



DigitX

Innovation Hub

by



ETP

Fibres Textiles Clothing

EUROPEAN TECHNOLOGY PLATFORM

The Digital Transformation of the European Textile and Apparel Industry

A Strategic Roadmap developed by the DigitX Innovation Hub

LECTRA SMARTEX.AI

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This strategy was collaboratively developed by over 100 experts from the European textile and apparel industry, technology, research and higher education community under the **DigitX Innovation Hub** initiative.

The DigitX Innovation Hub is co-led by the **European Technology Platform for the Future of Textiles and Clothing** (Textile ETP), EURATEX, and Lectra, with the input and support of Smartex.ai, Suomen Tekstiili & Muoti, ITA Academy, Politecnico di Milano, and CITEVE.

The Hub is a community-driven initiative designed to help European textile businesses become fit for the digital future. Under the theme "From AI to DPP: making European textile businesses fit for the digital future", its activities are organised around three core innovation themes: Artificial Intelligence & Digital Product Creation, Digital Manufacturing & On-Demand Production, and Digital Supply Chain & Digital Product Passports

These themes are delivered through monthly learning webinars, in-person meet-ups at major European trade fairs, hands-on workshops, and a dedicated community platform that brings together industry, research, technology providers, and policy actors.

More information on: www.textile-platform.eu/innovation-hub-digitx



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The present DigitX strategy describes **how the digital transformation of the European textile and apparel industry should be tackled**, what technology levers we can pull and what role each stakeholder in this rich and complex ecosystem must play, including EU policy makers and programme managers who can greatly improve the odds for this industry to succeed.



The current set-up of the global textile and apparel industry with the majority of volume production concentrated in low labour cost countries, primarily in Asia and long lead time, fragmented and wasteful supply chain operations that produce based on imprecise forecasts for highly volatile end markets is not the result of laws of nature nor is it an accident of history. It is a result of the industry's failure to innovate manufacturing technologies that enable highly automated clean production processes in agile integrated manufacturing clusters close to the point of final consumption and to adopt business models that favour on-demand provision of customised quality products to highly diverse consumer and professional end markets.

Thanks to rapid digital innovation the technology toolbox available to this industry is rapidly changing so that product creation, manufacturing and supply chain operations can be revolutionised through artificial intelligence, advanced robotics, digital twins, smart factories, traceable supply chains and digitally enabled business models that make local on-demand production in Europe a viable option again.

“Digitise or Die” is a rather dramatic slogan that is sometimes used to describe the consequences for companies or whole industries that fail to adapt to the rapid digitalisation that is sweeping all sectors of the economy and all functions of a modern enterprise. This digital wave is also at the doorsteps of textile and apparel businesses, while many aspects of this industry remain deeply physical, analogue and human, from the complex material composition of a yarn or fabric, to the chaotic interaction of chemical molecules with textile fibres in a wet process to the deeply subjective feeling of a beautiful, comfortable and well-fitting garment.

Combining the physical world of fibres and textile machines with the digital world of bits and bytes and soft factors like creativity, hands-on expertise or consumer psychology with rational and precise data-driven decision making in complex fast-paced supply chains are not easy tasks. But they must be undertaken, not only in the interest of greater competitiveness of the EU industry, but also to fully comply with a diverse set of upcoming EU regulations including the Digital Product Passport and to operate at a much higher level of sustainability and circularity in line with the vision of the EU strategy for sustainable and circular textiles.

The present DigitX strategy describes how the digital transformation of the European textile and apparel industry should be tackled, what technology levers we can pull and what role each stakeholder in this rich and complex ecosystem must play, including EU policy makers and programme managers who can greatly improve the odds for this industry to succeed. There is a true opportunity to revive this traditional manufacturing sector that is so deeply embedded in Europe's economic and cultural fabric in the interest of greater resilience, strategic autonomy and sustainable production and consumption of textile products that are genuinely European. Let's grasp it.

Marina Crnoja-Cosic

President of the European Technology Platform for the Future of Textiles and Clothing (Textile ETP)





Europe's textile and apparel industry is going through a difficult but important transition. Digitalisation is becoming central to how companies will design products, manage supply chains, comply with regulation, reduce waste and remain competitive in global markets.

For EURATEX, the value of this roadmap lies in its practical focus. It does not look at digitalisation as an abstract concept, but as something that must work across a complex and fragmented value chain, made up mostly of SMEs, specialised suppliers, manufacturers, brands, technology providers, research centres and training organisations.


The roadmap also shows that the digital transition cannot be left to individual companies alone. Common data standards, interoperable systems, trusted data-sharing models, affordable digital tools and new skills will be essential if this transformation is to reach the whole sector and not only the largest or most advanced companies.

EURATEX therefore welcomes the work of the DigitX Innovation Hub. It provides a useful basis to identify where collective action is needed and where EU policy and funding can help accelerate deployment. In particular, the roadmap can support discussions on future EU funding, including the next MFF and the proposed European Competitiveness Fund, Horizon Europe, Digital Europe and skills-related programmes.

The priority now should be implementation: making sure that digital solutions are accessible, affordable and relevant for companies on the ground. If Europe wants a competitive, circular and resilient textile and apparel ecosystem, digitalisation must become a practical enabler for industry, not an additional layer of complexity.

A handwritten signature in black ink, appearing to read 'Mario Jorge Machado', located below the main text.

Mario Jorge Machado
President of the European Apparel and
Textile Confederation (EURATEX)



The European textile and apparel industry (194,000 companies, 1.2 million workers, an annual turnover of over €166 billion, and 99.8% SMEs) stands at a decisive inflection point. Three converging pressures make digital transformation an existential necessity rather than a strategic option.

First, the agility imperative: traditional slow product development processes and document-driven workflows cannot keep up in a world characterised by volatile end market demand, disrupted supply chains, and the algorithmic speed of ultra-fast digital-savvy competitors, whether in fashion, home or technical textiles. **Second**, the regulatory imperative: the Ecodesign for Sustainable Products Regulation, the Digital Product Passport, the Corporate Sustainability Due Diligence Directive, the Waste Framework Directive and a parallel wave of horizontal EU digital legislation (AI Act, Data Act, Data Governance Act, Interoperable Europe Act) are turning sustainability and digital capability into a non-negotiable licence to operate. **Third**, the traceability imperative for circularity and service-driven business models: resale, rental, repair, and performance-based contracts for technical textiles are structurally impossible without deep product-level data and their handling in seamless largely automated workflows across the value chain.

The DigitX vision for 2035 is a **digitally integrated, transparent and responsive European textile value network**, built on four interdependent technology layers:

- a **Data Layer** that gives the industry a common, machine-readable language and a federated, European-governed data infrastructure;
- a **Hardware Layer** of digitised machines, IoT-enabled production lines, physical tracers, and hybrid human-robot collaboration that enhances rather than displaces craft skills;
- a **Software Layer** of interoperable, affordable, API-first SaaS tools that any SME can use;
- and a **Human & AI Layer** in which augmented workers and AI agents operate together under a clear human-in-the-loop architecture, with explicit validation steps at every consequential decision.

Four Core Building Blocks translate this vision into actionable innovation priorities:

1. Data Infrastructure: a harmonised European Textile Data Ontology, sector-specific data spaces, automated data acquisition, and compliance-by-design architectures;
2. Digital Product Creation: standardised digital fabric properties, AI-powered design and trend sensing, design-for-circularity tools, and simulation for technical textile performance;
3. Digital Production: on-demand and small-batch systems, smart-factory upgrades for existing facilities, AI-driven quality assurance, and textile-specific robotics and automation;
4. Digital Supply Chain: automated standards-based data exchange, multi-tier visibility, AI-powered orchestration and risk management, and Manufacturing-as-a-Service platforms.

Each building block tackles a concrete pain point identified by the expert community, with maturity assessments and time-phased KPIs from 2026 to 2035.

Delivering this transformation will require **Collective Action** across the ecosystem. Five cross-cutting actions cannot be accomplished by any actor alone:

- co-developing the **European Textile Data Ontology**;
- building and populating **shared digital fabric libraries**;
- establishing **end-to-end DPP data flow** across all supply chain tiers;
- creating real-time **digital feedback loops** between recyclers and designers;
- and developing a cross-border **digital skills and talent pipeline**.

These actions require pre-competitive collaboration between fibre producers, manufacturers, brands, technology providers, recyclers, research institutions, and standardisation bodies, coordinated by the European Textile Technology Platform, EURATEX, national associations, and regional clusters.

To accelerate this transformation, the strategy presents ten concrete **Recommendations to EU Policy Makers**. The four highest-priority recommendations are to:

1. link sustainability regulation explicitly to digitalisation and competitiveness;
2. mandate interoperability and open standards for all publicly funded digital innovations;
3. establish and fund a European Textile Data Space with 500+ active participants by 2030; and
4. fund the collaborative development of a harmonised Textile Data Ontology

The remaining six recommendations include flexible, low-bureaucracy funding schemes, including digital vouchers, subsidised SaaS and cascade funding that genuinely reach SMEs, startups, and scale-ups, support of lighthouse projects in breakthrough innovation, launch large-scale digital skills and upskilling programmes, modernise the digital infrastructure of research and education centres, support collective standard-setting and best-practice propagation, and designate e-textiles and smart wearables as a strategic innovation priority.

The choices made in the next three to five years will determine whether Europe heads toward **a Digital Renaissance** with a competitive on-shore value chain, **a Euro-Mediterranean Digital Belt** with seamlessly orchestrated Pan-Euro-Med production, a hollowed-out branding outpost dependent on Asian manufacturing, or the loss of its textile industry altogether. The DigitX strategy charts a credible course toward the first two futures. Inaction leads inexorably toward the last two. The technology is ready, the regulatory framework is slotting into place, and the industry's experts have spoken clearly.

What remains is collective will, coordinated investment, and decisive action - now.

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Introduction and Methodology

Objectives

This document presents a coherent and forward-looking vision for the digital transformation of the European textile and apparel industry. It has been developed as a collective exercise within the DigitX Innovation Hub of the European Technology Platform for the Future of Textiles and Clothing (Textile ETP), bringing together industry leaders, technology providers, research organisations, and education and training experts from across the European textile ecosystem. The strategy aims to:

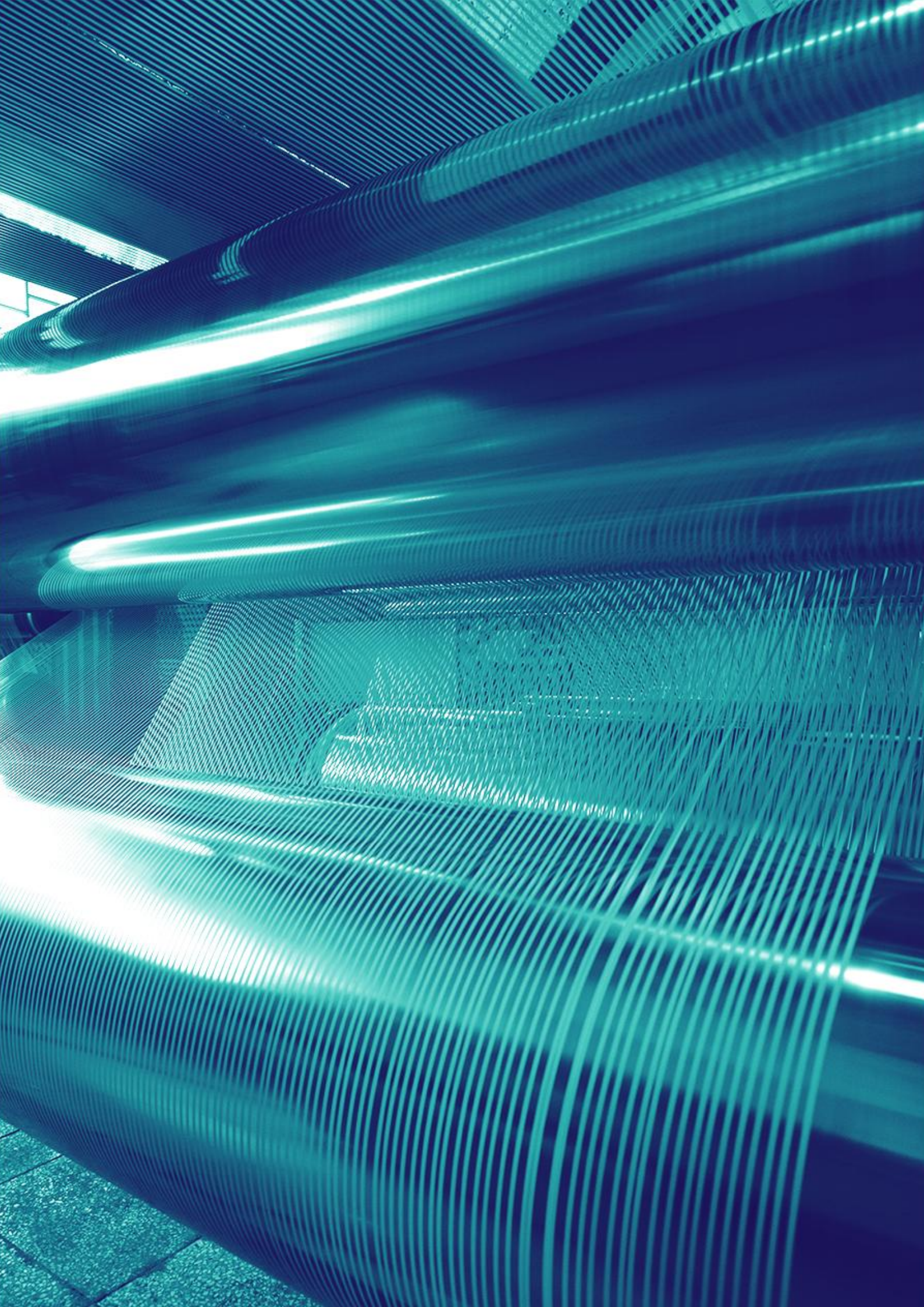
- articulate a shared 2035 vision for a digitally integrated European textile and apparel industry;
- identify the critical technology building blocks, innovation priorities, and structural enablers required to deliver on that vision;
- assign concrete roles and actions to each stakeholder group across the value chain; and formulate clear, evidence-based recommendations to EU policy makers and programme managers.

It is intended both as a strategic compass for industry actors and as a structured input to ongoing European policy and funding decisions affecting the textile sector.

Methodology

The strategy was elaborated over a period of six months through a structured, expert-driven process combining two online co-creation sessions and one complementary online survey. The first co-creation session focused on framing the current state of the industry, identifying the most pressing innovation challenges, and surfacing emerging priorities across digital product creation, digital production, digital supply chain, and data infrastructure. The second co-creation session, held two months later, validated and deepened the emerging strategic directions, sharpened the recommended actions for each stakeholder group, and explored alternative future scenarios for the European textile industry in 2035. The online survey provided an additional input channel, enabling experts who could not join the live sessions to contribute their assessment of technology priorities, barriers, and recommended policy responses. Each session combined interactive polling, visual collaborative mapping, and moderated thematic discussions to capture both quantitative rankings and rich qualitative input. The detailed inputs and results of both sessions and the survey are available in the dedicated working files of the DigitX Innovation Hub.

The entire process was guided and validated by a Strategy Board composed of selected experts representing each of the main stakeholder groups in the textile and apparel value chain: industry; technology and software providers; researcher and academic institutions; and industry associations and clusters. The Strategy Board met regularly to steer the work, review intermediate results, ensure balance across stakeholder perspectives, and validate the conclusions before publication. The outcome is a strategy that is rooted in the practical experience of those operating the European textile and apparel industry today, while remaining ambitious enough to chart a credible path toward 2035.





The Triple Challenge of Industry Transformation

The European textile and apparel industry is one of the continent's oldest and most culturally significant manufacturing ecosystems. **With approximately 194,000 companies, 1.2 million workers, and an annual turnover exceeding €166 billion, the sector remains a pillar of European industrial identity**, deeply embedded in local economic clusters. It sustains commercial activity in a broad range of service sectors from logistics, retail, hospitality to cultural, creative and educative activities. Its competitive position on the global stage rests on a distinctive duality: **Europe is a leading exporter of luxury fashion and premium interior textiles, and advanced technical textiles for automotive, aerospace, medical, construction, and protective applications**, while simultaneously being a major importer of fibres, yarns, fabrics, and mass-market commodity products, predominantly from Asia.

Structurally, the industry is overwhelmingly composed of micro, small, and medium-sized enterprises (MSMEs), which account for 99.8% of all textile companies. High-value activities such as design, branding, R&D for technical textiles, advanced finishing or fully automated carpet production are concentrated in Western Europe (Italy, France, Germany, the Netherlands, Belgium), while significant conventional textile and garment manufacturing capacity exists across Portugal, Poland, Romania, Türkiye, and the Mediterranean rim.

The vast majority of companies in the industry are specialised in one or very few related processes along the supply chain: a textile manufacturer may source synthetic fibres to make technical yarns that they then sell to specialised weaving or knitting companies, and a fashion brand may design their own products which they then get manufactured by a network of independent suppliers and market through the wholesale channel. This geographical and structural fragmentation creates a complex web of supply relationships spanning multiple tiers and continents, often mediated by agents and intermediaries. **Supply chain disintegration, primarily a result of selected outsourcing of the most labour-intensive processes, is one of the most defining features of this industry and responsible for a great deal of inefficiencies that plague the sector.** These include long-range forecast-based inflexible manufacturing organisation, slow capital turnover and poor economics for most manufacturers, structural over-production and waste generation, slow technology and material innovation cycles, lack of transparency and inefficient flow of information as well as a low level of digital maturity compared to many other sectors.

This industry now faces three converging pressures that make digital transformation not a strategic option but an existential necessity.

Speed & Precision: The Agility Imperative

The traditional fashion calendar, with its 12-18 month lead times, seasonal collections, and speculative production, is increasingly struggling with volatile consumer demand, disrupted supply chains and the competitive pressure of ultra-fast fashion players whose algorithmic supply chains can move from trend identification to delivery in under two weeks. **European manufacturers and brands cannot and should not compete on the same economic terms, but they must develop a new form of agility: the capacity to make rapid, data-driven decisions about what to produce, in what quantities, and for which markets.**

Europe's competitive strength lies not in mass-market volume but in its ability to serve demanding niche markets, from haute couture and luxury interior textiles to high-performance protective equipment, medical textiles, and advanced composites for automotive and aerospace. **This niche orientation is a strategic asset that digitalisation can decisively amplify:**

- precise, data-driven product development that accelerates innovation cycles for specialised products;
- flexible, digitally integrated production systems that make small-batch and custom manufacturing economically viable;
- and AI-enhanced customer intimacy that identifies and responds to niche demand signals faster or more precisely than any competitor.

Achieving this requires replacing fragmented, email-and-spreadsheet-based workflows with integrated digital systems that connect design, sourcing, production planning, and market intelligence in near-real-time. For technical textiles, where product development cycles are driven by performance specifications, certification requirements, and industrial customer timescales, the agility imperative manifests differently but no less urgently: shorter innovation cycles, faster time-to-certification, flawless technical documentation, and the ability to rapidly configure and deliver custom technical solutions.

Regulatory Compliance: The License to Operate

The EU's Green Deal legislative framework has transformed sustainability from a voluntary corporate initiative into a mandatory condition of market access:

- The Ecodesign for Sustainable Products Regulation (ESPR), with its requirement for Digital Product Passports (DPP) covering textile products by approximately 2028, demands that every product placed on the EU market carry a machine-readable digital record verifying its sustainability credentials, from recycled material content and presence of certain chemicals, to information for repair operators and recyclers and product environmental footprint.
- The Corporate Sustainability Due Diligence Directive (CSDDD) imposes legal liability for environmental and human rights violations deep in the supply chain.
- The Waste Framework Directive's Extended Producer Responsibility (EPR) provisions, and sector-specific technical standards for PPE, medical textiles, and construction products all add layers of compliance that are impossible to manage through analogue, or document-push based methods.
- For technical textiles, the regulatory landscape includes additional complexity: Market Surveillance Regulation (MSR) enforcement, CE marking requirements, REACH compliance for specialised chemicals, and dual-use export controls.

Without the digital infrastructure to capture, verify, and transmit this data across multiple supply chain tiers, companies will face market exclusion. Current methods, such as reliance on PDF certificates, Excel spreadsheets, and manual data re-entry, are neither scalable nor reliable enough for the granularity and auditability that the new regulatory framework demands.

Beyond product-specific sustainability rules, a parallel wave of EU horizontal legislation on digitalisation and artificial intelligence is reshaping the regulatory environment in which textile companies operate. The EU AI Act introduces a risk-based framework for AI systems, with concrete transparency, governance, and human-

oversight obligations that are directly relevant to AI applications in design, quality control, supply chain orchestration, and worker monitoring. The Data Act and the Data Governance Act together establish the rules for industrial data sharing, access to data generated by connected products and machines, and the operation of trusted data intermediaries, foundational instruments for the sector-specific data spaces and Digital Product Passport infrastructure on which textile digitalisation depends. The Interoperable Europe Act reinforces the use of open standards and shared technical specifications across European digital services, supporting the kind of cross-border interoperability that textile value chains require to operate at scale. Together, these acts function both as enablers, providing legal certainty, common standards, and access rights that make digital business models viable, and as compliance boundaries that companies must respect when designing and operating their digital systems.

Traceability for Circularity and Service-Driven Business Models

The transition from linear to circular business models is structurally impossible without deep data integration. But **the shift goes beyond circularity:** the European textile industry is increasingly moving from a purely sales-driven model, where the transaction ends at the point of sale, to service-driven business models that require a fundamentally different digital relationship with customers and end users. Resale, rental, repair-as-a-service, performance-based leasing of technical textiles, and managed workwear programmes all depend on ongoing knowledge of the product's location, condition, usage patterns, and remaining service life. These models demand real-time digital interaction with the customer or user at a level that analogue, sales-and-forget business practices simply cannot support.

This service orientation aligns naturally with Europe's niche market strength. Serving specialised and high-value market segments (whether luxury hotels who value impeccable product and service quality, or industrial clients who require guaranteed performance from their protective equipment) creates **fertile ground for service-driven models where digital data becomes the basis for ongoing value creation rather than a one-time compliance exercise.**

The specific data requirements of these models are substantial. Automated sorting for recycling requires precise, and machine-readable data on fibre composition, chemical treatments, and material construction methods. Resale and rental platforms depend on digital authentication, condition tracking, and ownership history. Repair services require access to construction data, spare parts specifications, and care instructions, all of which a DPP can host and deliver.

For technical textiles, traceability and digital service models serve additional purposes: tracking performance degradation over a product's service life (critical for PPE and protective workwear leasing), managing the complex material compositions of multi-layer composites, enabling performance-based contracts where customers pay for guaranteed protection or functionality rather than purchasing products outright, and ensuring that recycled technical fibres meet the stringent performance specifications required for re-entry into high-value applications.

Together, these three pressures (agility, compliance, and circularity/service-readiness) define a transformation that goes far beyond adopting new software tools. They demand a new data infrastructure, new workflows, interoperable digital technologies, and new skills across the entire value chain.





The Vision: A Digital Textile & Apparel Industry in 2035

By 2035, the European textile and apparel industry will have transitioned from an analogue, fragmented, and often opaque ecosystem into a digitally integrated, transparent, and responsive value network, or it will have largely ceased to exist. This is not a utopian fantasy, but **a practical necessity dictated by regulatory deadlines, competitive dynamics, and the physical requirements of circularity**. The vision is ambitious but achievable, built on four interdependent technology layers that together form the architecture of the industry's digital future.

The Data Layer: A Common Language for the Industry

What it looks like in 2035

A harmonised sector-specific data infrastructure enables the seamless, secure, and automated flow of structured data across the entire textile value chain, from Tier 4 raw material extractors through spinning, weaving, dyeing, finishing, and assembly, to brands, retailers, consumers, and end-of-life operators. The "Tower of Babel" problem, where a fabric mill's system cannot communicate with a brand's product lifecycle management (PLM), which cannot either communicate with a recycler's sorting line, has been resolved through the adoption of standardised semantic ontologies, interoperable data formats, and shared data spaces.

Core components

- **Standardised semantic ontologies:** A unified machine-readable vocabulary for textile products and processes (built on open standards and maintained by a multi-stakeholder governance body) standardises descriptions of fibre types, fabric constructions, chemical treatments, performance properties, environmental footprints, and end-of-life instructions. DigitX industry experts consistently identified standardised semantic ontologies as one of the most critical elements of the data layer, while also recognising that they will take the longest to become an industry standard. This combination of high importance and long lead time underscores the urgency of starting now.
- **Interoperable data spaces:** Decentralised federated data architectures (aligned with the European Data Strategy and built on frameworks such as the International Data Spaces Association (IDSA) reference architecture) allow companies to share specific data sets with authorised partners without surrendering control of their proprietary information. These address the trust deficit identified throughout the co-creation process, where suppliers fear that data sharing will lead to disintermediation and creators the loss of their intellectual property. European data sovereignty emerged as a strong theme in the DigitX expert community discussions: the industry needs European-hosted and European-governed data infrastructure rather than dependence on non-European platforms.
- **Circular material passports & DPP infrastructure:** Every textile product carries a persistent, machine-readable digital identity linked to a DPP that accompanies the product through its entire lifecycle, from creation through multiple use cycles to end-of-life processing. This emerged as the single most critical element of the data layer in expert assessments and once established by law in the consumer clothing market, DPPs may also be voluntarily adopted for technical products in professional and service-driven end markets.
- **Distributed Digital Identifiers and business IT guardrails:** The data layer relies on a new generation of distributed digital identification and verification mechanisms. Decentralised Identifiers (DIDs) and Verifiable Credentials allow supply chain actors to prove specific claims (e.g., organic certification, factory audit status) without revealing their full identity or commercial relationships. These mechanisms are reinforced by emerging business IT guardrails such as the European Digital Identity Wallet (the EU Business Wallet), which provides a trusted, interoperable framework for companies to authenticate themselves and exchange verified data across borders, and the United Nations Transparency Protocol (UNTP), which offers a globally aligned approach to supply chain transparency that prevents the DPP from becoming a purely European silo disconnected from global trade flows. Together, these tools create the trust infrastructure that makes data sharing viable in a sector characterised by fragmentation and secrecy.
- **Automated data acquisition:** Sensors, IoT gateways, and AI-assisted data collection tools that capture production process or logistical data at source, eliminating manual entry and the quality problems that accompany it and establishing the starting point of an unbreakable chain of custody. The DigitX expert community identified automated data acquisition as the most important foundational technology for the data infrastructure layer.

The Hardware Infrastructure Layer: Digitised Machines, Automation & Robotics

What it looks like in 2035

European textile and apparel factories operate as digitally connected, highly automated production environments. Machines across all process stages (from spinning, weaving, knitting, dyeing, printing, finishing, cutting, sewing, and assembly) are equipped with sensors, edge computing capabilities, and standardised digital interfaces that feed data continuously into factory-level and supply-chain-level information systems.

Core components

- **IoT-enabled production equipment:** Every major piece of production equipment communicates its operating state, output quality, energy consumption, and maintenance status in real-time. This is

the foundation for predictive maintenance, real-time quality assurance, and factory-level digital twins.

- **Physical tracers & scanners:** Technologies such as luminescent pigments, mineral or DNA markers, or digital watermarks are embedded into fibres or applied to fabrics at early stages of production, enabling unambiguous physical-digital linkage that withstands further processing. Combined with handheld and inline scanners, these create an unbreakable chain of custody.
- **Collaborative robots (cobots) and flexible automation:** Robots designed to work alongside human operators handle material transport, fabric manipulation, and repetitive assembly tasks. Advanced grippers and vision systems enable automation of tasks previously considered too variable or unreliable for robots, including fabric handling, one of the most persistent bottlenecks in textile automation. The guiding principle for this layer is hybrid human-robot collaboration: robotics is deployed not to displace skilled textile operators but to amplify them, taking over physically demanding, repetitive, or hazardous tasks and freeing human craftspeople to concentrate on the judgement, dexterity, and aesthetic sensitivity that machines cannot replicate. Done well, this hybrid configuration increases efficiency and precision while preserving and enhancing the unique human skills and craftsmanship that underpin European product excellence.
- **Automated sorting lines:** Fully automated textile sorting facilities use a combination of NIR spectroscopy, computer vision, and digital ID scanning to sort post-consumer and post-industrial textiles at scale, a prerequisite for cost-competitive sorting for reuse in Europe as well as for industrial-scale fibre-to-fibre recycling.
- **Automated micro-factories:** Compact, modular production units located close to points of sale or use, capable of on-demand production of small batches using circular or flatbed knitting, digital printing or finishing, automated cutting, and robotic assembly. These serve both the fashion segment (customised apparel, rapid response to local demand) and the technical textiles segment (custom-configured protective equipment, medical textiles such as customised bandages or orthoses, specialty filters and other applications).

The Software Layer: Applications That Connect Everything

What it looks like in 2035

A comprehensive software ecosystem connects all business functions, from design and product development through production scheduling, supply chain orchestration, marketing, sales, and end-of-life management, in a seamless, data-driven workflow. The era of disconnected point solutions and manual data transfers between siloed systems is over.

Core components

- **Specialised cloud-based Software-as-a-Service tools with open Application Programming Interfaces:** Given the fragmented and SME-dominated structure of the European textile industry, the realistic path to a connected software ecosystem runs not through complex, feature-rich, monolithic PLM systems (which are beyond the financial and organisational reach of the vast majority of companies), but through specialised, affordable, cloud-based Software-as-a-Service (SaaS) tools that each do one thing well and interconnect through standardised Application Programming Interfaces (APIs). A small dyehouse needs an affordable production monitoring and recipe management tool, not a full PLM suite; a garment assembler needs a cloud MES and order management system, not an enterprise resource planning (ERP). The critical requirement is that these specialised tools can exchange data seamlessly with each other and with the systems of supply chain partners.
- **Automated DPP generation software:** Tools automatically compile Digital Product Passport data from existing enterprise systems querying supplier databases, extracting data from certificates and test reports, and pulling data from sectoral data spaces using secure digital identifiers and authentication protocols), and allow post-consumer service providers such as resale and repair operators to update DPPs.

- **Physics-based 3D design and digital twins:** Advanced simulation tools create production-ready digital twins of textile products, incorporating accurate physical properties (drape, stretch, weight, thermal behaviour) and enabling virtual prototyping, virtual fitting, and digital showrooms.
- **AI-driven demand sensing and production scheduling:** Algorithms analyse real-time market signals, inventory positions, and production capacity to optimise what gets produced, when, and where, moving the industry from speculative "push" production to responsive "pull" manufacturing.
- **Traceability platforms:** Software manages the lifecycle tracking of products and materials, integrating physical tracer data, blockchain or distributed ledger verification, and DPP hosting.

The Human & AI Layer: Orchestrating the System

What it looks like in 2035

Human experts, AI-enhanced human operators, and autonomous AI agents work together to fully utilise and orchestrate the three underlying technology layers. The workforce has been transformed through large-scale upskilling programmes and the integration of AI assistants that augment human capabilities rather than simply replacing them.

Core components

- **New human roles:** The DigitX expert community identified several critical human roles for the digital textile industry: the Circular Systems Architect, who designs and manages closed-loop material flows and optimises value creation from each item produced, the Ethical AI Auditor, who ensures that AI systems operate within regulatory and ethical boundaries, and the Digital Textile Engineer, who bridges the gap between material science expertise and digital systems competency.
- **AI agents for supply chain orchestration:** Autonomous AI agents monitor supply chains for disruption, manage automated compliance reporting, negotiate sourcing decisions, and coordinate production scheduling across networks of factories.
- **AI-powered compliance automation:** AI agents handle the growing burden of sustainability reporting, carbon footprint calculation, chemical compliance verification, and due diligence documentation, relieving SMEs of administrative tasks that threaten to overwhelm their limited human resources. Automated compliance monitoring was recognised as one of the most urgently needed AI capabilities by the DigitX expert community.
- **Human-in-the-loop validation:** For the foreseeable future, fully autonomous AI decision-making in the textile value chain will remain neither desirable nor acceptable. Agentic AI systems, whether handling compliance reporting, supply chain orchestration, or design generation, must be embedded in human-in-the-loop workflows with several explicit validation steps along the process. Domain experts confirm key inputs, review automated outputs at defined checkpoints, and retain final authority over consequential decisions, while AI handles the volume, speed, and repetitive workload that humans cannot. This combination of machine scale and human judgement is essential to preserve product quality, regulatory accountability, intellectual property, and trust across the value chain, and is fully aligned with the human-oversight requirements of the EU AI Act.
- **Augmented workers:** Factory and warehouse workers are equipped with digital interfaces and AI-guided work instructions that enable them to perform complex tasks with reduced training time and higher consistency. While immersive tools such as Virtual and Augmented Reality (VR/AR) may play a role in specific training applications, initial emphasis should be on practical, accessible digital aids that can be easily integrated into existing workflows for task optimisation, quick error identification and correction rather than deeply immersive technologies as the primary approach.
- **A more attractive industry:** Critically, the transformation of the textile workplace into a digitised, AI-supported, data-driven environment will make professional careers in the textile and apparel industry significantly more attractive to young talent, also leading to more value generation and better remuneration. The current labour shortage, driven partly by the perception of textiles as a low-tech and low-pay sector, will be addressed not through competing for workers on the same

terms as before, but by fundamentally changing the nature of the work itself. Operating advanced digital design tools, managing AI-assisted production systems, orchestrating agile supply chain data, and optimising complex circular material flows are skilled, well-compensated roles that can compete for talent with other technology-driven industries. This upgrading of the workforce is not a side effect of digitalisation but one of its most strategically important outcomes.

How the Four Layers Interact

The vision is not four separate digital technology investment silos, but an integrated system. The data layer provides the common language and infrastructure that enables all other layers to communicate. The hardware layer generates data (from sensors, cameras, tracers, and self-recording machines) and executes physical operations instructed by the software layer. The software layer processes, analyses, and routes data to drive decisions and automate workflows. The human and AI layer governs the entire system, making strategic decisions, handling exceptions, and ensuring that the technology serves human and societal objectives rather than operating autonomously without oversight.

This **four-layer architecture maps directly onto the four practical building blocks for value creation in the textile and fashion business** that the chapter “The Four Core Building Blocks” will detail: Data Infrastructure, Digital Product Creation, Digital Production, and Digital Supply Chain, with each building block drawing on capabilities from all four technology layers.





The Technology Enablers

Digital technologies are no longer emerging curiosities for the textile and apparel industry. Many have reached or are rapidly approaching the maturity threshold for industrial deployment. What follows maps the key technology building blocks that will drive the transformation described in the 2035 vision, assessing their current readiness and concrete impact potential.



Artificial Intelligence: From Experimentation to Core Infrastructure

AI in the textile and apparel industry is transitioning from isolated pilot projects to embedded operational capability. Three distinct AI paradigms are converging.

Generative AI for design and content creation (large language models and image generation systems) **are being integrated into design workflows to accelerate concept ideation, automate product descriptions, generate photorealistic marketing imagery without physical samples, and create design variations at scale.** While the DigitX expert community views generative AI for design ideation as relatively lower in criticality compared to other software capabilities, **the technology is finding its highest-impact applications not in replacing human creativity but in accelerating the mundane tasks that surround it:** automated size grading, colour variation generation, tech pack or bill of materials drafting, and trend analysis across vast data sets, all while preserving European data sovereignty and intellectual property.

Where generative AI handles creation, **predictive analytics and demand sensing handle anticipation.** AI algorithms can analyse unstructured data, including social media signals, search trends, early sales data, weather patterns, diverse end market signals for technical textiles and macroeconomic indicators, to **forecast demand with a granularity and speed that traditional methods cannot match.** This enables the **shift from speculative seasonal or surge demand buying to responsive and data-informed production**

planning. DigitX industry experts consistently identified AI-powered trend and demand analysis as the most important technology for digital product creation.

The most transformative frontier, however, may be agentic AI: autonomous AI agents capable of executing multi-step tasks without continuous human supervision. This technology represents the **greatest transformative potential for the textile industry's most painful bottleneck: the administrative burden of compliance and supply chain coordination.** An AI agent could, for example, autonomously query supplier databases to populate DPP fields, monitor regulatory changes and flag non-compliant products, or negotiate logistics re-routing in response to supply chain disruptions. The DigitX expert community placed agentic AI in the upper-middle tier of transformative technologies, reflecting its high potential but also the industry's awareness that foundational data infrastructure must be in place first. Several practitioners are already working on agentic AI for product design and development, along with AI-driven data ingestion and cleaning. Crucially, for the foreseeable future these agents will operate within a human-in-the-loop architecture: domain experts validate critical outputs at several stages of the process, and human authority is preserved for consequential decisions such as supplier qualification, regulatory filings, or design approvals.



Digital Twins: From Visualisation to Production-Ready Simulation

The concept of the digital twin is evolving rapidly from static 3D visualisation to dynamic, physics-based simulation that accurately mirrors the behaviour of physical textile products and production processes.

Product digital twins incorporate measured physical properties (including weight, drape, stretch, thermal resistance, pilling tendency, and colour fastness) **to create virtual prototypes that can be validated for fit, function, and aesthetics without physical sampling.** Leading tools have achieved significant adoption for visual prototyping. The next frontier is "production-ready" digital twins where the virtual model contains sufficient technical data to directly drive manufacturing: pattern cutting, marker making, and machine programming. **The DigitX expert community identified a critical gap here: the digital properties of fabrics lack standardisation, and the fidelity of digital drapes and material simulations remains insufficient for many applications. Bridging this gap through standardised digital fabric property measurement and exchange formats is a prerequisite for the digital twin to fulfil its promise.**

At the facility level, **factory digital twins create virtual replicas of production lines and entire facilities,** integrating real-time IoT sensor data to simulate production flows, predict machine maintenance needs, optimise energy consumption, and test process changes virtually before implementing them physically. For technical textiles, where production processes involve complex multi-stage transformations (e.g., coating, laminating, composite formation), factory twins offer particular **value in process optimisation and quality prediction.**

The emerging concept of **material digital twins** aims to **create digital representations of raw materials and intermediates** (fibres, yarns, fabrics) **that carry forward their measured properties through each transformation stage,** enabling predictive modelling of how upstream material variations will affect downstream product performance.



Physical-Digital Linkage Technologies

The effectiveness of any digital infrastructure depends on the reliability of the link between the physical product and its digital record.

Physical Tracers (luminescent pigments, DNA markers, isotope signatures etc. embedded into fibres or applied during processing) **provide a physical "fingerprint" that can be scanned at any point in the supply chain to verify origin, composition, and authenticity.** These technologies are reaching cost levels viable for mid-market applications and are essential for credible DPP implementation. Physical tracers and scanners were recognised as the most critical hardware investment by the DigitX expert community.

Bridging the physical and digital, **digital identifiers and data carriers** (QR codes, NFC tags, RFID chips, and digital watermarks) **connect the physical product to its digital record**. The choice of carrier technology depends on the application: NFC and RFID for high-value fashion and technical textiles where repeated scanning is needed, QR codes for mass-market applications, and digital watermarks for invisible integration. Standards such as GS1 Digital Link provide the framework for resolving these identifiers to product data.

A complementary layer of trust infrastructure is emerging in the form of **distributed digital identification and verification mechanisms**. Decentralised Identifiers (DIDs) and Verifiable Credentials allow companies and products to **carry cryptographically secured and independently verifiable claims**, such as certification status, origin declarations, or compliance attestations, **without relying on a single centralised authority**. These mechanisms align with the European Digital Identity Wallet framework (including emerging EU Business Wallets) and the United Nations Transparency Protocol (UNTP), providing a standards-based approach to cross-border verification that is critical for an industry with global supply chains. The practical significance is that a European brand can verify a Turkish supplier's organic certification or a Vietnamese factory's social audit status through a trusted, interoperable digital credential exchange, without requiring that supplier to adopt a specific proprietary platform.

While the initial hype around blockchain for fashion has moderated, the core utility of **blockchain and distributed ledgers** (providing an immutable, auditable record of supply chain transactions that enables "selective transparency" without revealing commercially sensitive information) remains relevant, particularly when combined with the distributed identification mechanisms described above. The DigitX expert community expressed pragmatic scepticism about blockchain-first approaches, signalling a preference for getting the underlying data infrastructure and verification mechanisms right before layering on distributed ledger technology. At the same time, the call for a European blockchain for traceability, rather than reliance on non-European platforms, reflects the broader emphasis on European data sovereignty.



Automation and Robotics for Textile Manufacturing

The textile industry's most **persistent automation bottleneck is the difficulty of handling flexible, non-rigid materials**. Unlike metal or plastic, fabric deforms under its own weight, making pick-and-place operations extraordinarily challenging. Recent advances in soft grippers, vacuum manipulation, and AI-guided vision systems are making progress, but DigitX industry practitioners repeatedly identified **fabric handling and the need for affordable, adaptable automation solutions for small companies as critical unresolved challenges**.

Computer vision systems capable of detecting fabric defects, colour deviations, and construction flaws at production speed are approaching industrial maturity. These systems learn from production data, continuously improving their detection accuracy. The DigitX expert community recognised **AI-based quality inspection** as one of the key production technologies for near-term deployment.

Fully automated sewing remains one of the most difficult challenges in apparel manufacturing due to the three-dimensional deformation of fabric during stitching. However, for specific seam types, straight-line operations, and technical textile assembly (where materials may be stiffer), robotic sewing is becoming viable. The path forward is likely hybrid: **cobots handling material feeding and positioning while human operators perform the most complex manipulations**.

Digital textile printing, both inkjet and dye-sublimation, **enables production of custom designs in quantities as low as a single unit, eliminating the minimum order quantities and setup costs of conventional screen printing**. An emerging frontier is high-viscosity inkjet printing, which extends the on-demand principle beyond colour and pattern to a broader range of surface functionalisations, including coatings, adhesives, conductive inks, and functional finishes, that have traditionally required dedicated conventional processing lines with high minimum runs. **By enabling on-demand application of functional layers, high-viscosity inkjet printing opens the door to digitally controlled surface functionalisation for both fashion** (e.g., localised water-repellent finishes, textured effects) **and technical textiles** (e.g., selective conductor deposition for e-textiles, localised adhesive application for bonded seams). Combined with automated cutting systems and connected production management software, digital printing and finishing technologies are the enabling

infrastructure for micro-factories and on-demand production models. Several DigitX contributors are already active in this space, developing advanced digital printing with high-viscosity solutions for sustainable micro-factory production.



Sensors, IoT, and Connected Manufacturing

In-line process monitoring (affordable sensors for measuring fabric properties during production, including weight, width, colour, moisture content, and tension) **enables real-time quality control and process optimisation**. DigitX industry experts identified affordable sensors capable of distinguishing products as a top priority for production technology investment.

Where in-line monitoring tracks what is happening, **predictive maintenance** anticipates what is about to go wrong. IoT-connected machines that report their operating state continuously enable predictive maintenance algorithms to **anticipate failures before they cause downtime**. This is particularly valuable for the ageing machine fleet that characterises much of European textile manufacturing. Outdated machinery was consistently ranked among the top barriers to digital production.

Processing data at the machine or factory level rather than transmitting everything to the cloud reduces latency, bandwidth costs, and data security concerns, particularly important for SMEs in regions with limited connectivity infrastructure.



Data Standards and Interoperability Technologies

Open APIs and Integration Platforms. The shift from monolithic, closed software systems to API-first architectures is essential for enabling the seamless data flow that the vision demands. **Open APIs** for connecting CAD, PLM, ERP, and supply chain systems were identified as a foundational requirement throughout the co-creation process.

The development of sector-specific **harmonised data models and ontologies**, building on work by organisations such as ETSI, CEN/CENELEC, GS1, and the UNTP, **is the foundational enabler for all other digital capabilities**. The co-creation process produced an unambiguous signal: a harmonised EU industrial data model was identified as the single most critical innovation challenge across all domains, with uniform data structure close behind. Harmonised data ontologies and data spaces ranked uniquely among transformative technologies: rather than concentrating enthusiasm on a few advocates, they attracted near-universal recognition as a foundational, if not glamorous, necessity.

Built on these foundations, **data spaces and federated data sharing provide the governance and trust layer that makes inter-company data exchange viable at scale**. Drawing on the European Data Strategy and frameworks like Gaia-X, sector-specific data spaces allow companies to share specific data attributes with specific partners under specific conditions, without centralising all data in a single location. This addresses the trust and data ownership concerns that the DigitX expert community repeatedly flagged throughout the co-creation process.



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Europe possesses unique assets for this transformation: unrivalled textile heritage and craft knowledge, world-class research institutions, globally admired textile technology leaders, a strong regulatory framework that, if implemented wisely, can become a competitive advantage rather than a burden, and an emerging ecosystem of innovative digital technology start-ups developing solutions specifically for the textile value chain.



Key Challenges and Barriers

While the technologies described previously are increasingly ready, **the European textile and apparel industry faces structural, financial, and cultural barriers that could prevent or severely delay their adoption.** DigitX experts identified six challenges that demand urgent attention.



The Interoperability Crisis: No Common Language

The single most frequently cited barrier across all domains of the co-creation process was the **lack of harmonised data standards, ontologies, and interoperable systems.** The industry operates in a landscape of proprietary data formats, incompatible software systems, and manual data re-entry between every tier of the supply chain.

Technical limitations in **connecting different systems along value chains are the dominant barrier to digital transformation,** with tool proliferation and poor data integration and the lack of standards and protocols reinforcing the picture. The same challenge appeared in every domain: **fragmented tools and weak interoperability** between PLM, CAD, ERP, LCA tools, and supplier systems in digital product creation; persistent interoperability failures in the digital supply chain; and the absence of a coherent data strategy at enterprise level.

This is not merely a technical inconvenience. It is a **structural impediment that multiplies costs, prevents automation, degrades data quality, and makes the seamless supply chain data flow envisioned by the ESPR and DPP physically impossible.**



The SME Financing and Capacity Gap

For the 99.8% of European textile companies that are MSMEs, the **cost of digital transformation represents a disproportionate burden**. Lack of capital and the constraints inherent in small company size ranked jointly as the second most critical barrier in the DigitX expert assessments, immediately behind the interoperability challenge. SMEs face a compounding set of financial constraints: **the upfront cost of modern ERP, PLM, and traceability systems** (even in SaaS form, subscription fees accumulate); **the hidden cost of integration, data migration, and process re-engineering**; the opportunity cost of diverting limited management attention from daily operations; and the **uncertainty of return on investment (ROI)**, particularly for companies that may not survive the transition period. Investment and ROI uncertainty for SMEs was repeatedly flagged as a production barrier, while the cost of integration and maintenance for SMEs was identified as a leading data infrastructure challenge.

There is a concrete risk that the digital transition will drive market consolidation, pushing smaller players unable to achieve "digital certification" out of the supply chain entirely. This would reduce the diversity, resilience, and geographic distribution that characterise the European textile ecosystem. At the same time, it must be acknowledged that a degree of consolidation may be an inevitable and ultimately necessary price for achieving an overall higher-performing, better-capitalised, and more economically sustainable sector. A European textile industry with fewer but more digitally capable, better-equipped, and more professionally managed companies may ultimately deliver stronger innovation, better working conditions, and greater global competitiveness than the current landscape of many thousands of micro-enterprises operating at survival margins. The policy challenge is to manage this consolidation actively: ensuring that it is driven by capability and innovation rather than by sheer financial size, and that support mechanisms exist to help viable SMEs make the transition rather than being passively eliminated.



Skills Gaps and Knowledge Deficits

The industry faces a profound **shortage of professionals who combine textile domain expertise with digital competency**. Training and education were the most consistently raised issue across the DigitX co-creation sessions, while skills-related concerns appeared across every domain: product creation, production, supply chain management, and data infrastructure alike.

The skills challenge is two-sided. **The traditional workforce, whose deep tacit knowledge of materials, processes, and quality is irreplaceable, is ageing**, with 42% of workers over 50. This knowledge risks being lost before it can be digitised. Simultaneously, **digital natives entering the industry often lack the material science and process expertise needed to validate digital simulations and make informed decisions about physical production**. The DigitX expert community called for a new breed of "hybrid" professionals who connect digital capabilities with textile know-how. Universities and technical education and training providers are expected to **develop hybrid curricula combining textile science and engineering with data science, AI, and IoT**, and to partner with industry for applied R&D. Additionally, the lack of IT architecture knowledge was repeatedly identified as a barrier, indicating that even where willingness to digitalise exists, companies often lack the internal competency to evaluate, select, and implement appropriate technology solutions.

A less frequently discussed but equally significant dimension is age- and culture-related resistance at the top management level. Many European textile companies are family-owned and led by owner-managers whose formative professional experience predates the digital era. For these leaders, **the transition to transparent, data-driven decision-making can feel threatening, not only because it requires mastering unfamiliar tools, but because it fundamentally challenges management styles built on personal relationships, intuition, and information asymmetry**. Transparency, in particular, can be perceived as a loss of control rather than a gain in capability. Overcoming this barrier requires **targeted executive education and peer-to-peer leadership programmes that demonstrate the business case for digital transformation in terms that resonate with experienced industry leaders, rather than simply promoting technology for its own sake**.



Data Quality and Availability

Digital systems are only as good as the data they process. The industry suffers from a pervasive data quality problem: much of the data currently available is based on generic industry averages rather than actual, measured, facility-specific values. **Data availability and quality was identified as one of the most critical additional issues in the DigitX co-creation process, and data-related barriers appeared across all domains:** poor data quality in digital product creation, limited current data availability in digital production, and verification of data exchanged along the supply chain.

For technical textiles, data quality challenges are compounded by the complexity of multi-layer products with speciality finishing and the diversity of performance specifications across application domains. For fashion and apparel, the challenge centres on tracing environmental and social impact data deep into fragmented global supply chains where primary data collection infrastructure is often nonexistent.



Cultural Resistance and the Trust Deficit

Technology implementation is ultimately a human and organisational challenge. The co-creation process revealed a telling emotional landscape: alongside "opportunity," "innovation," and "cooperation", DigitX industry experts offered "fear," "resistance," "confusion," and "rivalry." The industry has historically been secretive about supply chain relationships, and the prospect of sharing data, even when it is commercially advantageous, triggers deep-seated concerns about disintermediation, intellectual property exposure, and loss of competitive advantage.

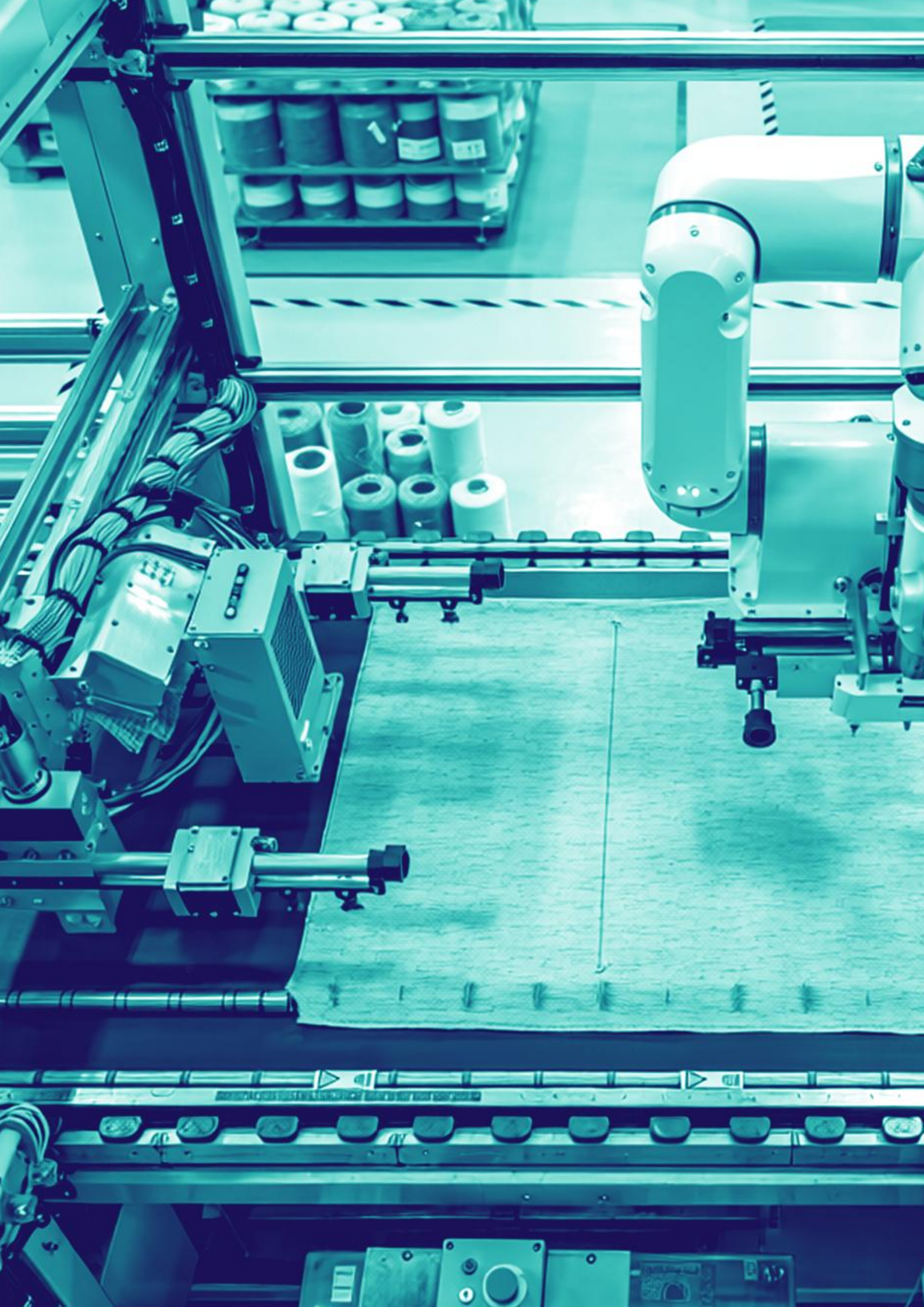
Trust and confidentiality, data ownership, and data governance reflect a fundamental challenge: **building the governance frameworks and trust architectures that allow data sharing to be both useful and safe.** For many companies, particularly in the "squeezed middle," the mindset challenge is as significant as the technology challenge. Traditional thinking was repeatedly flagged as a data infrastructure barrier that no amount of technology investment alone can resolve.



Lack of Technology Supplier Engagement

A frequently overlooked barrier emerged from the DigitX co-creation process: the lack of interest from technology suppliers was consistently ranked among the top production barriers. This reflects a structural market failure with a specific geographic dimension. **Many of the established machine manufacturers and IT system providers that serve the textile industry, including major European original equipment manufacturer (OEMs), derive the largest share of their revenue from Asian markets,** particularly China, India, Bangladesh, and Vietnam. As a result, their product development efforts and R&D investment are increasingly **oriented toward the requirements and price points of high-volume Asian production rather than the specialised, small-batch, high-flexibility needs of European niche manufacturers.**

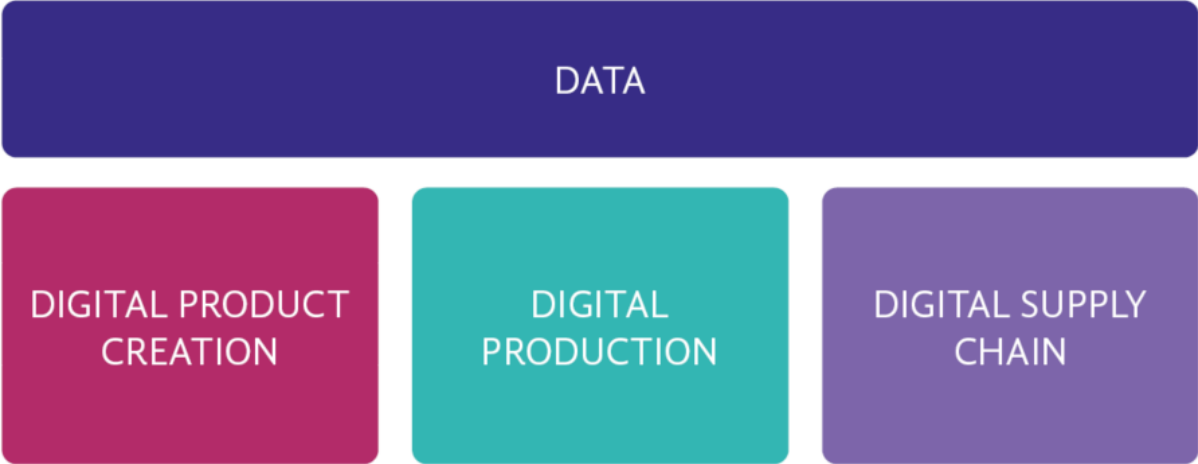
The digital interfaces, automation solutions, and software tools they develop are optimised for mass production environments, not for the customised, on-demand, and multi-product manufacturing that characterises Europe's competitive positioning. **This leaves European textile companies in a difficult position: the commercially available technology often does not fit their specific requirements, forcing them to develop in-house solutions and workarounds that may solve an immediate problem but lack the scalability, integration potential, and long-term viability of properly engineered commercial products.** These bespoke solutions remain trapped within the individual firm, unable to benefit from the continuous improvement, support infrastructure, and ecosystem integration that come with established commercial tools. The result is a widening gap between what European manufacturers need and what the technology market offers them.





The 4 Core Building Blocks

This chapter translates the vision and technology landscape into concrete, actionable innovation priorities across four interdependent domains. For each building block, we describe specific innovations, the pain points they address, their current maturity, and what must happen to achieve rapid industrial adoption.



Building Block 1:

The Underlying Data Infrastructure

The European textile industry lacks the foundational data infrastructure necessary for digital transformation. Data exists in silos: proprietary PLM systems, legacy ERPs, Excel spreadsheets, PDF certificates, email attachments. **There is no sector-wide agreed-upon vocabulary for describing textile products and processes in machine-readable form.** The result is that every data exchange between companies requires manual translation, re-entry, and verification, a process that is slow, expensive, and error-prone. The DigitX expert community converged on a harmonised EU industrial data model as the most critical innovation challenge in data infrastructure, with breaking down data silos as a closely related priority.

Harmonised Textile Data Ontology

What is it?	A comprehensive, open, machine-readable vocabulary and data model for the textile and apparel industry that defines how products, materials, processes, environmental impacts, and compliance attributes are described, structured, and exchanged.
Pain points	Without it, every digital initiative, from DPP implementation to supply chain traceability to automated compliance reporting, must solve the data definition problem from scratch. This is the root cause of the interoperability crisis.
Current maturity	Partial. Several initiatives are developing pieces of the puzzle: GS1 is defining product identification and data carrier standards for the DPP; the UNTP is developing frameworks for transparency and traceability; ETSI and CEN/CENELEC are working on standardisation mandates; and projects like CIRPASS have explored DPP architecture requirements. However, no single, comprehensive textile ontology exists that covers the full breadth of the industry, from fibre properties to garment construction to environmental impact to end-of-life instructions.

What needs to happen to achieve this vision:

- **Immediate (2026-2027):** Launch a dedicated multi-stakeholder initiative, involving industry, research, standardisation bodies, and technology providers, to define the scope and governance structure for a European Textile Data Ontology. Map existing standards and identify gaps. Target: publish a v1.0 reference ontology covering the core data elements required for DPP compliance by Q4 2027.
- **Scale (2028-2030):** Extend the ontology to cover technical textiles performance data, advanced circularity attributes, and LCA/PEF data requirements. Develop open-source reference implementations and validation tools. Target: 30% of EU textile trade data flowing through ontology-compliant formats by 2030.
- **Mature (2031-2035):** Achieve broad adoption through integration into commercial PLM and ERP systems. Target: 80% ontology compliance for products placed on the EU market by 2035.

Progress on these actions will be measured by the percentage of textile products on the EU market with fully ontology-compliant digital records.

Sector-Specific Data Spaces

What is it?	A federated data infrastructure, built on European data space principles (Gaia-X, IDSA), that enables textile companies to share specific data sets with specific
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partners under governed conditions, without centralising all data in a single platform or surrendering proprietary control.

Pain points

Companies need to share data to comply with regulations and participate in circular supply chains, but fear losing control of commercially sensitive information. The DigitX expert community identified the need for clear governance and incentives for data sharing, as well as the risk of fragmented, duplicative data systems, as key challenges.

Current maturity

Early but gaining momentum. The European Data Strategy provides the policy framework, and sector-specific data spaces are being developed in other industries (e.g., Catena-X for automotive). For textiles, data space concepts have been explored in projects like CIRPASS, and a significant step forward is the SAGE (Supporting the Ambitions of the Green Deal with Environmental data) project, a Green Deal Data Space initiative that includes a dedicated textile circularity pilot. SAGE demonstrates the feasibility of federated data sharing for circular textile value chains, but its current scope focuses on the circularity and end-of-life segment and needs to be extended to cover the full primary production supply chain, from fibre and yarn production through fabric manufacturing, finishing, and assembly, to deliver the comprehensive data infrastructure the sector requires.

What needs to happen to achieve this vision:

- **Immediate (2026-2028):** Fund 2-3 pilot data space deployments connecting specific supply chain segments (e.g., a cotton-to-garment pilot involving fibre producers, spinners, weavers, and brands; a technical textiles pilot connecting technical yarn/fabric producers and finishers, converters, and end-users). These pilots should test governance models, access control mechanisms, and data quality assurance processes in real supply chain conditions.
- **Scale (2029-2031):** Establish an operational European Textile Data Space with at least 500 participating companies, interoperable with other sector data spaces (chemicals, automotive, construction) and aligned with DPP data hosting requirements.
- **Mature (2032-2035):** Full integration with EU-level DPP infrastructure and circular economy data flows, enabling real-time data exchange across 80%+ of the European textile value chain.

Progress on these actions will be monitored by the number of companies actively participating in textile data space infrastructure; percentage of DPP data exchanged through data space protocols.

Automated Data Acquisition and Quality Assurance

What is it?

Hardware and software tools that capture production data, material properties, and process parameters automatically at source, eliminating manual data entry and the quality problems that accompany it.

Pain points

"Too much Excel" appeared repeatedly throughout the co-creation process, in both digital supply chain and data infrastructure discussions. Even companies that are willing to digitise often lack the tools to capture data automatically from their production processes. The result is that data quality remains poor, undermining the value of every downstream application from DPP generation to AI-driven analytics.

Current maturity

Mixed. Automated data acquisition is mature in some process stages (modern weaving and knitting machines often have built-in data outputs) but nearly absent in others (specialised finishing processes, small-scale dyeing, garment assembly). The DigitX expert community identified automated data acquisition as the most important foundational technology for the data infrastructure layer.

What needs to happen to achieve this vision:

- Develop affordable, retrofit-capable sensor and data capture kits that can be added to existing production equipment without requiring full machine replacement. The target market is the millions of textile machines currently in operation across Europe that have no digital interface.
- Create standardised data output formats for textile machinery, so that data from different machine manufacturers can be aggregated without bespoke integration. This requires collaboration with the textile machinery sector (e.g., through CEMATEX and their national association member companies).
- Fund the deployment of automated data acquisition in 100+ SME production facilities by 2028 as demonstration and best-practice projects.

Progress on these actions will be gauged by the number of production facilities with automated, real-time data capture across core process stages.

Compliance-by-Design Data Architecture

What is it?	Information systems designed so that regulatory compliance data (DPP, EPR, CSRD, CSDDD) is generated as a natural by-product of normal business operations, rather than requiring a separate data collection and reporting effort.
Pain points	SMEs face a growing avalanche of reporting requirements. Compliance should not be a bolt-on burden but an embedded feature of the data architecture. The DigitX expert community specifically endorsed compliance-by-design as a key architectural principle, and the second co-creation session confirmed that software developers should build compliance-by-design functionality into core platforms as standard.
Current maturity	Conceptual. Some PLM providers are beginning to integrate DPP data collection into their standard workflows, but true compliance-by-design, where all regulatory data is automatically captured, validated, and packaged, remains aspirational.

What needs to happen to achieve this vision:

- Define "compliance-by-design" reference architectures for different product categories, company types and sizes.
- Incentivise PLM and ERP providers to embed compliance data generation into their standard product offerings.
- Develop and publish open-source compliance data validation tools that SMEs can use to verify their data before submission.

Progress on these actions will be measured by the percentage of regulatory reporting data generated automatically (vs. manually) by participating companies.

Building Block 2:

Digital Product Creation

Textile and fashion product development remains heavily dependent on **physical processes** (physical fabric sampling, physical prototype development, physical fit testing), which are slow, wasteful, and poorly connected to downstream production and compliance requirements. For technical textiles, product development involves complex performance specification, testing, and certification cycles that are largely **paper-based**. The DigitX co-creation process identified **digital fabric properties, design-for-circularity, and the reduction of physical prototypes as the top innovation challenges** in this domain.

Standardised Digital Fabric Properties

What is it?

An industry-agreed standard for measuring, describing, and exchanging the digital properties of textile fabrics: the data that simulation tools need to create accurate digital twins of textile products.

Pain points

This was identified as the top innovation challenge in digital product creation. Currently, every 3D design tool defines fabric properties differently, and there is no standard exchange format. A fabric digitised for one digital design tool cannot be directly used in another without re-digitisation. This fragments the industry's investment in digital assets and prevents the creation of shared digital material libraries.

Current maturity

Early. Individual tool vendors have developed proprietary approaches. Research initiatives are exploring standardised measurement and exchange protocols, but no industry standard exists.

What needs to happen to achieve this vision:

- Establish a working group (under CEN/CENELEC, ISO TC 38, or a similar body) to define a standardised digital fabric property format, covering at minimum: weight, thickness, bending stiffness, shear, stretch, drape coefficient, surface friction, and visual appearance properties (colour, texture, sheen).
- Develop an open exchange format (building on concepts like the Fabric Data Exchange Format discussed in research projects) that all major simulation tools can import and export.
- Create a certified fabric digitisation methodology so that properties measured in different laboratories are comparable.
- Publish an industry standard for digital fabric properties by 2028.

Progress on these actions will be tracked through the number of fabric suppliers offering standardised digital property datasets alongside physical fabric sales.



Lighthouse project idea

"Digital Fabric Library Europe"

A collaborative project involving 10+ major fabric producers, 3+ simulation software vendors, and 5+ brands/retailers to create a shared, standards-based digital fabric library with 5,000+ digitised fabrics accessible through open APIs.

AI-Powered Design and Product Development

What is it?

Integration of generative AI, predictive analytics, and machine learning into the design and product development workflow to accelerate decision-making, reduce waste, and embed compliance and circularity considerations from the earliest design stages.

Pain points

Designers currently lack real-time access to data about specific material availability, environmental impact of required processes or available production facilities, cost implications, and regulatory constraints. Design decisions made early in the process lock in 80%+ of a product's environmental footprint, its time to market or its suitability for repair and reuse, yet these decisions are often made with incomplete information. DigitX industry experts consistently identified AI-powered design tools with deep data access to material properties and production profile/capacity data as the most important technology for digital product creation.

Current maturity

Moderate for trend analysis and demand forecasting; early for integrated design-compliance tools. Generative AI for visual design is advancing rapidly but is not yet deeply integrated into technical product development workflows.

What needs to happen to achieve this vision:

- Develop AI tools that combine design ideation with real-time compliance checking (DPP requirements, chemical restrictions, recyclability scores) and LCA estimation.
- Create AI-powered "material recommendation engines" that suggest optimal material choices based on performance specifications, environmental targets, cost constraints, and supply chain availability.
- For technical textiles: develop AI-assisted tools for rapid performance prediction based on material and construction parameters, reducing the dependence on lengthy physical testing cycles.
- Integrate parametric design with automated nesting and zero-waste pattern optimisation. Several DigitX contributors are already active in digital cutting rooms with nesting, markers, and automated cutting, as well as in digital 3D modelling that incorporates eco-design methodologies and parametric made-to-measure garment design.

Progress on these actions will be measured by the average number of physical samples per product development cycle (target: reduce by 50% by 2030, 80% by 2035), and the percentage of products with LCA data generated at design stage.

Design for Circularity Tools

What is it?

Digital tools that enable designers to evaluate and optimise the circularity of their designs, including recyclability, repairability, durability, and material efficiency, as an integral part of the design process.

Pain points

Implementing design-for-circularity was identified as one of the top innovation challenges in digital product creation. Currently, designers lack tools to assess whether their material choices, construction methods, and joining techniques will enable or prevent end-of-life recycling. This information exists in the recycling and sorting industry but is not connected to design tools. The second co-creation session confirmed the priority: designers placed integrating circularity assessment into design workflows as their single highest priority action.

Current maturity

Early. Some research projects are developing circularity assessment tools, and a few PLM vendors are beginning to integrate recyclability scoring. But the data

linkages between design tools, material databases, and end-of-life intelligence are largely missing.

What needs to happen to achieve this vision:

- Develop standardised recyclability scoring algorithms for textile products based on material composition, construction complexity, and the availability of industrial recycling pathways.
- Integrate these algorithms into mainstream CAD and PLM tools as real-time design feedback.
- Create feedback loops from sorting and recycling facilities to design teams, communicating which product types are successfully circulating and which are problematic.

Progress on these actions will be gauged by the percentage of new products designed with verified recyclability scores above sector thresholds.



Lighthouse project idea

"Circular Design Intelligence Hub"

Connect 5+ textile recycling facilities with 10+ brands' design teams through a real-time data platform that feeds end-of-life processing intelligence back into the design process.

Simulation for Technical Textiles Performance Validation

What is it?

Advanced simulation tools that predict the performance of technical textile products (PPE, geotextiles, medical textiles, automotive components) under operating conditions, reducing the dependence on lengthy and expensive physical testing and certification cycles.

Pain points

For technical textiles, product development is constrained by mandatory performance testing and certification. Physical testing of hundreds of material/construction combinations is time-consuming and costly. Simulation tools that accurately predict performance could dramatically accelerate innovation cycles.

Current maturity

Moderate for certain applications (e.g., structural simulation of composites is well established in aerospace); early for many textile-specific applications (e.g., predicting the thermal protective performance of multi-layer PPE systems under dynamic conditions).

What needs to happen to achieve this vision:

- Invest in fundamental research on the relationship between textile material properties, construction parameters, and product-level performance. This was identified by the DigitX expert community as one of the most critical gaps: "missing complete know-how about metric dependencies properties input-output."
- Develop validated simulation models for key technical textile applications.
- Work with notified bodies to establish pathways for simulation-supported certification, reducing the need for exhaustive physical testing.

Progress on these actions will be tracked through the number of technical textile product certifications achieved with simulation-supported testing protocols.

Building Block 3: Digital Production

European textile manufacturing is characterised by ageing machine fleets, limited automation, and analogue process management, barriers that industry practitioners rank as the sector's greatest obstacles to innovation, alongside insufficient flexibility for small-batch production. To remain viable against both ultra-fast fashion players in the volume segment and global competitors in technical textiles, European manufacturers must fundamentally reinvent their operations, becoming significantly more automated, flexible, and data-driven.

On-Demand and Small-Batch Production Systems

What is it?

Integrated production systems combining digital printing, automated cutting, robotic handling, and connected production management software, capable of economically producing batches as small as a single unit without the setup costs and minimum order quantities of conventional production.

Pain points

On-demand automation was the top innovation challenge for digital production, followed closely by increasing flexibility for small batches.

The current cost structure of European manufacturing is built around medium-to-large batches; serving small orders profitably requires a fundamentally different production architecture.

When asked about their dream projects, industry leaders envisioned shared production hubs for brands that enable optimised on-demand production with a low carbon footprint, as well as new process machinery within factories covering Tiers 2-3 with less manual labour requirements.

Current maturity

Moderate for digital printing and automated cutting; early for integrated single-piece flow systems. Pilot micro-factories exist (e.g., in digital printing hubs in Italy and the Netherlands) but are not yet widely deployed.

What needs to happen to achieve this vision:

- Fund development and deployment of integrated micro-factory systems combining digital printing, automated cutting, and robotic assembly for fashion apparel.
- For technical textiles: develop flexible production cells capable of rapidly reconfiguring for different product types and short runs of specialised items.
- Create standardised interfaces between design/order management software and production equipment to enable seamless digital job transfer.
- Target: 50+ operational on-demand micro-factories across European textile clusters by 2030.

Two primary KPIs will measure the progress: first, the minimum economically viable batch size, with an ambition to reach single-unit production for standard garments by 2030; second, the cost premium associated with on-demand production relative to conventional batch manufacturing, targeted at no more than 30% above batch costs by the same date.



Lighthouse project idea

"European Textile Micro-Factory Network"

A network of 10 automated micro-factories across 5 EU countries, connected through a common digital platform, capable of receiving and fulfilling on-demand orders with automated job routing based on capacity, capability, and proximity.

Smart Factory Infrastructure for Existing Facilities

What is it?

Retrofit solutions, including sensors, cameras, data gateways, and software platforms, that enable existing textile factories to achieve "smart factory" capabilities without full equipment replacement.

Pain points

Most European textile factories rely on outdated machinery they cannot afford to replace. Rather than full equipment renewal, they need solutions that add digital intelligence onto existing infrastructure upgrading capability without the cost of starting from scratch.

Current maturity

Mixed. IoT sensor and gateway technologies are mature, but the integration challenge, connecting sensors to meaningful analytics and decision support, remains significant, especially for SMEs without in-house IT capacity.

What needs to happen to achieve this vision:

- Develop industry-specific IoT retrofit kits for common textile machinery types (looms, knitting machines, dyeing equipment, finishing ranges) with plug-and-play installation.
- Create affordable Manufacturing Execution System (MES) platforms tailored to textile production, available as SaaS with low entry costs.
- Fund a "Digital Factory Accelerator" programme offering subsidised smart factory upgrades to 200+ SME manufacturers by 2029.

Progress will be measured through two KPIs: the number of SME production facilities operating with real-time digital production monitoring, and the average reduction in machine downtime and material waste.

AI-Driven Quality Assurance and Process Optimisation

What is it?

AI systems that use sensor data and computer vision to monitor production quality in real-time, detect defects, predict quality deviations, and optimise process parameters to minimise waste and resource consumption.

Pain points

Quality inspection in textile production remains largely manual and post-hoc, meaning defects are often detected only after significant amounts of defective material have been produced.

For dyeing and finishing processes, the relationship between input material properties, process settings, and output quality is complex and often managed through operator experience rather than data.

Current maturity

Moderate for defect detection (AI vision systems are commercially available for fabric inspection); early for predictive process optimisation based on input material data.

What needs to happen to achieve this vision:

- Develop AI models that predict output quality based on input material properties and process settings, addressing the widely recognised gap in understanding metric dependencies between properties input and output.
- Create training datasets for AI quality inspection systems across a range of textile products and defect types.
- Fund research into "right first time" dyeing and finishing, using AI to adjust process recipes based on incoming fabric properties rather than relying on fixed recipes.

The KPIs are the first-pass quality rate, targeting 95% or above in participating facilities, and the reduction in energy and water consumption per unit of output.

Robotics and Automation for Assembly and Handling

What is it?

Robotic systems for the textile-specific challenges of fabric handling, material transport, sewing, and product assembly, areas where conventional industrial robotics fails due to the flexibility and variability of textile materials.

Paint points

Automation and upskilling for the labour shortage was identified as one of the top economic challenges. Labour availability in European textile and garment manufacturing is declining rapidly, particularly for physically demanding and repetitive tasks. Yet automation solutions for textiles lag far behind those available for other manufacturing sectors.

Current maturity

Early to moderate. Collaborative robots for material transport and loading/unloading are available. Fabric handling (picking, spreading, folding, stacking) remains a major research challenge. Automated sewing is limited to specific applications mostly for 2D flat surfaces.

What needs to happen to achieve this vision:

- Fund dedicated research programmes on fabric manipulation robotics, including advanced gripper development, vision-guided handling, and AI-based motion planning for deformable materials.
- Develop modular, reconfigurable robotic cells that can be integrated into existing production lines.
- Create demonstrator facilities where SME manufacturers can test and evaluate robotic solutions before committing to investment.
- For unmanned or lights-out manufacturing, develop the full automation stack for specific product categories, starting with simpler items (e.g., flat textiles, straight-seam products) and progressively expanding.

Progress on these actions will be tracked through the number of commercially available textile-specific robotic solutions brought to market and the share of European textile production capacity operating with robotic assistance.

Building Block 4: Digital Supply Chain

The textile and apparel sector lacks the digital infrastructure to manage the complexity of its own supply chains. Information still flows primarily through emails, spreadsheets, and PDF documents, with ad-hoc coordination often happening over WhatsApp. Digitix industry experts consistently identify secure and standardised data exchange as a top innovation challenge, with key barriers centred on cross-border alignment with EU data frameworks, data semantics, and a fundamental lack of interoperability between systems.

Automated, Standards-Based Supply Chain Data Exchange

What is it?	Systems and protocols that enable the automated exchange of structured supply chain data, including orders, specifications, shipping notices, quality certificates, compliance documents, and invoices, between supply chain partners without manual re-entry or format conversion.
Pain points	This was the top-ranked supply chain innovation challenge. Currently, even basic transactional data between a brand and its suppliers is often transmitted through unstructured means (email attachments, manual portal entry), creating unacceptable costs, delays, errors, and data loss at every handover point. Industry leaders envisioned a pilot shared textile data platform for DPP and interoperability as one of their highest-priority projects, alongside an open-access platform for DPPs for all fashion firms that would be free, intuitive, and accessible, modelled on the ease of use of platforms like Shopify.
Current maturity	Low for the textile industry specifically, despite the fact that electronic data interchange (EDI) and automated B2B data exchange are mature in other sectors (automotive, retail). The textile industry's fragmentation in company sizes, IT capabilities, and geographical spread has prevented broad adoption.

What needs to happen to achieve this vision:

- Define a minimum viable set of standardised electronic messages for textile supply chain transactions, building on existing standards (GS1 EANCOM, EDIFACT, or modern API-based alternatives).
- Develop lightweight, low-cost integration tools that enable SME suppliers to send and receive standardised data without requiring expensive ERP upgrades, potentially through simple web portals, mobile apps, or AI-assisted data extraction from existing documents.
- Fund supply chain digitisation pilots involving complete supply chains (Tier 4 to Tier 1) to demonstrate end-to-end automated data flow. Target: 5 fully digitised supply chain corridors operational by 2028.

Progress on these actions will be measured by the share of supply chain data exchanges conducted through standardised, automated protocols, with a target of 30% by 2030 and 70% by 2035.

Lighthouse project idea

"5-Tiers DPP Data Flow Pilot"

A multi-country pilot connecting a complete cotton-to-garment supply chain (fibre producer, spinner, weaver, garment manufacturer, brand) through automated, standards-based data exchange, demonstrating that DPP data can flow seamlessly across 5 tiers without manual intervention.

Supply Chain Mapping and Multi-Tier Visibility

What is it?

Digital tools and processes that map the full extent of a company's supply chain, including sub-suppliers, subcontractors, and raw material sources that may be several tiers removed from the purchasing company.

Pain points

Supply chain mapping and traceability were consistently identified as a top sustainability priority.

Brands often lack visibility beyond their direct Tier 1 suppliers; the identity and practices of Tier 2, 3, and 4 suppliers remain opaque. This makes compliance with the Corporate Sustainability Due Diligence Directive (CSDDD) requirements and DPP origin tracking impossible.

Current maturity

Moderate for several commercial platforms offer supply chain mapping capabilities (e.g., leveraging AI to trace material flows). However, the mapping relies on the willingness of suppliers to disclose their sub-suppliers, which brings back the trust challenge identified in the chapter “Key Challenges and Barriers”.

What needs to happen to achieve this vision:

- Develop technology solutions that enable multi-tier traceability while protecting commercially sensitive supplier identities through verified credential systems and zero-knowledge proofs, so that a brand can verify that its Tier 4 fibre source meets sustainability criteria without necessarily knowing the identity of the source.
- Create incentive structures (commercial advantages, preferential scoring in procurement, EPR fee reductions) that reward supply chain transparency.
- Fund the development and deployment of supplier onboarding tools that make it technically and financially feasible for small Tier 3 and 4 suppliers to participate in digital supply chain networks.

Progress on these actions will be measured through two KPIs: the average supply chain mapping depth, defined as the number of tiers with verified digital records, and the share of supply chains achieving full visibility down to Tier 4.

AI-Powered Supply Chain Orchestration and Risk Management

What is it?

AI systems that continuously monitor supply chains for disruptions, compliance risks, quality deviations, and capacity constraints, enabling proactive management rather than reactive firefighting.

Pain points

Supply chain diversification and resilience was identified as a prominent economic challenge by the DigitX expert community. Recent years have demonstrated the vulnerability of global textile supply chains to disruption (pandemic, logistics crises, geopolitical tensions). Companies lack the tools to monitor risks in real-time and rapidly reconfigure supply chain routes.

Current maturity

Early for textile-specific applications, though supply chain risk management platforms exist in other sectors.

The key challenge is data availability, as the AI supply chain orchestration requires the data infrastructure and automated data exchange described above to function effectively.

What needs to happen to achieve this vision:

- Develop textile-specific AI models for demand forecasting, supply risk assessment, and production capacity optimisation.

- Create "digital supply chain twin" platforms that model a company's supply chain and simulate the impact of disruptions, regulatory changes, or demand shifts.
- Integrate compliance monitoring (DPP, CSDDD, EPR) into supply chain management platforms as standard functionality.

Progress on these actions will be measured through two KPIs, namely the average supply chain response time to disruption events and the share of compliance monitoring conducted through automated systems.

Manufacturing-as-a-Service (MaaS) Platforms

What is it?	Digital platforms that connect brands and product developers with manufacturing capacity on demand, enabling production to be sourced based on real-time availability, capability, cost, and proximity rather than pre-committed capacity agreements.
Pain points	European manufacturing capacity is underutilised because of poor visibility and complex commercial relationships. Simultaneously, brands struggle to find suitable manufacturing partners for small batches, specialised products, or rush orders.
Current maturity	Early. Some B2B platforms exist for connecting buyers and manufacturers, but true MaaS, with standardised digital interfaces for capacity, pricing, and job specification, remains aspirational.

What needs to happen to achieve this vision:

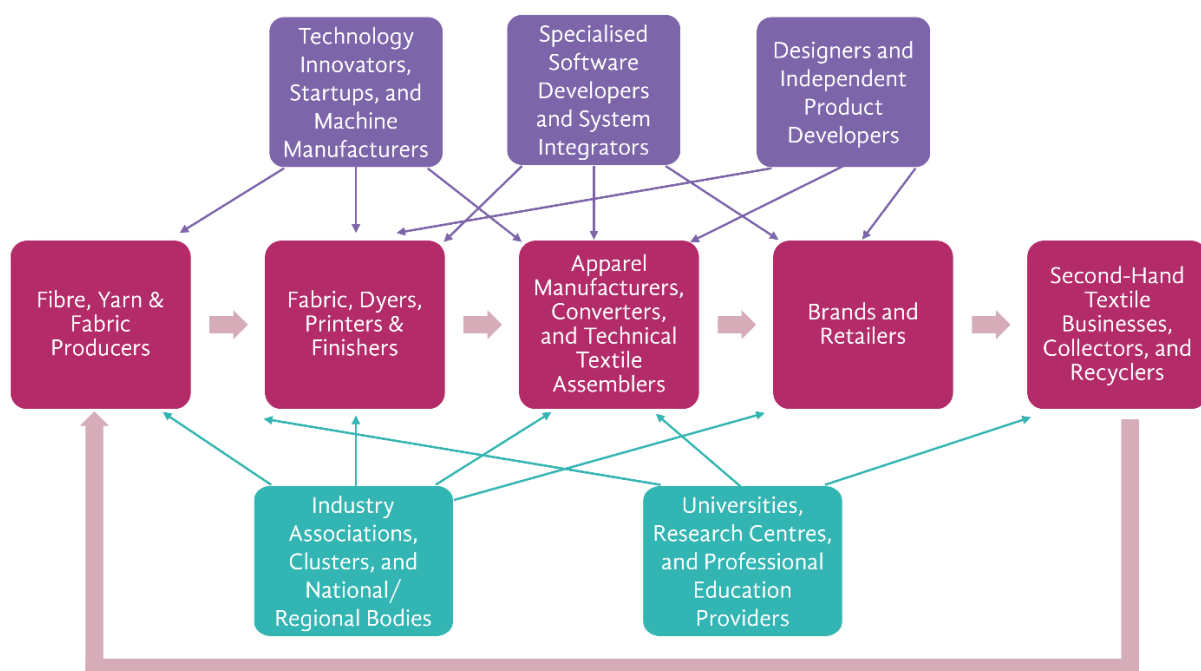
- Develop standardised digital interfaces for describing manufacturing capabilities, available capacity, and job specifications.
- Build MaaS platform prototypes that match production orders with available capacity across a network of certified factories.
- Target: pilot MaaS platforms operational in 3+ European textile clusters by 2029.

The key performance indicators to measure the success of this vision are the number of production orders fulfilled through Manufacturing-as-a-Service platforms and the average capacity utilisation rate of participating factories.



Key Actions and Players

The digital transformation of the European textile and apparel industry is a collective endeavour that cannot be achieved by any single actor alone. This chapter outlines the concrete responsibilities that each key stakeholder player must take on to drive the progress.



DigitX contributors reported active work on DPP integration and sustainability data provisioning, data governance and interoperability, digital twins, AI for textile design using European-developed models, advanced digital printing for micro-factory production, digital 3D modelling with eco-design methodologies, collaborative robotics, AI-assisted post-industrial and post-consumer waste sorting, and the development of collaborative data platforms for supply chain compliance. **However, many of these technologies remain at lab-scale or are developed by early-stage start-ups.**

Their true industry scaling needs massive investment in the underlying infrastructure, in standards and ontologies, in skills development and regulatory clarity to give companies the confidence and urgency to deploy scarce resources towards digital transformation.



Fibre, Yarn, and Fabric Producers

These companies sit at the origin of the textile value chain and hold critical data about material composition, provenance, and environmental impact. The DigitX experts confirmed that adopting standardised product data formats aligned with the Textile Data Ontology and providing digital yarn and fabric property datasets alongside physical products are the top priorities for this stakeholder group.

Key actions:

- Invest in automated data capture at production level: sensors for quality parameters, energy monitoring, and process data logging.
- Adopt standardised product data formats (aligned with the Textile Data Ontology) to describe materials in machine-readable form.
- Provide digital fabric property datasets alongside physical products, enabling downstream digital product creation.
- Implement physical tracer technologies (where applicable) to ensure verifiable origin claims.
- Participate actively in data space pilots and collaborative data ontology development, contributing primary production data and material property definitions.



Fabric Dyers, Printers, and Finishers

These processors transform grey goods into finished materials and hold critical environmental impact data (water, energy, chemicals). The DigitX expert validation process placed standardised digital reporting of environmental impact data per batch or per metre as the clear top priority for this group, reflecting the urgency of sustainability compliance at the processing stage.

Key actions:

- Deploy IoT sensors for real-time monitoring of process parameters (temperature, pH, chemical dosing, water consumption, energy use).
- Adopt automatic fabric inspection systems to improve quality management, minimise waste and provide real-time feedback for machine recalibration or predictive maintenance
- Invest in digital recipe management and AI-assisted process optimisation for "right first time" production.
- Adopt standardised digital reporting of environmental impact data per batch or per metre.
- Transition from conventional to digital printing and finishing technologies where economically viable, enabling on-demand and small-batch production.



Apparel Manufacturers, Converters, and Technical Textile Assemblers

These companies perform the complex assembly operations that turn the content of a bill of materials (fabrics, trims, accessories) into a final product or install a textile component into a complex technical system.

The high complexity of textile production, particularly the handling and joining of flexible materials, means that manual processing remains the norm across much of the industry. Deployment of robotics and other automated manufacturing systems supported by smart digitally connected factory set-ups are needed to preserve the required flexibility while lowering production costs.

Interfaces for exchanging job specifications and production capacity data with supply chain partners was confirmed as high priority for apparel manufacturers in the DigitX expert validation process, closely followed by implementing automated data capture for production output, quality assurance, and resource consumption measurement.

Key actions:

- Invest in smart factory infrastructure: production monitoring, quality inspection, Manufacturing Execution System (MES) platforms.
- Evaluate and pilot robotic and cobot solutions for material handling, loading/unloading, and specific assembly operations.
- Implement automated data capture for production output, quality, and resource consumption.
- Build digital interfaces for receiving job specifications and returning production capacity data to supply chain partners.
- Technical textile assemblers should invest in simulation-supported design and manufacturing integration.



Designers and Independent Product Developers

These creatives define the products that the supply chain produces and make decisions that can determine up to 80%+ of environmental impact.

The DigitX expert community placed integrating circularity assessment into design workflows as the top priority for this group, followed by a trio of equally weighted actions: adopting 3D design and virtual prototyping tools, engaging with digital fabric libraries and standardised digital material data, and developing data literacy around DPP requirements.

Key actions:

- Adopt 3D design and virtual prototyping tools as standard practice, targeting elimination of physical prototypes for first design validation.
- Integrate circularity assessment into design workflows, using design-for-recycling tools and recyclability scoring.
- Engage with digital fabric libraries and standardised digital material data rather than relying exclusively on physical swatches.
- Develop data literacy, including an understanding of the DPP's data requirements, and design products that can be fully digitally described.



Process Innovators, Tech Startups, and Machine Manufacturers

These actors develop and deliver the tools, systems, and equipment the industry needs. DigitX experts considered commitment to open standards and interoperability, and the focus on affordable modular solutions for SME budgets as particularly high priority. The industry demands openness and affordability above all else from its technology suppliers.

Key actions:

- Commit to open standards and interoperability: develop products with standardised APIs and data interfaces; avoid proprietary lock-in.
- Invest in textile-specific R&D, understanding the industry's unique challenges (fabric handling, material variability, process complexity) rather than offering generic solutions.

- Develop affordable, modular solutions tailored to SME budgets and capabilities.
- Collaborate with European industry end-users in co-development. Meeting their sophisticated niche market requirements may not sell large numbers of standard systems but provides the technical capacity to remain on the global leading edge of innovation.
- Equip new machines with standardised digital interfaces and provide retrofit kits for existing machines.



Specialised Software Developers and System Integrators

Product Lifecycle Management (PLM), Enterprise Resource Planning (ERP), and Manufacturing Execution Systems (MES) and specialised application developers are gatekeepers of the industry's digital infrastructure.

The validation process confirmed that creating lightweight, affordable SaaS offerings accessible to SMEs and developing open APIs for interoperability between systems and platforms are the top two priorities for this group. Compliance-by-design functionality and DPP-ready workflows as standard features, not premium add-ons, followed closely.

Key actions:

- Engage with industry-wide consortia and standardisation bodies in open data standard development.
- Rapidly adopt an emerging harmonised Textile Data Ontology as the basis for data models in textile-focused software products.
- Develop DPP-ready workflows as standard features across different systems.
- Build compliance-by-design functionality into core platforms.
- Create lightweight, affordable SaaS offerings accessible to SMEs with minimal IT infrastructure and lack of deep digital expertise at either management or operator level.
- Develop open APIs and integration connectors to enable interoperability between competing platforms.



Original Equipment Manufacturers, Brands and Retailers

As the primary interface with consumers, professional end users and regulators; Original Equipment Manufacturer (OEMs), brands and retailers have the market power to drive digital adoption across the supply chain.

The DigitX expert community confirmed that setting clear digital data requirements for suppliers, and investing in supporting those suppliers to meet them, is the top priority for OEMs and brands. Funding and participating in supply chain digitisation pilots and data space initiatives followed closely.

Key actions:

- Set clear digital data requirements for suppliers and invest in supporting suppliers to meet them.
- Fund and participate in supply chain digitisation pilots, including data space initiatives.
- Invest in digital product creation capabilities (3D design, virtual sampling, AI-powered demand forecasting).
- Deploy DPP infrastructure and consumer-facing digital product information systems.
- Use procurement power to incentivise digital maturity: preference for digitally certified suppliers.



Second-Hand Textile Businesses, Collectors, and Recyclers

These actors are essential for closing material loops and depend on digital data for efficient operations.

DigitX experts considered adopting automated sorting technologies using digital product identifiers and AI-based material recognition and decision support systems of highest priority. Also, the provision of feedback on effective product circularity enablers or disruptors back to the design and manufacturing stages was seen as promising.

Key actions:

- Adopt automated sorting technologies using digital product identifiers and AI-based material recognition that feed fully automated expert systems or serve as efficient decision support system for expert human operators.
- Feed end-of-life intelligence back into the digital ecosystem by sharing data on which products are more or less easily repairable and recyclable, and what design changes would improve their circularity.
- Develop digital platforms for resale authentication and condition assessment using DPP data.
- Participate in data space infrastructure to enable real-time information exchange with upstream producers and brands.



Universities, Research Centres, and other Professional Education Providers

Research institutions and universities form the knowledge and talent pipeline for the sector's digital transformation, with the DigitX expert community identifying the development of hybrid curricula, combining textile science and engineering with digital skills such as data science, AI, IoT, and software engineering, as their top priority. Industry partnerships for applied R&D in areas such as fabric simulation and process optimisation ranked second. Flexible continuing professional development programmes for mid-career upskilling and investment in digital infrastructure for teaching and research also scored highly. Notably, immersive VR/AR training tools scored significantly lower, suggesting that the industry sees these as relevant for specific applications rather than as a primary approach to skills development.

Key actions:

- Develop hybrid curricula that combine textile science/engineering with digital skills (data science, AI, IoT, software engineering).
- Invest in digital infrastructure for teaching and research, including simulation labs, digital fabric testing facilities, and smart manufacturing demonstrators.
- Partner with industry for applied R&D, particularly in fundamental research areas identified by the DigitX expert community (fabric simulation, process optimisation, automation).
- Create flexible continuing professional development programmes for mid-career professionals needing to upskill on digital technology and skills.
- Explore emerging training tools, including VR/AR for specific manufacturing applications where spatial immersion adds genuine value.



Industry Associations, Clusters, and National/Regional Bodies

These organisations coordinate collective action and amplify the voice of the sector. The DigitX expert community expects them to advocate for industry-specific funding instruments, regulatory clarity and feasible timelines, to initiate or contribute to Digital Innovation Hubs and "test before invest" centres for SMEs, and to facilitate matchmaking between technology providers and designers, brands and manufacturers.

Key actions:

- Coordinate industry participation in standardisation processes (data ontology, DPP, fabric properties).
- Drive the set-up of Digital Innovation Hubs and "test before invest" centres for SMEs.
- Facilitate matchmaking between technology providers and industry users.
- Engage in regulatory stakeholder dialogue with deep subject matter expertise to ensure regulatory clarity, realistic high impact measures, feasible implementation timelines especially for smaller players and avoid unnecessary administrative overhead.
- Advocate for industry-specific high impact funding instruments
- Organise sectoral training programmes and knowledge-sharing events.
- Support cross-border collaboration and technology transfer between leading and lagging regions.

Collective Actions Across the Ecosystem

Several of the most critical actions in this strategy cannot be accomplished by any single stakeholder group acting alone. They require **coordinated, pre-competitive collaboration across the value chain**, often involving actors who are otherwise competitors or who have no established working relationships.

The DigitX co-creation process revealed that the industry's most pressing calls were not for individual company action, but for collective infrastructure, shared standards, and collaborative frameworks.

The following **five cross-cutting actions require multi-stakeholder commitment** to succeed:

1. Co-develop the European Textile Data Ontology

A harmonised, machine-readable vocabulary for textile products and processes cannot be defined by any one company, software vendor, or standardisation body. It requires fibre, yarn and fabric producers contributing material property definitions, garment and technical textile manufacturers contributing construction and assembly terminology, dyers and finishers contributing process and environmental impact data structures, OEMs and brands contributing product-level and compliance data requirements, and recyclers contributing end-of-life attribute definitions. This must be a genuinely collaborative effort, co-ordinated through bodies such as the European Technology Platform for the Future of Textiles and Clothing (Textile ETP), associations and interest groups representing manufacturers, brands and retailers as well as machine, software and research experts, linked to formal standardisation bodies like CEN/CENELEC, and industry standardisation organisations.

2. **Build and populate shared digital fabric libraries**

The transition to digital product creation depends on the availability of standardised digital fabric property datasets. **No single fabric producer or software vendor can create these alone. It requires producers to measure and provide digital property data, simulation software vendors to agree on exchange formats, and brands and designers to commit to using digital material data in their workflows.** A consortium approach, pooling resources to digitise thousands of fabrics to an agreed standard and making them accessible through open APIs, is the only path to the critical mass needed for this to become industry practice.

3. **Establish end-to-end DPP data flow across supply chain tiers**

the Digital Product Passport is not a single company's responsibility; it is a chain-wide data relay. Demonstrating that DPP data can flow seamlessly from Tier 4 raw material producers through spinning, weaving, dyeing, and assembly to the brand and ultimately to the consumer and recycler requires every tier to participate, contribute data, and agree on formats and protocols. **Brands must invest in supporting their suppliers, suppliers must invest in data capture and exchange capabilities, and technology providers must deliver interoperable solutions, since no single actor can build this data pipeline alone.**

4. **Create real-time digital feedback loops between recyclers and designers**

Closing the information loop between end-of-life processing and product design is one of the most frequently cited priorities in the DigitX co-creation process, but it sits at the intersection of two communities, design and post-consumer textile managers, that have almost no established channels of communication. Building these feedback loops requires recyclers and sorters to systematically capture and share data about which products and materials are recyclable and which are problematic, brands and designers to integrate this intelligence into their design workflows, and data infrastructure providers to build the platforms that connect them, making this fundamentally **a collaborative systems challenge rather than a technology procurement decision.**

5. **Develop a cross-border digital skills and talent pipeline**

The hybrid professionals the industry needs, people who combine textile domain expertise with digital competency, will not emerge from any single university programme or company training scheme. **Universities must redesign curricula in partnership with industry, industry must offer structured placements and co-development opportunities, professional education providers must create flexible upskilling pathways, and associations and clusters must coordinate cross-border exchange programmes,** since the challenge is Europe-wide and the response must be too.



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Recommendations to EU Policy Makers

Based on the analysis, expert input from the DigitX co-creation sessions, and the strategic assessment presented in this document, we recommend the following concrete actions to EU policy makers and programme managers. The recommendations are ordered to reflect the priorities validated by the DigitX expert community: the first four recommendations received the strongest and most consistent support, while the remaining six address important dimensions where the sequencing and emphasis have been calibrated to reflect the industry's expressed needs.

**Recommendation 1:
Link Sustainability Regulation Explicitly to Digitalisation and
Competitiveness**

Regulatory frameworks (ESPR, DPP, CSDDD, EPR) should explicitly recognise that compliance is impossible without digital infrastructure and should include provisions and funding mechanisms to support the digital capability building that compliance requires. Regulations should set digital capability targets alongside sustainability targets, acknowledging that the two are inseparable.

Industry practitioners want EU regulation to connect sustainability requirements explicitly with the digital tools needed to meet them, and to reward companies that invest in transparency. Specific suggestions

included making traceability and circularity data requirements explicit in legislation, developing frameworks to incentivise transparent companies, and connecting the digital and sustainable transitions through inspiring best practices. Regulatory requirements help justify the investment in digital infrastructure that companies need to make regardless.

Recommendation 2:
Mandate Interoperability and Open Standards for Publicly Funded Digital Innovations

Require that all publicly funded software, platforms, and infrastructure for the textile sector comply with open standards and provide open APIs. Discourage the emergence of new proprietary silos created with public money. Mandate that data formats and interfaces developed with EU funding be freely available for industry use.

Without open standards, SMEs remain anxious, confused, and compelled to lock into proprietary solutions that their immediately available IT providers or consultants recommend. The DigitX expert community proposed funding the development of open-access, customisable infrastructure that companies can use to progress in data digitalisation and ensuring that DPP systems use interoperable data formats from the outset.

Recommendation 3:
Establish and Fund a European Textile Data Space

Building on the European Data Strategy and International Data Spaces Association framework, fund the development and deployment of a sector-specific textile data space with a mandate to achieve 500+ active participants by 2030. This data space should ideally be interoperable with other relevant sector data spaces (chemicals, automotive, construction) and should be linked to the infrastructure for DPP data hosting and supply chain transparency.

The DigitX expert community emphasised that this data space must be built on practical foundations: simple, low-cost onboarding for SMEs, built on existing infrastructures rather than starting from scratch, and designed to create easy workflows between all supply chain stakeholders with the DPP in mind. Large-scale pilots under Horizon Europe or the Competitiveness Fund were suggested as the path to making this real. European data sovereignty is essential: the infrastructure must be European-hosted and European-governed.

Recommendation 4:
Fund the Development of a Harmonised European Textile Data Ontology

Launch and fund a dedicated, multi-stakeholder standardisation initiative to develop a comprehensive, open, machine-readable textile data ontology covering materials, processes, products, environmental impacts, and end-of-life attributes. This remains one of the most impactful investments for enabling digital transformation across the sector, as confirmed throughout the DigitX co-creation process.

The DigitX expert community suggested creating DPP data requirements with both mandatory and voluntary data in a unique format and clearly defining who should develop and govern the standard. Without governance clarity, progress on this foundation will remain fragmented.

Recommendation 5:
Create Flexible Funding Schemes for SMEs, Startups, and Scale-ups

Existing funding instruments are often too complex and agentive AI administratively burdensome for the micro-enterprises and SMEs that make up the vast majority of the textile sector. Create simplified funding schemes promoted by industry associations and clusters for reduced administrative overhead, shorter application cycles, and dedicated support for companies with fewer than 50 employees. Include: digital voucher schemes for technology adoption, subsidised SaaS subscriptions, and co-investment mechanisms that de-risk technology adoption.

The DigitX expert community called for simplified, fast-track schemes such as cascade funding models, and matchmaking between established companies and startups for long-lasting innovation. The resource burden of current funding schemes was described as bringing no commensurate ROI for SMEs, requiring close monitoring with strong reporting and sharing requirements. Funding must cost-effectively reach the companies that need it.

Recommendation 6:
Support Lighthouse Projects in Breakthrough Innovation

Fund large-scale, multi-country lighthouse projects that demonstrate transformative capabilities at industrial scale. Priority areas include fully automated textile micro-factories for on-demand production; end-to-end DPP data flow across 5+ supply chain tiers; AI-powered compliance automation for SMEs; and integrated digital product creation pipelines from design to production-ready digital twin.

While fast-tracking high TRL digital technology adoption among European textile SME's is best achieved with unbureaucratic small-scale funding instruments, lower TRL radical innovation projects require top level consortia bringing together the leading players from across Europe for accelerated industrial-scale deployment that are truly paradigm-shifting. Future lighthouse funding should be explicitly tied to commercialisation milestones and industry-wide dissemination requirements, not merely technical demonstration.

Recommendation 7:
Launch Large-Scale Digital Skills and Upskilling Programmes

Fund cross-border upskilling programmes that combine textile domain expertise with digital competencies. Use a range of training approaches, from hands-on digital tools workshops to AI tutoring systems and, for specific applications, immersive simulations, to make digital skills acquisition engaging and accessible. Target: 50,000 textile professionals with certified digital competencies by 2030. Include specific programmes for mid-career professionals and management-level decision makers who need to lead digital transformation within their organisations.

The DigitX expert community validated hybrid curricula combining textile science with data science, AI, and IoT as the clear educational priority. Industry partnerships for applied R&D and flexible continuing professional development scored highly. Immersive VR/AR training tools, while potentially valuable for specific manufacturing applications where spatial learning adds genuine value, were not seen as the primary approach to upskilling. The emphasis should be on practical, accessible digital skills development at scale.

**Recommendation 8:
Fund Digital Modernisation of Research Centres and Professional
Education**

Invest in the digital infrastructure of European textile research centres, universities, and professional education facilities. Many of these institutions, which are critical for knowledge creation and workforce development, operate with outdated equipment and 'old school' learning environments that do not reflect the digital reality of modern textile production. Fund simulation and digital twin laboratories, smart manufacturing pilot lines for training, AI and data science computing infrastructure, and state-of-the-art robotic and digital printing equipment for professional training.

**Recommendation 9:
Support Collective Action in Standard Setting and Best Practice
Propagation**

Fund and empower collective industry initiatives, through the European Technology Platform, EURATEX, national associations and regional clusters to coordinate standardisation activities, develop best practice guidelines, and create shared infrastructure (e.g., certified testing facilities for digital fabric properties, reference implementations of data exchange standards). The textile industry's fragmentation means that no single company can drive the required systemic changes alone; collective action mechanisms are essential.

**Recommendation 10:
Designate E-Textiles and Smart Wearables as a Strategic Innovation
Priority**

E-textiles and smart wearables, and their combination with AI, represent a longer-term strategic opportunity that, while not an immediate operational priority for most textile companies, positions Europe at the frontier of textile innovation for the next generation. Applications span healthcare (patient monitoring, smart bandages), sports and fitness (performance tracking, injury prevention), gaming and entertainment (haptic feedback, immersive experiences), robotics (soft actuators, sensor skins), and education (interactive learning wearables). Fund dedicated R&D programmes, create regulatory sandboxes for e-textile medical devices, and position Europe as the global leader in this convergence technology. The DigitX co-creation sessions confirmed that this is a domain where Europe should invest for the future, even as the industry's immediate priorities rightly focus on data infrastructure, interoperability, and the digital transformation of existing production.



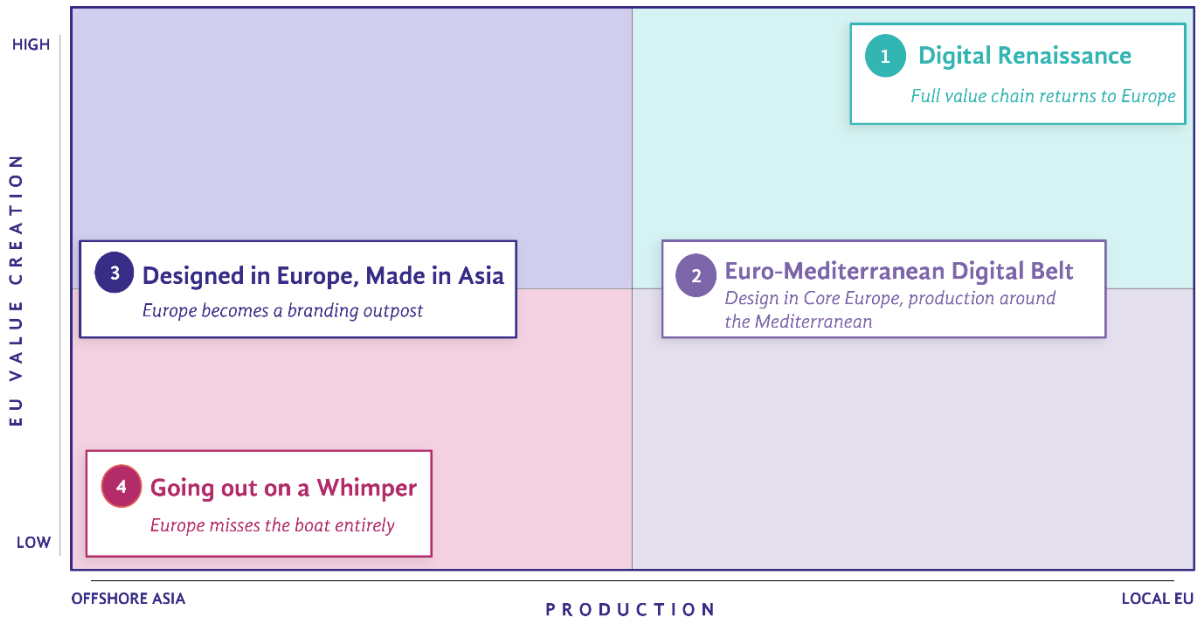
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The DigitX Innovation Hub will develop concrete implementation strategies for the key action items laid out in the chapter “Recommendations to EU Policy Makers” in the second half of 2026, informed by the commitments of key industry players following the public presentation of this strategy at the 20th Textile ETP Annual Conference and by the outcomes of structured interactions with EU policy makers and programme managers during the same period.



4 Scenarios: Where the European Textile Industry could be in 2035

The choices made, or not made, over the next decade will determine which of four fundamentally different scenarios will inhabit the European textile and apparel industry.



These scenarios are not predictions; they are provocations, designed to make the stakes of action and inaction viscerally concrete.

Scenario 1: “Digital Renaissance”

The Full Value Chain returns to Europe



Imagine walking into a textile district in northern Italy, Portugal's Minho region, or Saxony in 2035. What you see looks nothing like the factories of 2025. Compact, brightly lit micro-factories hum with robotic arms, digital printers, and automated cutting tables, producing custom garments, technical workwear, and smart medical textiles in batches of one.

There are no warehouses stuffed with unsold inventory. Every order was placed 48 hours ago by a consumer, a hospital, or an automotive OEM, and every product carries a digital twin that traces its fibre origin to a European or partner-country farm or man-made fibre plant.

In this scenario, Europe has executed the DigitX strategy decisively. Massive investment in automation, AI-driven production, and on-demand manufacturing has eliminated the labour cost disadvantage that drove offshoring decades ago. Local-for-local production networks, connected through data spaces and Manufacturing-as-a-Service platforms, serve European markets from European soil.

The full value chain, from fibre processing to finished product, has been re-shored or near-shored for a significant share of sophisticated or highly time-critical products, sustained not by protectionism but by the superior economics of digitally integrated, zero-waste, hyper-responsive production. Europe leads the world not only in design but in manufacturing innovation. The sector has doubled in value while halving its environmental footprint. Young engineers and data scientists compete for jobs in an industry that is now unmistakably high-tech.

Probability of this scenario remains aspirational, with full realisation requiring sustained political commitment, €500+ billion in cumulative public and private investment, and radical collaboration across a historically fragmented industry. Partial realisation is realistic for specific high-value segments (luxury, advanced technical textiles, e-textiles).

DigitX industry experts identified concrete near-term actions to advance this trajectory: investing in robotisation and shared production hubs combined with minimal in-store stocks, building interoperable European-owned software for data integration from design to prototyping to production, securing a common technical language along the value chain, ensuring European data sovereignty for traceability and data hosting, and enabling recycling to be fully managed within Europe so that value chains restart from EU soil. **Long-term investment projects with built-in checkpoints for verifying results and calculating the business case were seen as essential.**

Scenario 2: “The Euro-Mediterranean Digital Belt”

Design in Core Europe, Production around the Mediterranean



In 2035, the design studios of Milan, Paris, and Antwerp are buzzing with AI co-designers and holographic fabric simulators.

But the fabrics those studios specify are woven and dyed near Istanbul or Casablanca, and assembled in Iasi or Porto, all orchestrated in real-time through a digitally integrated production network that stretches from Helsinki to Tunis.

In this scenario, Europe has built a powerful Pan-Euro-Mediterranean value creation network. Core Europe (Western EU) retains the highest-value activities: design, product development, brand management, R&D, and advanced technical textile innovation. But the physical manufacturing supply chain is digitally orchestrated across the Mediterranean rim, including Turkiye, North Africa, Portugal, Romania, Bulgaria, and Greece, where labour costs are lower but digital integration with European brands is seamless and short distance sea or land transport is quick and emission neutral. **Standardised data ontologies, shared data spaces, and automated compliance systems ensure that a product assembled in Tunisia carries the same verifiable digital credentials as one produced in Germany.**

The model leverages Europe's geographic neighbourhood as a strategic advantage: production close enough for rapid response, in time zones and regulatory frameworks that enable tight coordination, with digital infrastructure that makes physical distance irrelevant for data flow. Also emerging Asian brands and technical textile OEMs appreciate the competitive advantage and reduced compliance risk of this system to serve their European customers.

The probability that this scenario represents the natural evolution of existing trends is high, particularly if amplified by successful digital infrastructure investment. It is the most likely "positive" outcome if the DigitX strategy is implemented effectively but full re-shoring remains economically unrealistic for lower cost mass-market products. DigitX industry experts identified concrete near-term actions to advance this trajectory: investing in microfactories and distributed production networks across EU and Mediterranean regions, mapping textile stakeholders in the Mediterranean basin including research centres and factories with their specialisations, establishing trade agreements that recognise shared standards and streamlining customs and administrative processes, ensuring SME access to shared digital tools and infrastructure, achieving real-time visibility across supply chain tiers for capacity, inventory, and processes, funding skills exchange programmes between European and Mediterranean countries, and scaling digital solutions beyond pilots across the full value chain.

Several DigitX experts noted that this scenario has already begun, accelerated by supply chain disruptions and tariff pressures, and is considered the most credible positive trajectory for the coming decade.

Scenario 3: “Designed in Europe, Made in Asia”

Europe Becomes a Branding Outpost



The Paris showroom is exquisite. The collection is stunning. The AI that generated the initial concepts is European.

The digital twin was created on a European cloud. But every single physical product, every fibre, every seam, every button, was produced in Asia. The European textile "industry" employs designers, marketers, and compliance officers. It does not employ a single weaver, dyer, or sewing operator.

In this scenario, **Europe has invested in digital product creation and brand management but has failed to make manufacturing competitive.** The regulatory burden of ESPR, DPP, and CSDDD has driven production costs even higher without a commensurate investment in automation and productivity. Asian manufacturers, particularly in China, Vietnam, and Bangladesh, have adopted the same digital standards and can deliver DPP-compliant products at half the cost. European brands remain globally powerful, but they are hollow design shells sitting atop entirely foreign supply chains. When geopolitical disruptions hit, as they inevitably do, these brands discover that they have no manufacturing resilience whatsoever. The European workforce has lost its textile production skills permanently. A few ultra-luxury brands as well as some niche technical textiles are the last holdouts, sustained by some remaining global cachet of the Made in Europe label or strict defence and aerospace procurement requirements, but even here the erosion is visible.

The probability of this scenario materialising is moderate and rising, particularly if digital manufacturing investment is not accelerated. It represents the default trajectory if the industry digitalises its front-end (design, marketing) but fails to digitalise and automate its back end (production, supply chain).

The DigitX expert community suggested that while elements of this scenario are already visible, it is manageable if Europe retains design and data sovereignty. Companies are increasingly moving toward more controlled, governed models where European firms actively guide the DPP process rather than passively outsourcing accountability. Others urged encouraging European companies that work with Asian factories to shift their waste recycling collaboration to Europe, and to reduce bureaucracy to make European production more competitive again.

Scenario 4: "Going Out on a Whimper" Europe Misses the Boat Entirely



The last Italian fabric mill closes in 2035. It is a small item in the regional news. The owner, 77, says he could not afford to keep up with regulatory compliance system and failed to find any weaving experts after the last operators generation retired. His children chose careers in tech.

The machines are sold to a buyer in Bangladesh. The building is turned into a warehouse for an Asian direct-to-consumer business.

In this scenario, Europe has failed on both fronts: it has neither digitalised nor maintained manufacturing competitiveness. The regulatory framework, implemented without adequate transition support, has crushed SMEs that could not afford compliance. The skills gap has become a skills chasm: the last generation of master weavers, dyers, and textile engineers has retired, and no one has replaced them. Asian and increasingly African textile industries, which invested heavily in both digitalisation and new capacity, serve European consumers through platforms that European brands no longer control. The European textile industry, once a €170 billion sector employing 1.3 million people, has shrunk to a fraction of its former size: a handful of luxury houses, a few technical textile specialists serving defence customers, and a scattering of artisan workshops marketed as cultural heritage. The industrial knowledge, the supply chain relationships, the research infrastructure, and the skilled workforce that took centuries to build have been lost in less than a decade.

The probability of this scenario occurring is low but not negligible, as this is the failure scenario that this strategy exists to prevent. The most reassuring signal from the second co-creation session was that most DigitX industry experts consider this outcome unlikely, but only on the condition that deliberate, coordinated action is taken. Every year of delayed action shifts the probability upward.

The Choice

These four scenarios are not equally likely, but they are all plausible.

The European textile and apparel industry's future is not predetermined; it will be determined by the decisions that industry leaders, technology providers, investors, and policy makers take in the next three to five years. The DigitX strategy charts a course toward Scenarios 1 and 2. Inaction leads inexorably toward Scenarios 3 and 4.

There is no standing still: in a global industry undergoing radical digital transformation, the status quo is not an option. It would merely be a slow-motion version of Scenario 4.





Conclusions and Outlook

The European textile and apparel industry stands at a decisive inflection point. The convergence of regulatory imperatives, competitive pressures, and circularity requirements has made digital transformation not merely advantageous but existential. **The evidence assembled in this strategy, from market analysis, technology assessment, and the direct input of industry experts through the DigitX co-creation process, is clear: the industry that does not digitalise by 2035 will not survive in any recognisable form.**

But this is not a story of threat alone. It is, fundamentally, a story of opportunity. Europe possesses unique assets for this transformation: unrivalled textile heritage and craft knowledge, world-class research institutions, globally admired textile technology leaders, a strong regulatory framework that, if implemented wisely, can become a competitive advantage rather than a burden, and an emerging ecosystem of innovative digital technology start-ups developing solutions specifically for the textile value chain. In technical textiles, Europe holds a particularly powerful position: its engineering prowess in developing advanced textile solutions for automotive, aerospace, construction, medical, protective, and geotechnical applications is globally leading, and its end-market customers in these sectors are among the most sophisticated and demanding in the world. **This combination of advanced textile engineering capability and sophisticated industrial customers creates an innovation flywheel that digitalisation can accelerate dramatically.**

The DigitX co-creation process confirmed the strategic direction laid out in this document, and, equally importantly, they revealed an industry that is already in motion. Industry innovators are not waiting for the strategy to be published before acting. They are building DPP infrastructure, developing European AI models for textile design, deploying collaborative robotics, creating data governance frameworks, advancing digital printing for micro-factory production, and working on the industrialisation of upcycling with AI and robotics.

The breadth and ambition of this activity, spanning every segment of the value chain from fibre production through recycling, provides genuine grounds for optimism. The challenge now is not to ignite momentum but to channel and scale the momentum that already exists.

The strategy laid out in these pages is ambitious but achievable. Its core message can be distilled into three imperatives:

1. Build a common data language that enables the industry to communicate digitally across all tiers and all functions.
2. Invest in the concrete technologies, from digital twins to robotics to AI agents, that will make this data actionable.
3. Ensure that every actor in the ecosystem, from the micro-enterprise dyehouse to the global luxury brand, from the university researcher to the policy maker, has a clear role and the resources to play it.

This strategy deliberately refrains from presenting a detailed operational roadmap with fixed milestones and timelines. The landscape is moving too fast, and the commitments that will give such a roadmap credibility do not yet exist. Instead, in the second half of 2026, informed by the commitments of key industry players following the public presentation of this strategy at the 20th Textile ETP Annual Conference and by the outcomes of structured interactions with EU policy makers and programme managers during the same period, the DigitX Innovation Hub will develop concrete implementation strategies for the key action items laid out in the chapter “Recommendations to EU Policy Makers”. That roadmap will translate the strategic priorities described here into phased actions with named partners, defined budgets, measurable milestones, and clear accountability.

The urgency, however, is not in question. The DPP mandate creates a hard deadline. **The competitive dynamics of global textile markets create an equally firm market deadline. Within these constraints, the European industry has the opportunity to shape its own future, to build an industrial system that is not only compliant and competitive but genuinely sustainable, innovative, and resilient.**

Beyond 2035, the capabilities developed through this transformation will position European textiles for even greater ambitions: AI systems that continuously optimise entire value networks in real-time, materials that carry their own intelligence, production systems that achieve zero-waste operation as standard, circular business models that fundamentally decouple economic value from virgin resource consumption, and a new generation of smart, connected, and functional textiles, including e-textiles, sensor-integrated fabrics, and AI-enabled wearable systems, where Europe's unique combination of textile engineering depth and digital innovation capability gives it an unmatched competitive position on the global stage. **The digital infrastructure built in the next decade will be the platform on which this next generation of innovation is constructed.**

The time to act is now. The technology is ready. The regulatory framework is slotting into place. The industry's experts have spoken clearly, across the DigitX co-creation process, about what is needed. What remains is collective will, coordinated investment, and decisive action.



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The competitive dynamics of global textile markets create an equally firm market deadline. Within these constraints, the European industry has the opportunity to shape its own future, to build an industrial system that is not only compliant and competitive but genuinely sustainable, innovative, and resilient.

Glossary of Terms

This glossary defines the key technical terms, acronyms, regulations, and concepts used throughout the strategy document, listed in alphabetical order.

A

Agentic AI: A class of artificial intelligence systems composed of autonomous agents capable of executing multi-step tasks (e.g., monitoring supply chains, populating Digital Product Passport data, negotiating logistics changes) without continuous human supervision.

AI (Artificial Intelligence): Computer systems that perform tasks normally requiring human intelligence, such as pattern recognition, decision-making, language understanding, and prediction. In textiles it underpins demand sensing, quality inspection, design ideation, and compliance automation.

API (Application Programming Interface): A standardised set of rules and protocols that allows different software systems to communicate and exchange data with each other. Open APIs are essential for interoperability between CAD, PLM, ERP and supply chain platforms.

AR (Augmented Reality): Technology that overlays digital information (images, instructions, data) onto the real-world environment, typically through smart glasses or mobile devices. Used in training and worker guidance applications.

B

Bill of Materials (BoM): A structured list of all the raw materials, components, sub-assemblies, and quantities needed to manufacture a finished product.

Blockchain: A type of distributed ledger technology in which transactions are recorded in immutable, cryptographically linked blocks across a decentralised network, enabling auditable supply chain records and selective transparency.

C

CAD (Computer-Aided Design): Software used by designers and engineers to create 2D drawings or 3D models of products, including garment patterns, fabric constructions, and technical components.

Catena-X: A European sector-specific data space initiative for the automotive industry, often referenced as a model for what a comparable textile data space could become.

CE Marking: A mandatory conformity marking indicating that a product complies with the relevant EU health, safety, and environmental protection requirements, allowing it to be placed on the European Economic Area market.

CEN/CENELEC: The European Committee for Standardization (CEN) and the European Committee for Electrotechnical Standardization (CENELEC), the recognised European bodies responsible for developing voluntary technical standards.

CIRPASS: An EU-funded coordination and support project that explored the architecture, data requirements, and technical foundations of the Digital Product Passport across pilot sectors, including textiles.

Cobot (Collaborative Robot): A robot designed to operate safely alongside human workers in a shared workspace, typically used in textile manufacturing for material handling, transport, and repetitive assembly tasks.

Compliance-by-Design: An architectural principle in which information systems are designed so that regulatory data (e.g., DPP, EPR, CSRD, CSDDD) is generated automatically as a by-product of normal business operations rather than through a separate reporting effort.

CSDDD (Corporate Sustainability Due Diligence Directive): An EU directive imposing legal liability on companies for environmental and human rights violations occurring within their operations and supply chains.

CSRD (Corporate Sustainability Reporting Directive): An EU directive requiring large and listed companies to disclose detailed information on sustainability-related risks, opportunities, and impacts.

D

Data Space: A federated, decentralised data architecture (aligned with the European Data Strategy and frameworks such as IDSA and Gaia-X) that enables companies to share specific data sets with authorised partners under governed conditions, without surrendering control of proprietary information.

DID (Decentralised Identifier): A type of digital identifier that allows individuals, organisations, or products to prove specific claims (e.g., certification status, origin) without relying on a single centralised authority.

Digital Product Passport (DPP): A machine-readable digital record, accessible via a data carrier (e.g., QR code, NFC tag, RFID), that carries information about a product's composition, origin, environmental footprint, repairability, and end-of-life instructions. Mandatory for textiles under ESPR from approximately 2028.

Digital Twin: A dynamic, data-driven virtual replica of a physical product, process, or facility. In textiles, this includes product twins (3D simulations with measured properties), factory twins (production line replicas with IoT data), and material twins (representations of materials carrying properties through processing stages).

Dual-Use Export Controls: Regulations governing the export of items that can be used for both civilian and military applications, particularly relevant for advanced technical textiles in aerospace and defence sectors.

E

EANCOM: A subset of the EDIFACT standard developed by GS1 for electronic business communication in retail and consumer goods supply chains.

Ecodesign for Sustainable Products Regulation (ESPR): An EU regulation establishing a framework for setting eco-design requirements for sustainable products placed on the EU market, including the requirement for Digital Product Passports for textiles.

EDI (Electronic Data Interchange): The structured electronic exchange of business documents (orders, invoices, shipping notices) between trading partners using agreed message standards.

EDIFACT (Electronic Data Interchange for Administration, Commerce and Transport): an international UN-developed standard for the exchange of structured business data.

EPR (Extended Producer Responsibility): An environmental policy approach in which producers are made responsible for the post-consumer stage of their products' life cycles, including collection, recycling, and disposal costs.

ERP (Enterprise Resource Planning): Integrated business software that manages and connects an organisation's core processes, including finance, procurement, production, inventory, sales, and human resources.

ETSI (European Telecommunications Standards Institute): An independent European standardisation organisation producing globally applicable standards for information and communications technologies.

EU Business Wallet: An emerging European Digital Identity Wallet framework for businesses, providing a trusted, interoperable infrastructure for companies to authenticate themselves and exchange verified data across borders.

EURATEX (European Apparel and Textile Confederation): the principal trade association representing the European textile and clothing industry at the EU level.

F

Federated Data Sharing: A data architecture model in which data remains distributed across the systems of individual owners and is shared selectively with authorised partners under defined governance rules, rather than being centralised in a single repository.

G

Gaia-X: A European initiative to develop a secure, federated, and sovereign data infrastructure based on common standards and interoperability principles, supporting the European Data Strategy.

Generative AI: A category of artificial intelligence (including large language models and image generation systems) capable of producing new content such as text, images, designs, and code based on training data.

Geotextiles: Permeable technical textiles used in civil engineering and construction applications such as soil reinforcement, drainage, filtration, and erosion control.

Green Deal: The European Green Deal: a package of EU policy initiatives aimed at making Europe climate-neutral by 2050, with significant implications for the textile sector through sustainability and circularity legislation.

GS1: An international standards organisation that develops and maintains global standards for business communication, including product identification (barcodes, GTINs) and data carriers used in the Digital Product Passport.

GS1 Digital Link: A GS1 standard that enables product identifiers (e.g., GTINs in barcodes or QR codes) to be expressed as web URIs, linking physical products to online information including DPP data.

H

Haute Couture: The creation of exclusive, made-to-measure high-fashion garments by leading fashion houses, typically representing the highest tier of European luxury textile and apparel production.

Horizon Europe: The European Union's key funding programme for research and innovation.

I

IDSA (International Data Spaces Association): An international non-profit association that develops the reference architecture and standards for secure and sovereign data exchange, including the International Data Spaces (IDS) framework.

IoT (Internet of Things): A network of physical devices, sensors, machines, and other objects embedded with connectivity that allows them to collect, exchange, and act on data, enabling real-time monitoring and connected manufacturing.

ISO TC 38 (ISO Technical Committee 38): the International Organization for Standardization technical committee responsible for standards in the field of textiles.

L

LCA (Life Cycle Assessment): A standardised methodology for evaluating the environmental impacts of a product across all stages of its life cycle, from raw material extraction through production, use, and end-of-life.

Lights-Out Manufacturing: A production model in which factories operate fully automatically without on-site human staff, typically used for repetitive, well-defined processes.

M

MaaS (Manufacturing-as-a-Service): A business model in which digital platforms connect brands and product developers with manufacturing capacity on demand, enabling production to be sourced based on real-time availability, capability, cost, and proximity rather than long-term capacity agreements.

MES (Manufacturing Execution System): Software that monitors, tracks, documents, and controls the production process on the factory floor in real time, bridging the gap between enterprise planning systems (ERP) and shop-floor machinery.

Micro-Factory: A compact, modular production unit, often located close to points of sale or use, capable of producing small batches on demand using technologies such as digital printing, automated cutting, and robotic assembly.

MSME (Micro, Small and Medium-sized Enterprise): A classification of companies based on size, employee count, and turnover.

MSR (Market Surveillance Regulation): An EU regulation governing the rules and procedures for surveillance of products placed on the EU market, ensuring compliance with applicable safety and conformity requirements.

N

NFC (Near Field Communication): A short-range wireless communication technology enabling data exchange between devices held very close together, used as a digital carrier on textile products to link to DPP data.

NIR Spectroscopy (Near-Infrared Spectroscopy): An analytical technique using near-infrared light to identify the chemical composition of materials. In textiles it is widely used for automated sorting of post-consumer fibres by composition.

O

OEM (Original Equipment Manufacturer): A company that produces parts, components, or full products that are then sold to another company under that company's brand. In textiles, OEMs are particularly relevant in technical sectors such as automotive and aerospace.

On-Demand Production: A manufacturing approach in which products are produced only after an order has been placed, eliminating the need for speculative inventory and minimising overproduction.

Ontology (Semantic Ontology): A formal, machine-readable vocabulary that defines the concepts, attributes, and relationships within a specific domain. A harmonised textile data ontology is identified as the most critical innovation challenge in the strategy.

P

PEF (Product Environmental Footprint): A standardised European methodology for measuring and communicating the environmental performance of products throughout their life cycle.

PLM (Product Lifecycle Management): Software that manages all the information and processes associated with a product across its entire life cycle, from initial concept and design through manufacturing, service, and disposal.

PPE (Personal Protective Equipment): Clothing or equipment designed to protect the wearer from health or safety risks, including technical textiles used in industrial, medical, military, and emergency-response contexts.

Predictive Maintenance: A maintenance strategy that uses sensor data, machine learning, and analytics to predict equipment failures before they occur, allowing repairs to be scheduled proactively and minimising unplanned downtime.

R

REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals): an EU regulation governing the use of chemical substances, particularly relevant for textile finishing and treatment processes.

RFID (Radio-Frequency Identification): A wireless technology that uses electromagnetic fields to identify and track tags attached to objects, used as a digital carrier on textile products to link to DPP and traceability data.

ROI (Return on Investment): A financial performance measure expressing the gain or loss generated by an investment relative to its cost.

S

SaaS (Software-as-a-Service): A software delivery model in which applications are hosted in the cloud and accessed by users over the internet, typically through a subscription rather than a one-off licence purchase.

SAGE (Supporting the Ambitions of the Green Deal with Environmental data): A Green Deal Data Space initiative that includes a dedicated textile circularity pilot, demonstrating the feasibility of federated data sharing for circular textile value chains.

Selective Transparency: An approach to supply chain disclosure in which specific data attributes can be verified by authorised partners without revealing other commercially sensitive information.

SME (Small and Medium-sized Enterprise): A company that meets EU-defined thresholds for staff headcount, turnover, and balance sheet total. SMEs dominate the European textile and apparel sector.

T

TRL (Technology Readiness Level): A scale from 1 to 9 used to assess the maturity of a technology, where TRL 1 represents basic research and TRL 9 represents technology proven through successful commercial deployment.

U

UNTP (United Nations Transparency Protocol): A globally aligned framework for supply chain transparency, developed under UN auspices, that provides a standards-based approach to cross-border verification of sustainability and compliance claims.

V

Verifiable Credentials: Tamper-evident digital credentials whose authorship can be cryptographically verified. They allow supply chain actors to prove specific claims (e.g., organic certification, audit status) without revealing their full identity or commercial relationships.

VR (Virtual Reality): An immersive computer-generated three-dimensional environment that users can interact with through specialised equipment, with applications in textile training, virtual showrooms, and design review.

W

Waste Framework Directive: An EU directive setting the basic concepts and definitions related to waste management and establishing the framework for waste prevention, recycling, and recovery, including the EPR provisions applicable to textiles.

Z

Zero-Knowledge Proofs: A cryptographic method that enables one party to prove to another that a given statement is true without revealing any information beyond the validity of the statement itself; relevant for protecting supplier identities in multi-tier traceability.

The Organisers

The European Technology Platform for the Future of Textiles and Clothing, Textile ETP in short, is the largest network for textile research and innovation in Europe. It acts as a think tank, strategic connector and EU funding access facilitator for textile industry, research, education and cluster organisations.

The Partners & Co-Hosts

Strategic Innovation Partners

LECTRA

Lectra, France
www.lectra.com

Co-hosts



ITA Academy, Germany
www.ita-academy.de/en/welcome/

Key Technology Partners



CITEVE, Portugal
www.citeve.pt

SMARTEX.FI

SmartexAI, Portugal
www.smartex.ai



Finnish Textile & Fashion (STJM), Finland
www.stjm.fi/en

Supporting Partners



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From AI to DPP: making European textile
businesses fit for the digital future