanitaria.it/formazione/alta-formazione/corsi-alta-formazione/1175-master-fashion-design-tecnico-per-la-comunicazione-commercializzazione-e-il-marketing-della-filiera-produttiva-moda-e-del-design |
| Italy | ACOF | IFTS | 4° EQF | Digital/Green | Techniques for the production of Made in Italy products - Women's wear: technical design of innovative and sustainable collections | Designing innovative and sustainable women's clothing collections in compliance with the standards of Made in Italy, design and craftsmanship with new 4.0 technologies | https://www.acofbusto.it/wp-content/uploads/2021/07/ACOF_Borsano_WomensWear_A5-EXE.pdf |
| Italy | ITS SMART ACADEMY (Fermo) | ITS | 5° EQF | Digital | High specialised technician in the development and valorisation of the fashion industry, in business communication and web marketing | Social Media, Digital Marketing and Digital Advertising; Visual Storytelling, Graphics and Digital Tools; Web design; Video for the web; E-Commerce | https://www.itssmart.it/wp-content/uploads/2021/09/ITS-SMART_MODA.pdf |

| Country | Title of resource | Type of resource | Level | Education level | Area | Curricula title | Main topics |
|---------|---------------------------|------------------|--------|-----------------|--|--|---|
| Italy | ITS SMART ACADEMY (Fermo) | ITS | 5° EQF | Smart | High specialised technician in production, quality and innovation in the fashion system | New Technologies for the Made in Italy Fashion System. | https://www.itssmart.it/moda-produzione/ |
| Italy | ITS MACHINA LONATI | Master | 4° EQF | Smart | Technological stylist | Tailoring 4.0; 3D design software | https://www.itsmachinalonati.it/stilista-tecnologico-corso |
| Italy | ITS COSMO | ITS | 5° EQF | Green | Fashion sustainability manager | Sustainability and circular economy, principles of business economics and organisation in the fashion supply chain, sustainable supply chain management methods, socio-environmental risk analysis | https://www.itscosmo.it/corsi/veneto/valdagno/fashion-sustainability-manager/ |
| Italy | ITS COSMO | ITS | 5° EQF | Green | Technology Sustainability Manager | Eco-sustainability in textiles and fashion, the regulatory framework of sustainability and corporate, environmental and chemical management systems; sustainable reporting, transparency and traceability of data. | https://www.itscosmo.it/corsi/lombardia/busto-arsizio/technology-sustainability-manager/ |
| Italy | ITS COSMO | ITS | 5° EQF | Digital | High specialised technician in Marketing and web strategy for internationalisation in the fashion industry | Web marketing, new technologies for the made in Italy fashion system | https://www.itssmart.it/moda-marketing/ |
| Italy | PIN | Master | 4° EQF | Green | Sustainable Fashion Supply Chain Management | Circular Economy, Sustainability Reporting and KPIs, Certification, CSR, Sustainable | https://www.pin.unifi.it/filieramodasostenibile |

| Country | Title of resource | Type of resource | Level | Education level | Area | Curricula title | Main topics |
|---------|-------------------|------------------|--------|-----------------|---|---|---|
| | | | | | | Business Models, EMS & Environmental Regulation, Traceability | |
| Italy | PIN | IFTS | 4° EQF | Green | REFITES- Sustainable Textile Supply Chain Manager | Textile material technologies, sustainability certifications, sustainable textile supply chain management | https://www.pin.unifi.it/refites |