

DIGITALIZATION PROTOCOL OF TEXTILE VALUE CHAIN

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PARTNERS

ASSOCIATES

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EXECUTIVE SUMMARY

In an increasingly uncertain, changing, and competitive environment, business transformation through digital technologies is essential. This transformation allows the company to improve competitiveness, as well as the agility of response, flexibility, and adaptation to this environment, in addition to taking advantage of new business models to offer a comprehensive and ubiquitous experience to its customers.

In a context of information overload, in which day-to-day activities consume time, the transformation process is a challenge for most companies, especially SMEs. For this reason, it is essential that the company has a strategic plan for digital transformation that emphasizes strategic, organizational change and the business model derived from the opportunities offered by the technologies and tools of industry 4.0.

In the Textile / Clothing sector of the SUDOE area (Southwest Europe Region; France, Spain, and Portugal), this transformation of companies is underway, more than two thirds of the managers consider that the development of their company is linked to its digital transformation, and for slightly less than half of them this transformation must be done now in the short term.¹

Despite this, the textile sector, and the companies in its value chain encounter difficulties in implementing digital transformation, so there is room to improve their degree of digital maturity. There are, therefore, great opportunities in aspects related, among others, to internal organization and logistics, monitoring and optimization of production processes and quality control. For this reason, it is necessary to incorporate enabling technologies such as IoT, Big Data, Cloud Computing and Artificial Intelligence, among others. This implementation of technological solutions must be carried out gradually and continuously, analysing the cost-benefit, with the aim of achieving the greatest impact on the organization's operations and results.

This is reflected in the use cases and pilots in this report that show real solutions to needs and opportunities for improvement that are widely present in companies in the sector's value chain:

- **Optimize the control of production processes** by connecting machines and data capture, management, and monitoring systems to maximize efficiency by minimizing stops, downtime and energy consumption.
- **Automate non-quality detection** to minimize its impact. Artificial intelligence and computer vision solutions to detect fabric defects and thus minimize product loss, as well as the added cost, both economic and environmental impact.
- **Facilitate product traceability** in its production from start to finish throughout the value chain, as well as its logistics management in control and management of stocks and inventories through the implementation of RFID and *blockchain technologies*.
- **Advanced systems** combining *Big Data* and *Data Analytics* for prediction and prescription to facilitate decision making.
- **Automate processes** that streamline routine and repetitive employee tasks to minimize errors and assign people to higher value tasks based on skills and abilities such as creativity, intuition, teamwork, or problem solving, among others.
- **Facilitate the incorporation of talent and the generational change** of specialized textile technicians and operators by generating knowledge platforms and tools that allow *know-how to be transferred* intuitively, reducing learning curves as well as enhancing the skills of new workers.

In a sector with high competitiveness and margins as tight as textiles, it is essential to accelerate the transformation of companies through the gradual and continuous incorporation of technology and digital tools and the development and incorporation of digital skills. This transformation must be promoted to

achieve more competitive, sustainable, and adaptive organizations to address the present and future challenges of the sector.

As a starting point, the context of the sector, the value chain and the main trends are presented. It reflects on the main challenges faced by companies in the digitalization process. Elements such as data management, cybersecurity or talent attraction and management. The main facilitating technologies and information systems are presented that should allow companies to advance in the digitalization process and incorporate the benefits that it brings. In this sense, four large areas are identified: improvement of production processes, logistics optimization, sustainability, and maximization of customer value.

The Digitalization Protocol aims to promote and accelerate the digital transformation of SMEs in the textile value chain, solving the challenges to achieve the proposed benefits and maximize their competitiveness. For this reason, its own methodology is presented so that companies in the sector can activate a reflection process structured around different areas of global analysis of the company. All this, focused on its technological transformation, emphasizing strategic, organizational change and the business model derived from the opportunities offered by the innovative technologies of industry 4.0. This methodology should help companies define the technology incorporation strategy gradually and continuously through a short, medium, and long-term roadmap.

A guide for the facilitator/digital expert is also presented with recommendations on how to implement the proposed methodology accompanying organizations in the process of strategic reflection. This guide defines the set of sessions and participatory workshops with the team involved in the company to successfully achieve the definition of a roadmap for digital transformation.

1 INTRODUCTION

1.1 Goal

This digitalization protocol, developed within the scope of the DigiTVC project² – Digitalization of the Textile/Clothing value chain aims to be a tool for companies and all actors in this sector (with a special focus on the SUDOE area) to boost their competitiveness through digital transformation.

The objective is to present a guide that allows promoting and accelerating the digital transformation of companies in the textile value chain. To this end the document:

- Contextualizes the current state and trends of the textile sector.
- Defines the benefits that digitalization brings and the challenges that organizations must face
- Introduces the enabling technologies and key information systems in the transformation process.
- Presents a methodology for the definition of a strategic plan for digital transformation through the identification, prioritization, and sequencing of initiatives for the incorporation and implementation of technology.
- Includes success stories, good practices and recommendations based on the opinions and knowledge of experts and experiences of companies in the sector itself.

1.2 Who is it for?

To achieve the stated objective, the report addresses two main profiles:

- **Managers and/or intermediate managers of small and medium-sized companies** in the textile value chain. Those profiles of the organizations that must lead the process of change that digitalization requires. Capable of promoting the necessary strategic reflection process as well as the organizational and cultural changes that will accompany the transformation process.
- **Consultants on digitalization, and technology experts.** The external advisors or developer entities and facilitators of technology that support and help companies in the textile value chain in their strategic definition and in the implementation of technology. That profile with technological and business knowledge will facilitate the process for the organization with a neutral and transversal vision that will complement the internal vision of the company.

LIST OF ABBREVIATIONS

- APS - Advanced Planning and Scheduling Software
- AR - Augmented Reality
- B2B - Business to Business
- B2C - Business to customer
- BI - Business Intelligence
- CDTI - Center for Industrial Technological Development
- CIE - Spanish Intertextile Council
- CNAE - National Business Activity Code (Spain)
- CRM - Customer Relationship Management Software
- ERP - Enterprise Resource Planning Software
- ETL - Data Extraction Transformation and Loading
- EURATEX - European textile and clothing industry
- R&D (Research & Development) (R&D) - Research and Development
- AI - Artificial Intelligence
- INE- Spanish National Institute of Statistics
- IoT - Internet of Things
- IIoT - Industrial Internet of Things
- IT (IT) - Information technology
- KPI - Key performance indicator.
- MES - Production process management software
- NIR - Near Infrared Spectroscopy
- SDG - Sustainable Development Goals and Targets
- OT - Operational Technology
- GDP- Gross Domestic Product
- PIM - Product Information Management
- PLC - Programmable Logic Controller
- PLM - Product Lifecycle Management
- SME - Small and medium enterprises
- QR - Quick response code
- RFID - Radio frequency identification
- RPA - Automation of administrative processes
- SAAM - Advanced Maintenance Assistance System
- SCM - Supply Chain Management Software
- WMS - Warehouse Management Software
- SUDOE – Territorial Cooperation Programme of the Southwest Europe Region (France, Portugal and Spain).
- TEXFOR - Textile Industry Confederation
- VR - Virtual Reality

2 CURRENT SCENARIO OF THE TEXTILE SECTOR

2.1 General context (and of each region) – Statistics

The textile industry presents an international and complex ecosystem, due to the interrelationship of the actors that form it, as well as tariff policies that hinder access to some markets or environments of political confrontation that prevent commercial traffic. Added to all this is the increase in the prices of raw materials and energy costs, reducing the competitiveness of the companies that comprise it. However, the textile industry remains an economically relevant industry due to the impact of its activities in terms of turnover, as well as the level of employment it generates. The comparative data of the regions of France, Portugal, and Spain at the global level of the textile sector appear in Figure 1 for the year 2020.

The textile ecosystem is considered the 2nd most globalized sector of the European economy³, with 38% of the EU's turnover coming from the world market, influenced by free trade agreements. According to **EURATEX estimates**⁴, the turnover of the textile and clothing industry in the EU-27 is **€162 billion**. This industry is made up of a total of approximately 160.000 companies distributed throughout the entire textile value chain, employing a total of 1.5M workers.

- The sector in the EU is based on small companies (<50 employees) which represent more than 90% of the workforce and produce almost 60% of the value added.
- The largest producers in the industry are Italy, France, Germany, Spain, and Portugal. Together they account for around three quarters of EU production.
- Southern EU countries contribute more to total clothing production. While northern countries such as Germany, Belgium, the Netherlands, and Austria contribute more to textile production, particularly technical textiles.
- The level of exports in the sector is high, amounting to 25 billion euros, although since the number of imports is also high, in total 34 billion euros, the trade balance is negative¹.

Textile and clothing products are developed, more than in other sectors, through international value chains, which leads to fierce competition between the EU, China, the United States, Bangladesh, Turkey, and many others. For these value chains to function efficiently, it is essential that markets function properly, both within the EU (the EU single market) and outside Europe (global markets). This relates to transparency and predictability, effective and equitable enforcement, removal of trade barriers, efficient customs procedures, and industrial resilience. If we go into more detail about the countries that make up the pilots of this project, we see the following data referring to 2020:



Figure 1. Employment data, companies, and turnover of the textile sector. 2020⁵.

¹ Facts & key figures 2022 of the European textile and clothing industry, Euratex, 2021.

However, the sector faces great uncertainty. To the impact that the global pandemic has produced in terms of billing, we must add an overly complex international scenario due to tariff policies in some markets and a climate of confrontation that discourages when it does not block commercial traffic. The rise in the prices of raw materials and the increase in energy costs reduce the investment capacity of our companies and harm their competitiveness.

Ecommerce has in the fashion sector, given the global situation from which we have come generated by the root pandemic of COVID. What was a major misfortune for physical stores was the definitive spark for the explosion of the online sales channel, especially for this sector, which grouped 8.4% of online sales among all sectors in 2020.

Insight: Digital Ecosystem

Within the framework of the DigiTVC project, a [digital ecosystem](#) of companies and entities in the textile sector has been developed. This ecosystem translates into a database of organizations in the value chain distinguishing between textile producing companies and technology providers.

A total of **87 SMEs representing** Spain, France and Portugal are presented. Below are some representative figures of this ecosystem (see annex for the full list of companies).



	Spain		France		Portugal	
	Textile companies	Tech Suppliers	Textile companies	Tech Suppliers	Textile companies	Tech Suppliers
Micro	8	11	0	2	1	10
Small	10	13	2	1	4	3
Medium	6	5	3	0	7	2

The weight of Ecommerce amounts to 19.4% of total fashion sales in Spain. Its evolution had already been very promising since 2012, when its share of the total business in the sector was only 1.4%. Although the growth of the weight of Ecommerce in fashion sales had had a regular trend, the period between 2019 and 2020 was the one that made the difference in its acceleration rate.

2.2 Textile value chain: From raw material to sales

In the value chain, the different agents that make up the textile ecosystem and how they relate to each other can be seen below, from the point of view of the processes they carry out, the technologies that are most common in each group and its activities around textile recycling. Bodies and organizations have also been added that, from an administrative and/or auxiliary point of view, reinforce this value chain:

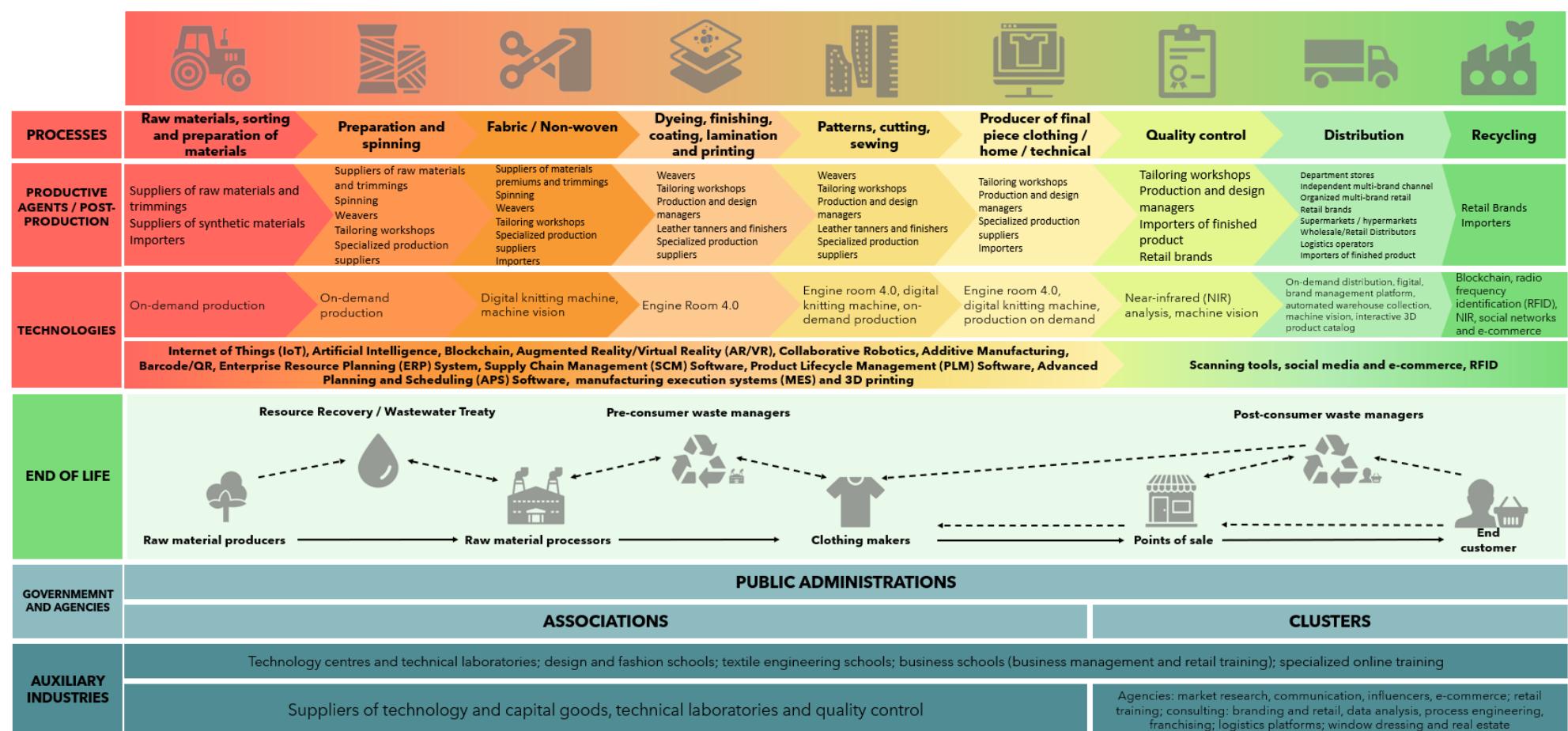


Figure 2. Textile value chain. Own elaboration

3 MAIN MARKET TRENDS

3.1 Eco - design and sustainability

In October 2015, more than 150 countries adopted 17 Sustainable Development Goals (SDGs) to end poverty, protect the planet and ensure prosperity for all by 2030. To achieve the goals, everyone must do their part: governments, organizations, Business. and civil society. It is recognized that to make meaningful progress towards the SDGs, all parts of society must work together to achieve the goals.

It is also important to keep in mind when interpreting hotspots that certain impacts, such as those associated with land and water use, are highly dependent on the type of fibre the textile is made from, particularly if it is of natural origin or synthetic.

The current environmental impact of the textile industry, according to the data collected in the report published by Quantis in 2018 "Measuring Fashion" is as follows:

- More than 3.3 billion metric tons of greenhouse gases are emitted along the textile value chain per year.
- 215 billion litres of water consumed per year.
- Cotton cultivation uses 2.5% of the world's arable land. Other natural fibres also have a large footprint on land, with wool at the higher end of the scale, requiring 278 hectares per tonne of fibre, compared to just over 1 hectare per tonne for cotton.

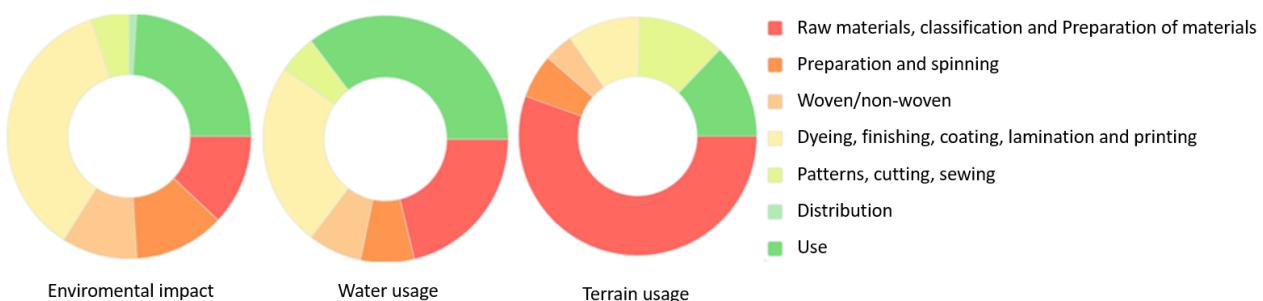


Figure 3. Ecological impact of the production processes of the textile value chain. Source: Own elaboration through data extracted from the document "Measuring Fashion, Quantis, 2018".

Figure 3 shows which are the processes of the textile value chain that have the greatest environmental impact, positioning the processes of obtaining raw material and dyeing, finishing, coating, lamination, and printing as those that carry out activities that are most harmful to the same. The use of textile products (washing clothes, drying them, ironing, etc.) also has a notable impact, and it is important that the actions carried out by the productive agents of the textile ecosystem include education and awareness, especially on the part of the actors closest to the final consumer.

To correctly control and measure the impact of a company's activities on the environment, it is necessary to know the life cycle of the product, as well as the impact of each of the activities that comprise it. To help in this process and to be able to adjust the life cycle of each product according to the needs of the companies, different software helps to carry out this management, from free open source options such as [openLCA](#), tools known in the market such as [SimaPro](#) or newer players that bring interesting functionalities to this environment such as [Ecochain](#).

Traceability and origin: Full transparency of the supply chain reveals the main environmental impacts and where efforts and investments are best focused. Companies can identify areas of high environmental risk by collaborating with their supplier network, especially regarding activities taking place in countries with weaker

environmental legislation, known pollution problems, high deforestation and/or intensive energy generation. into carbon, such as coal.

The London company [Petit Pli](#) considers how to extend the use phase of children's clothing through design engineering. Children's clothing has a truly short shelf life, and all too often ends up in landfill. His team, made up of engineers, fashion designers, neuroscientists, and sociologists, has developed outerwear that can grow alongside the child from nine months to four years.

Sustainable farming methods can reduce the environmental impact of producing wool, cotton, and cellulosic materials. The difference between conventional and organic farming can be dramatic in terms of chemical, water, and energy use. The land remains fertile due to frequent crop rotation and the maintenance of local biodiversity. Today, as much as 19% of the world's cotton is sourced organically, the balance between organic and conventional is expected to increase.

Leather production has considerable ethical and environmental impacts, especially livestock farming, and the significant amounts of energy required to convert hides into leather. The process is highly toxic due to the number of chemicals and dyes used, and while new techniques reduce the impact of these dangerous chemicals, offers a nature-based alternative. [Piñatex](#), by Ananas Anam Ltd, is a sustainable textile made from pineapple leaf fibre, a by-product of pineapple farming in the Philippines. The plant's long fibres are extracted from the leaves on the farm, providing farmers with an additional source of income from a resource that would otherwise go to waste. It was developed by PhD. Carmen Hijosa, who worked in the leather industry and witnessed its detrimental effects.



Image 1: Vegan leather Piñatex. Source: Linnoa Bags.

Hilaturas Arnau case: circular economy

Hilaturas Arnau is a company from Barcelona, with more than 60 years of experience, in the production of technical yarns to produce flame retardant yarns, with high tenacity for the protection of people who work in extreme conditions in the industry, with risk of cuts. To do this, it works on the recycling of natural and synthetic fibres, turning the waste into an asset.

With the aim of strengthening its presence in the market and aligning itself with the demands of the end consumer, it has developed a new BRE BCN brand with the aim of marketing products based on natural materials that respect the environment. Sustainable and ecological products made from recycled or organic materials, without losing sight of their functionality, comfort, and design.



This new brand allows the company to change its business model, offering a product to the final consumer (B2C) positioning itself with 100% ethical and sustainable products. The sale of the products is established through digital channels with direct management and through multiple relationship channels with the consumer customer.

3.2 Connected Industry / Digital Transition

Connectivity today, or hyperconnectivity as it is also known, is a necessity in many sectors, which only increases in relevance every year. Due to globalization, companies require modern technologies that facilitate collaboration both internally and with other actors in the production chain. Digital integration along textile value chain lets data flow digitally between companies, in a secure way, reducing the number of emails, pdfs or phone calls. In addition, the international decentralization that this sector has seen exacerbates this situation, since to maintain a service with an optimal level of quality, companies must have an elevated level of efficiency at each step of the production chain. Considering the factors mentioned above, technologies are born or strengthened due to these needs, some of them being the globalization of the production chain, advanced digital manufacturing, virtual modelling, hybrid retail models or the automation of checks and balances quality and traceability among others.

Smart Manufacturing, also known as Industry 4.0, tries to achieve manufacturing process flexibility, mass customization, better quality, and improved productivity through the integration of various technologies⁶. One of the technologies that drives the connectivity of this industry are those related to RFID, one of the representative technologies used to build IoT environments (although this technology cannot be used in every step of the value chain as many manufacturing processes can easily damage those RFID tags). In smart manufacturing, the use of IoT technologies is intended to acquire a large amount of data from components such as operators, machines, and products.

[Software Automation](#) has developed robots capable of knitting T-shirts that are connected to an online production system *demand*, where the garments that are produced respond in real time to the demand, producing only the pieces that are going to be sold. In addition, within the model they propose, the local market is also promoted, so that the time that elapses between when an order is placed and when the customer receives it is reduced. This system allows garments to be adapted to trends driven by social networks, significant cultural or sporting events, events, holidays or even memes.



Image 2. Sewbot from Softwear Automation. Source: Softwear Automation.

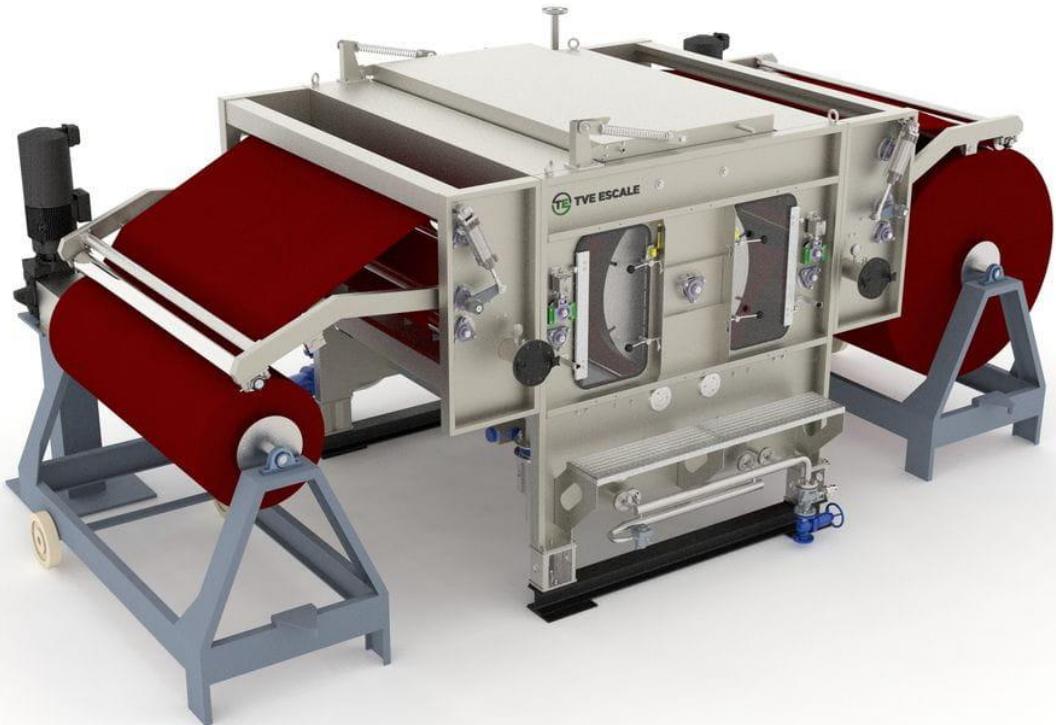
On the other hand, technologies based on digital printing are seeing a great increase in their introduction in the production chain, not only as options for prototyping but also as a viable option for many textiles business models (i.e. personalization of a lot-size-1). A company that has been promoting digital printing since 2002 is [Kornit Digital](#), which focuses its value proposition on highly personalizing its products, shortening the production cycle of the textile sector and reducing its environmental impact. Among the functionalities of the printers, its connectivity with other systems in the production chain can be highlighted, allowing the automation of a large part of the production process.

An important emerging trend in terms of digitalisation is about the digital development and engineering of textile products. In this category are considered tools that give companies the ability to develop a textile/clothing product (a fabric or a shirt) from a clean canvas to a digital POS. 3D editor, digitization of fabrics, simulation, etc. Right now, companies are starting to use 3D editor tools, such as CLO3D, to make the first samples, but some are selling, or at least testing on social media, products that never had a physical instance. This has obvious impacts in terms of waste because sampling produces a lot of waste. If the initial iterations in product development are made digitally, tons of waste are not produced. Also, if a textile/clothing product is born digitally, it is ready to be experienced on digital platforms (AR/VR, metaverse, etc.).

TVE Escala Case: Connected Machines

TVE Escala is a Spanish company, with more than 30 years of experience, which focuses its activity on the production of machinery for the textile industry.

With the aim of providing its machines with greater features, offering better customer service, and getting to know the product in depth, it has developed an IoT platform in the cloud. This platform collects and integrates the data generated by the machines. This connection allows the client to monitor and control their production process, having control panels on its situation, the energy consumption of the machines, as well as the operation of its components.



In the short term, the platform will allow the deployment of additional advanced services to clients based on the analysis of aggregate data. In this way, TVE Escale will be able to provide predictive maintenance and recommendations for productive optimization among other services. It will allow to develop new business models, unthinkable without the development of the IoT platform and the connection of the machines.

3.3 Ecosystem and new business models

Within the trends that are shaping the textile industry, in addition to social aspects (*eco - fashion* and sustainability), technological aspects (connected industry, digital transition), it is also necessary to pay attention to how the companies that develop activities in the final part of the textile value chain, the retail sector, are adapting their business models. Although these changes are not exclusive to this segment of companies in the value chain, their proximity to the end customer and their varying needs means that they must know how to quickly adapt their value offer. In any case, the changes that occur in this group of companies also translate into modifications throughout the entire value chain due to the interrelationships that are created in the ecosystem of the textile industry. Here are some examples of these new business models and ecosystems:

Hyper-Personalization: By using *Big Data* to curate products, provide better product recommendations, and improve targeting, hyper-personalization is taking fashion to another level. Hyper-personalization exists to bridge the gap between customer expectations and reality. When a customer has an image of a product in mind and is met with mismatched search results, hyper-personalization has the power to change the entire customer experience. Some examples of companies that have this concept as the basis of their business model are [Finesse](#), which asks users to vote for their favourite clothes and produces the winning outfit in limited quantities. [FOMO](#) uses fashion artificial intelligence to generate clothing in real time, based on user preferences.

Servitization of products: Today, in addition to the direct sale of a product, it is also possible to rethink the activities of a company around the product itself without the direct exchange of the same being the main source of value. Some examples of this are the well-known physical performance Apps that can be connected to a sensor inside a pair of shoes, a T-shirt, or another textile element. On the other hand, there is also the example of the [Mud Jeans](#) brand that, in addition to selling jeans, also rents them. If the user wants to keep it at the end of the lease, they can buy it, but if they want to return it, the factory will collect it and recycle it to make another set of clothes.

Hybrid retail: By digitizing retail companies, purchasing processes, product delivery or customer service are simplified. Brands want to provide the customer with the best possible interaction and prefer to intelligently combine the digital world with the offline world. One of the main challenges is for the client to be clear about what digital products will look like in the real world. Solutions such as virtual reality or augmented reality are being used to solve this problem just by using the smartphone. Amazon will open a physical store in Los Angeles, in which, through algorithms, the company wants to make the shopping experience of its customers as personalized as possible. To do this, every time users browse the Amazon application, scan the items, or save them in favourites, the app will recommend clothes like those they like. Likewise, the interested parties will be able to share information such as their style, size, and other preferences to receive more detailed recommendations. The fitting rooms will be a key point in the user experience, since when the garments you are interested in are selected in the application, they will arrive directly at the fitting room. These spaces will also include a touch screen that will allow customers to continue with their purchases. In real time, more styles or other sizes can be ordered to be delivered to your fitting room closet in minutes.

4 DIGITALIZATION: BENEFITS AND CHALLENGES

4.1 Introduction to Industry 4.0

Industry 4.0, or the fourth industrial revolution, involves digital transformation of industry through the integration and digitalization of all the processes that form the value chain. This transformation leads to the development of smart factories characterized by the adaptability, flexibility and efficiency that enable them to meet the needs of customers in today's market.

This revolution is dual in nature. On a technological level, it implies the use of facilitating technologies and tools that allow the interconnection between machines and systems and the exploitation of substantial amounts of data to generate value. At the same time, it involves a cultural transformation that requires strategic and organizational change and new business models for organizations that, in turn, require new skills and professional capacities.

If companies in the textile value chain do not understand the changes and opportunities that digitalization entails, there is a risk of losing market share.

4.2 The main benefits of digitalization

Digital transformation allows companies to improve competitiveness, as well as response agility, flexibility, and adaptation to the current uncertain and changing environment, in addition to taking advantage of new channels to offer a comprehensive and ubiquitous experience for their customers and the development of new business models.

Improvement of production processes

Increased performance and efficiency of existing assets by reducing machine downtime and configuration due to change or improving job planning and assignment. Sensorization and automation, as well as mobile solutions, facilitate the operation of workers, maximizing their productivity and minimizing errors.

Sustainability

Prediction and planning technologies based on artificial intelligence allow us to optimize the use of resources, reducing materials and energy consumption. In turn, advanced quality systems allow reducing the generation of shrinkage and waste by reducing non-quality, minimizing consumption and subsequent impacts. At the same time, the development of digital products for testing and validation and even pre-sale allows to reduce the waste generated from the physical manufacture of samples and constant tests.

Logistics

The collaboration and integrated coordination with the chain's suppliers through the incorporation of information systems, together with the use of virtualization, simulation and additive manufacturing technologies allow logistics to be accelerated in the ecosystem, reducing costs and the time to market of the products. Digitalization makes it possible to reduce decision times between an action and its reaction. It is about letting data flow digitally between companies, in a secure way. No more emails, pdf, or phone calls. A textile/clothing product involves a huge supply chain, but the related *data supply chain* still lags behind

Señor case: *track&trace system*

Señor is a small company that markets both men's and women's clothing, and makes custom-made dresses, mostly to the Catalan market.

They have developed a project, hand in hand with Maccion, provider of information systems, to implement a digital control system for the production process. With this, they have traceability from the generation of the order and the taking of measures in the store to the management of inventories in the warehouse, through the planning of series of pieces, the cutting workshop, and the preparation and management of arrangements.



The system affects the optimization of process times, management of finished or semi-finished parts, logistics costs or arrangements and, in turn, provides a better service in terms of quality, response time and information to the end customer. The company estimates the following benefits due to the implementation:

- Cost reduction of 5% in the FASHION section.
- Increase in billing in the MEASURED section between 3% and 6%
- Cost reduction and fixes.
- Reduction of direct and indirect transport costs by 5%.
- Improvement in locating, controlling, and valuing stocks of finished, semi-finished and raw material fabrics.

Maximize customer value

Multiple channels of communication enable you to capture the needs of your clients and to offer them personalized and higher quality services. In turn, the flexibility and adaptation of production processes throughout the value chain thanks to digitalization allow continuous adaptation to demand. On the other hand, digitalization gives rise to the generation of new value assets (data) that can be marketed in the form of new services and business models.

Facilitate decision making

The capacity to monitor and analyse information in real time, through the digitalization of all processes, allows decision-making and planning based on factual knowledge. Moreover, by using data analytics and artificial intelligence, expert systems can be developed to predict and prescribe, thus automating the process. The company has a greater capacity to respond and adapt to changes.

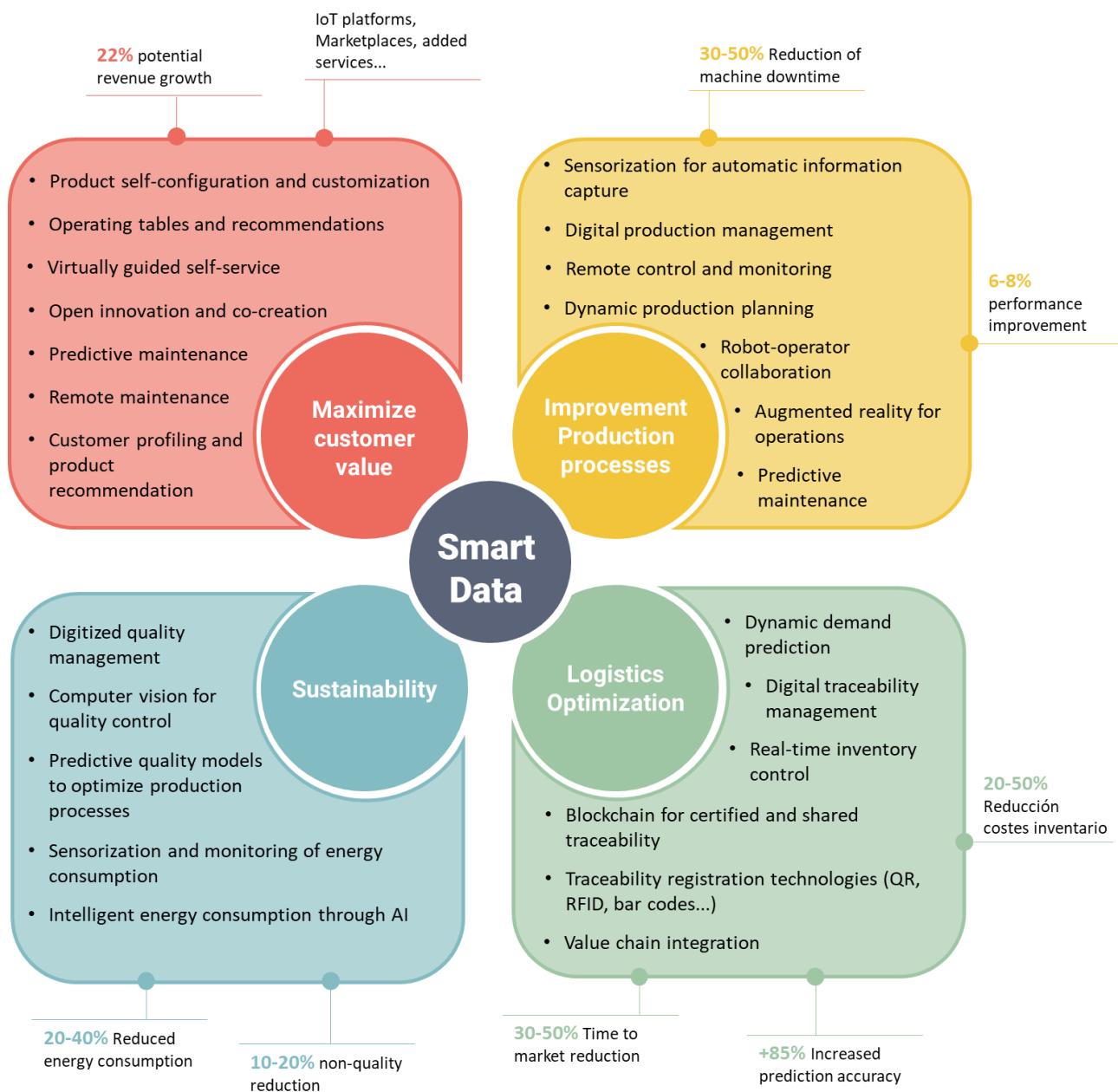


Figure 4. Benefits of digitalization. Source: Own elaboration with impact data from McKinsey.

4.3 Main challenges for the organization

Digital transformation offers organizations the opportunity to reimagine the way business is managed through new processes and digital tools. However, the implementation of new business processes is never easy, and it will always face difficulties.

Active data management

Having real data on processes and operations will allow effective monitoring, control and decision-making based on knowledge, as well as generating knowledge to develop intelligence and autonomy. Data must be actively managed at all stages of its life cycle: collection, storage, analysis, sharing and archiving, using standards and the definition of appropriate policies and good practices.

Integration of data and systems within the company

The integration of different information systems (ERP, CRM, PLM, etc.) is a key factor in digital transformation, particularly when leveraging process information to inform management and business information.

Cyber security

The digitalization of an industry and its industrial processes brings great benefits, but it also entails great risks related to the security of the data and the technologies involved. Therefore, it is necessary to anticipate and know how to manage through the establishment and adoption of processes, specific tools, and solutions, with the aim of guaranteeing the security not only of the information systems but also of all the components, equipment and 'connected' installations that make up the company's industrial network in its factories.

The impact of an attack on security can become incredibly significant, potentially affecting a company's productivity, reputation with customers, and overall competitiveness, and in some cases causing significant financial damage and even jeopardizing its viability.

Insight: Cybercrime

Cybercrime is growing extremely fast, and new trends are emerging all the time. Cybercriminals are becoming more agile, exploiting modern technologies at breakneck speed, adapting their attacks using new methods, and cooperating with each other in ways never seen before. Criminal networks operate on a planetary scale, coordinating complex attacks against their targets in a matter of minutes.

The following cybersecurity statistics provide insight into the growing threat cybercrime poses to organizations.

- Global cybercrime damages in 2021 amounted to \$16.4 billion per day, \$684.9 million per hour, \$11 million per minute, and \$190,000 per second⁷
- Every 11 seconds, a company falls victim to a ransomware attack⁸.
- More than 50% of cyberattacks target small and medium-sized businesses. And 60% of SMBs that experience a hack or data breach experience a six-month delay⁹

It is important that users and business managers take note of cybersecurity statistics, while organizations must put in place training processes that incorporate awareness, prevention, and best practices into their culture.

Collaboration and coordination with the ecosystem

The communication and exchange of information between suppliers, clients and collaborators must be managed strategically, finding the right balance between sharing, and protecting data. In addition, interrelation processes, service or quality level agreements, interoperability standards, integration of technologies and information systems, management of intellectual property generated from shared information and knowledge, or management of exploitation of joint business models.

Asphalte case: co-creation with client

Asphalte is a French *ready-to-wear brand* that aims to offer aesthetic, durable and high-quality products at a competitive price.

It has implemented a system of interaction with the customer community so that consumers can proactively communicate with the brand to express their concerns and needs and can participate in the creation of new collections and products. The company implements the concept *project by product* where it allows the user to develop their customized product based on a series of digital questionnaires.

CHEZ ASPHALTE, C'EST VOUS QUI CRÉEZ LES VÊTEMENTS

Et tout se passe dans nos questionnaires.



Plan de collection été 2023 -
Partie 1



Plan de collection été 2023 -
Partie 2



Vous voulez co-créer
avec nous ? Inscrivez-vous ici



The challenge is to manufacture the product defined by the client in the established period of 4 months, which is why Asphalte has integrated its business and production management systems with the communication portal to streamline internal processes and respond in time and the quality expected by the consumer. The company has gained visibility and brand positioning in addition to manufacturing on demand, being more sustainable and effective in all logistics and production operations.

Innovation and agility

Companies, especially SMEs, are involved in the maelstrom of their day to day, leaving little room for reflection and strategic definition. But companies must aspire to be ambidextrous. They need to diligently manage their day-to-day lives and they need to prepare for the future. They need to exploit current businesses and explore future businesses. Establish an agile organization that allows to adapt quickly to changes and establish an innovation portfolio that allows improving efficiency through continuous improvement but that leaves room for the exploitation of new value propositions or business models. Invincible companies are good at managing their day-to-day lives and exploit their current success while exploring new opportunities.

Talent management and attraction

Carrying out the digital transformation of an organization requires new profiles with different skills and abilities. Companies need to identify and train the talent available in the organization so they can adapt and facilitate change. At the same time, they must identify and seduce (attract and retain) talent to incorporate with the new skills necessary to advance in the process and be successful.

4.4 Enabling Technologies

The following technologies identified, are considered key to digital transformation. The importance of these is not in how they are implemented individually, but in how they are combined to have the most impact and benefit in achieving the goals that have been stated.

Textil Olius Case: Production Control with IIoT

Textil Olius is a Spanish company specialized in natural wool felts. Combining tradition passion and technology to offer unique products. They provide efficient and innovative solutions to the decoration, industrial goods and consumer goods sectors.

It has implemented an industrial Internet of Things (IIoT) environment through a platform (PTC Thingworx) to which multiple sensors and meters are connected to capture process data automatically and granularly. Some of the data that is collected are:

- Process time: allows you to optimize scheduling, provide accurate delivery times and meet customer service expectations and flexibility.
- Water and energy consumption: detect inefficiencies, adapt production to valley rates, size photovoltaic infrastructure, forecast costs...



To achieve the success of the project, the company has implemented a training program for staff to develop IoT knowledge and learn how to use the platform. In this way the team feels more qualified for the digital transition.

The Internet of Things (IoT): interconnection of all physical objects through the Internet communicating with each other and with their environment. It allows any element to connect, transmitting and/or receiving information, facilitating real-time monitoring and control for subsequent data analysis.

3D printing (or additive manufacturing): part manufacturing processes by adding or agglomerating material, stacking successive layers to reproduce any 3D model in a real object. This technology enables hyper-customization, small batch production, and continuous adaptation to demand. At the same time, it allows the reduction of materials and tools in production and the decentralization of this, minimizing the time to market.

Robotics (autonomous and collaborative): robotic systems capable of performing tasks self-sufficiently without explicit human control or in cooperation with the worker to increase operator productivity and safety, to have greater flexibility to work on different processes as needed at any time and allow a redefinition and simplification of existing industrial processes to gain greater efficiency.

Augmented reality (AR): is a technology that allows the integration of 3D virtual elements (text, graphics, audio...) in real time within a real environment. These mixed realities facilitate work and productivity by providing the ability to interact and access information of interest, *in situ* and in a systematic way.

Velutex Case: Maintenance with Augmented Reality

Velutex Flock is a company with more than 70 years of experience that focuses its activity on the production of textile fibre (Flock)

The company has implemented an assistance solution based on augmented reality to provide digitalization and efficiency to maintenance tasks. This SAAM (Advanced Maintenance Assistance System) solution from Innovae uses Hololens tablets and glasses to carry out maintenance tasks, superimposing virtual information and 3D content on the physical reality in which the operator must carry out the action. In turn, the solution allows digital management of all related tasks, such as the planning of preventive tasks, imputation of actions carried out, resource planning...

In this way, maintenance response times have been optimized, minimizing the associated costs and maximizing the performance of the production machines.



Simulation and virtualization: A simulation is a representative model or example of the operation of a process, system, or object over time. The simulation of products with virtual prototypes allows the optimization of the design phase of new products with a minimization of development costs and a reduction in the duration of the commercialization period. 3D product modelling techniques also allow the implementation of high-precision quality controls (i.e., metrology) of manufactured products. The virtual reproduction of a factory (which can include machines, products, and humans), through which the performance of the plant in question is modelled, allows the evaluation due to costs and deadlines of the suitability of different configuration alternatives in the plant and an analysis of its current response capacity in the face of different forecasted demand scenarios.

Big Data and Artificial Intelligence (AI): Set of technologies, algorithms and systems designed and used to collect enormous amounts of data to later extract valuable information through advanced analytical systems. Through machine learning techniques, using mathematical algorithms, expert prediction and prescription systems are created to recommend and support decision-making.

Cloud computing: Delivery of resources and services on demand through the Internet. It allows payment for use, making it technically and economically viable to have access to large storage and computing resources.

Vertical and horizontal integration of systems: Technologies and communication standards that allow interaction through a platform of the different components and information systems; vertical between the systems and departments of the organization and horizontal integrating the entire value chain (suppliers, customers, and partners). It makes it possible to have aggregated and shared information to speed up tasks and processes between the different actors, in addition to being able to generate new value and new business models.

Cybersecurity: Technologies to guarantee the confidentiality, availability, and integrity of the company. Security measures and criteria must be implemented from the beginning (*security by design*) adopting models that consider existing norms and standards.

5G: It is the fifth generation of wireless communication standards for mobile devices. It will make it possible to increase data transmission speed (between 10 and 20 times higher), minimize latency (1 millisecond) and increase coverage of remote areas.

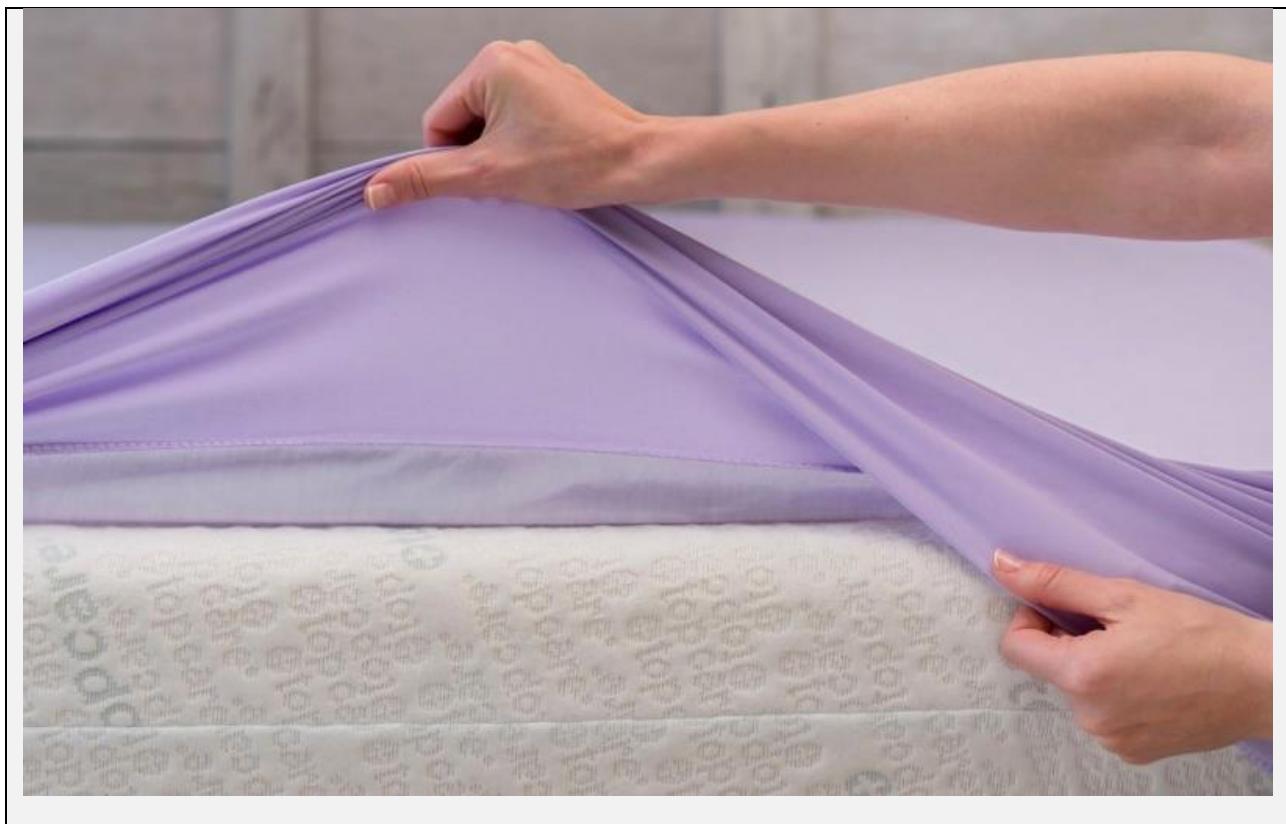
RFID (Radio Frequency Identification): It is a radio frequency identification technology that uses RFID tags (identification chip) to identify objects when they pass near a detector (terminal, smartphone, tablet, antenna, etc.). Unlike the barcode, it can track your movements, but also store and retrieve your data. This technology allows communication between the object and the sensor without visibility, either at a distance or in opaque materials, for example.

Blockchain: It is a registry, a large database that has the particularity of being shared simultaneously with all its users, all of whom are equally holders of this registry, and all can enter data in it, according to specific rules set by a computer protocol very well secured thanks to cryptography.

Bedding Case: RFID Traceability

Bedding is a Spanish company specialized in the manufacture of custom fabrics for bedding. They design and manufacture the bedding products of the BSensible brand.

Since 2009, the company has implemented a flexible and scalable internal RFID traceability solution. This system developed to measure by its suppliers and collaborators; Eurecat and ADS, includes several control points; reception of materials, preparation of the product, warehouse, and dispatch. The traceability solution is integrated with the ERP always knowing and in real time the stock of each reference, validating the content of the orders to be issued... In turn, automated rotating warehouses and handling robots are integrated into traceability, ensuring traceability throughout the production chain.



4.5 Information systems

In addition to facilitating technologies, digital tools and information systems are required to allow the digitalization of the different processes and operations of the company. Its effective implementation adjusted to the characteristics of the organization, as well as its integration, are key in the digital transformation process.

ERP system (Enterprise Resource Planning) is an information system that allows daily management and control of all the information and operational services of a company. The objective of ERP is to automate and optimize processes between departments.

Advanced Planning and Scheduling Software (APS) is a planning tool that synchronizes and optimizes a company's processes based on the constraints present in its system. The APS thus integrates all the factors that limit a company's performance, such as supply times, machine efficiency, product seasonality, storage capacity, delivery times to customers, utilization rates of resources, etc. It is, therefore, an essential complementary module of an ERP system.

Customer Relationship Management (CRM) is a system for managing a company's relationships and interactions with its customers or potential customers. A CRM system helps companies to constantly interact with customers, streamline their processes and improve their profitability.

Manufacturing Execution System (MES) is an information system that connects, monitors and controls complex manufacturing systems and data flows at the shop floor. The main purpose of an MES is to ensure the effective execution of manufacturing operations and to improve production efficiency.

Joyer textiles case: MES solution

Joyer Textiles is a Spanish company that makes home textiles for interior and exterior use, as well as lines of technical fabrics. It has a design service adapted to the needs of each client.

You have implemented an MES software solution (*Manufacturing Execution System*) going from collecting production data on paper to doing it directly against the system. Each employee on the production line is equipped with a smartphone where they record for each manufacturing order the number of items produced, the waste generated, as well as any incidents that occur during their shift. Working with a smartphone interface, known to all, makes it easier for operators to adapt to operational change.



This implementation has made it possible to minimize production times, facilitating employee operations, remote monitoring, and control of the process, planning and optimization of resources, as well as expanding design possibilities in production.

Supply Chain Management (SCM) is the management of all operations related to the supply chain, i.e., the management of flows within the company and between the company and its environment (supply, delivery, storage, information, financial transactions...). In other words, it is the management of all the resources, means, methods, tools, and techniques aimed at managing the global supply chain and delivery of a product or service to the final consumer in the most efficient way possible.

Product life cycle management system (PLM) centralizes all the data and processes generated during the various stages of design and industrialization of a product (CAD model, drawings, documentation, planning of the manufacturing process, product nomenclature, assistance to client, catalogues, etc.) in a common and secure space that guarantees the traceability of the data exchanged during the project. It allows all the parties involved in the development of a product to communicate and collaborate research department, subcontractor, co-contractor, marketing department, etc.

5 DIGITALIZATION METHODOLOGY / PROTOCOL

5.1 Digital transformation strategy

In a context of information overload, in which day-to-day activities consume time, the transformation process is a challenge for most companies, especially SMEs. For this reason, it is essential that the company has a strategic plan for digital transformation that emphasizes strategic, organizational change and the business model derived from the opportunities offered by the technologies and tools of industry 4.0.

To face the transformation process and succeed, it is vital to define the technology inclusion plan gradually and consistently based on cost-benefit analysis, avoiding allocating large resources to it without achieving the expected impact.

The Digitalization Protocol aims to promote and accelerate the digital transformation of SMEs in the textile value chain, as well as help them become more efficient, sustainable, and competitive by bringing in new talent. For this reason, its own methodology is presented so that companies in the sector can activate a reflection process structured around different areas of global analysis of the company. All this, focused on its technological transformation, emphasizing strategic, organizational change and the business model derived from the opportunities offered by the recent technologies of industry 4.0. This methodology should help companies define their own digital transformation plan to boost their competitiveness.

Case Alliance textile machines: Machinery virtualization

Alliance Machines Textiles is a French company that supplies machines for the textile industry (especially dry cleaning), which uses virtual reality (VR) and augmented reality (AR) to present its machines in its marketing.

The company has 3D modelled its machines to incorporate the models into its portal. The goal is to involve the customer by allowing him to view the machines in a virtual environment, scroll to see their size and operational capabilities, to better plan their purchase and facilitate their final integration into the production chain. In turn, the company has a fully digital catalogue and facilitates the sales process for salespeople; these through a device (smartphone, pc...) and Virtual Reality glasses transfer a differential experience to the potential customer. The client can customize elements of the machine in the model, and this will be transferred to production directly having the exact virtual model of each client's product, facilitating subsequent technical services; maintenance, spare parts or replacement of parts, among others.



5.2 Previous Considerations

This methodology is aimed at SMEs in the textile value chain, both industrial and service sectors. For this reason, it offers useful tools, but sufficiently general to be utilized by the many company profiles in the industry.

However, there are three key aspects that are considered essential for the implementation of the proposed methodology.

- **Transformation will.** Companies are aware of the importance of digitalization, but it is necessary to integrate it into their strategy. We are talking about digitally transforming the company, so it will be necessary to do things differently and adapt internal procedures. We are talking about involving the entire company and not just specific areas. New organizational processes must be implemented and not just modern technology or machinery.
- **Internal leadership.** Any process of change needs clear leadership and internal alliances to be carried out successfully. If we are also talking about global changes in the company, which may be strategic, then that leadership must come directly from the company's management team. For this leadership to be effective, it is necessary to have certain knowledge about digitalization and technology to identify, among the amalgam of technologies associated with industry 4.0, which ones can really improve the competitiveness of our company. As it is also necessary to know certain transversal capacities to promote the organizational and cultural changes that will accompany the entire transformation process.
- **Resource Allocation.** It is advisable, first, to define a multi-departmental work team that helps to have a global vision of the company during the diagnosis and, therefore, commit to making a reservation of space in their agendas to be able to work together. As it will also be essential to foresee that, once the roadmap towards the digital transformation of the company has been defined, a certain budget will have to be available to be able to implement the defined and prioritized actions, especially those in the short term.

5.3 Phases of the Methodology

The methodology of the digitalization protocol is established in four phases to be followed sequentially as presented in the following figure. The goal of this is to help companies see where they are, where they want to go, and how to get there. The resulting transformation plan, or roadmap, will help the business plan what, when, and why certain technologies will be incorporated, avoiding costly mistakes, and even planning for technologies to become obsolete.

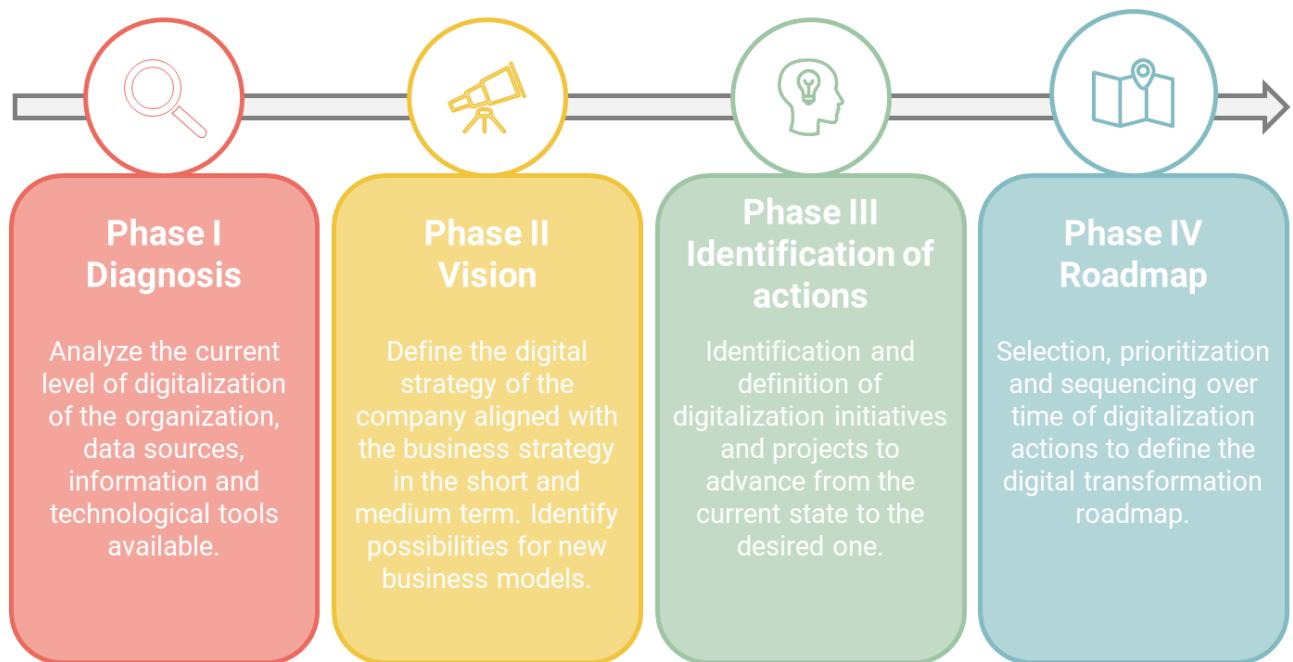


Figure 5. Phases of the digitalization methodology. Own elaboration.

It is recommended to work with an external advisor or a technology developer/facilitator to help develop this process. This external support will help to get out of the day to day ensuring that the process advances and is not lost along the way. In addition, it will enrich the process and provide it with a more neutral and transversal vision that will complement the internal vision of the company (*Insight: Key Partners in Digitalization – page 56*).

5.3.1 Phase I: Diagnosis

We understand the first of the phases, as the starting point, the identification of the current situation of the company. In this way, the first objective is to be able to have an initial description of what its current situation is regarding digital transformation, what are the elements that stand out or concern the company and, finally, define its business model to know how the company creates and currently captures value. At the same time, having information on the accounting and financial status of the organization can help to understand its priorities that are not expressed by its managers.

The diagnosis can take many forms and results, but this phase must allow the detection of opportunities and points of improvement (*pains* or pain points) in the different dimensions of the company's analysis. These needs will be the basis for proposing actions (in the form of initiatives, projects, or technological solutions) that allow them to be solved.

Insight: Analysis Dimensions

The methodology must consider different areas of analysis that make it possible to structure both the diagnosis and the roadmap towards digital transformation. Next, six areas of analysis are considered that correspond to different dimensions of the company that must be considered to face the digital transformation process globally.

Products



Generation of new connected products and exploitation of new business models that offer a new experience to customers.

Processes



Real-time information to optimize productivity and process quality, eliminate inefficiencies and improve decision-making.

Information and data



One of the most important assets of the company that needs to understand and actively manage them at all stages of their life cycle.

Tec and infrastructure



Application of new technologies and development of new infrastructures to manage all information in real time.

Ecosystem



Integration of the value chain, automating and improving the efficiency of all relationships with the ecosystem shaping new relational models.

Culture and organization



Have a specific strategy with a company-wide mindset shift that requires new talent, new organizational models, and change management.

It is important to undertake the analysis with as many roles as possible to define the real situation of the company; interviewing only the management team could lead to a wrong perception of reality. Gaining bottom-up and top-down insights across all dimensions of the business will identify where more technology and organizational transformation is needed and where investment is required. A participatory workshop can be a useful method to include representatives from different areas of the company and discuss the company's situation together, including reaching an agreement. But the best way to identify the current situation, needs, deficiencies and areas for improvement is through in-depth interviews with those responsible for the different functional areas of the company – personal meetings with the different people involved in day-to-day activities. Carrying out individual interviews will reveal the limitations of each team, their information needs, the hours spent on spreadsheets, printed documents and repetitive tasks, the lack of communication with other units, the lack of computer software to be efficient and even solutions and projects in mind, but never implemented.

Below are key elements for achieving a good diagnosis.

Business model

The Business Model Canvas (Figure 6) is a strategic consulting tool that allows you to describe the company's current business model and learn how the company creates, provides, and captures value. This allows a better analysis of how the digital transformation could affect, improve, or change the company's current business model to make it more competitive.

Insight: Self-diagnostic tools

There are various tools that allow you to carry out a self-diagnosis of the level of digital maturity. Thus, by means of an extensive questionnaire that the user answers based on the current situation of their company, guidance is obtained on the current level of maturity of their organization. In some cases, these tools offer comparative information about the company with respect to the rest of the companies diagnosed (always anonymously), allowing it to be in the context of similar organizations. In turn, some of the tools convey generic recommendations to improve the current state of digitalization and advance in each of the areas of analysis.

These tools allow you to start digitalization and have a first impression of the current level, but they are not recommended as the only element for evaluating the level of maturity. This requires a deeper and more specific analysis of the organization's own processes.

Although there is no specific self-diagnosis tool for the textile sector, those that are known and are presented below allow diagnosing the level of digital maturity of companies in all sectors (more information in annex 9.3):



hada
HERRAMIENTA DE
AUTODIAGNÓSTICO
DIGITAL
AVANZADA



Technological and
Holistic Engagement for
Industry 4.0 Assessment

Digital Maturity Level

Maturity models are maps with distinct levels of consistency, which, from a starting point, can offer organizations a guide for evolutionary improvement from the first inconsistent stages to a state corresponding to leadership or vanguard in the field of the proposed model. Specifically, a digital maturity model makes it possible to identify the level of digitalization of processes, describing for each stage the use given to data, technologies and/or system integration and autonomy that should be achieved at each level according to its description, aimed to different areas of the organization, or dimensions of analysis.

The model goes from an initial stage, in which a company has a traditional behaviour with a basic use of technologies, to the ideal situation of a fully digitized industrial company, which can take full advantage of enabling technologies for the optimization of its industrial processes. In this way, an evolution process is described in which each area must advance. Intermediate levels describe a continuous progression where each subsequent level can be identified by specific criteria and characteristics. It is not necessary for a company to reach the highest level in all areas, each company must define the desired level of progress based on its business strategy.

Several consulting firms and market leading companies have developed digital transformation maturity models. Some prominent examples include Bosch Maturity Model¹⁰, Rockwell Automation: The Connected Enterprise Maturity Model¹¹, PTC (Axeda): Connected Product Maturity Model¹², Switzerland Global Enterprise (S-GE): Industry 4.0 Maturity Model¹³, and Generalitat de Catalunya: Maturity model for the adoption of industry 4.0 in the company¹⁴.

5.3.2 Phase II: Vision

Complemented by the knowledge of the current digital reality of the company and, in turn, its current level for each dimension of the maturity model, the company must also define its ambition and strategy for digital transformation: *where do you want to go and what is it intended to do/achieve?*

Gerry Johnson and Kevan Scholes, authors of *Exploring business Strategy*, say that strategy determines the long-term direction and scope of an organization. For them, the strategy should determine how resources should be configured to meet the needs of markets and stakeholders. Michael Porter, Strategy Expert, and professor at Harvard Business School, emphasizes the need for a strategy to define and communicate an organization's unique position, saying it must determine how the organization's resources, skills, and competencies should be combined to create advantage competitive.

While there will always be some evolved element of strategy, planning for market success is important. This means that organizations must make the most of the opportunities in front of them and anticipate and prepare for the future. In this sense, digitalization is an opportunity to improve and increase competitiveness that should not be missed.

In the same way that in the diagnosis phase, the level of digital maturity of the organization can be completed in the different dimensions analysed, in this phase the company must define the level that it intends to reach in the medium term. Defining this future scenario based on digital transformation allows the company to identify how it will impact the way in which value is created, provided, and captured, with the aim of strengthening its competitiveness and ability to adapt to new environments.

Tools and techniques such as the SWOT analysis, the Five Forces, among others, are useful for ordering and visualizing strategic aspects of the company. Annex 9.2.2 presents a table with strategic analysis tools for the organization, categorized according to purpose. These tools are intended to analyse the impact of digital

transformation on strategic objectives to work on future scenarios and its impact on the business model in the medium term.

That is why it is interesting to use the *Business Model Canvas* in this phase to define likely future business models based on the future or desired digital level. Figure 6 shows a *Business Model Canvas* with different questions to facilitate the filling of the different dimensions. Many times, it may be enough to formalize or even define the strategic objectives and compare the forecast with the real one since the leaders of the company have a good vision of its offer and its market.

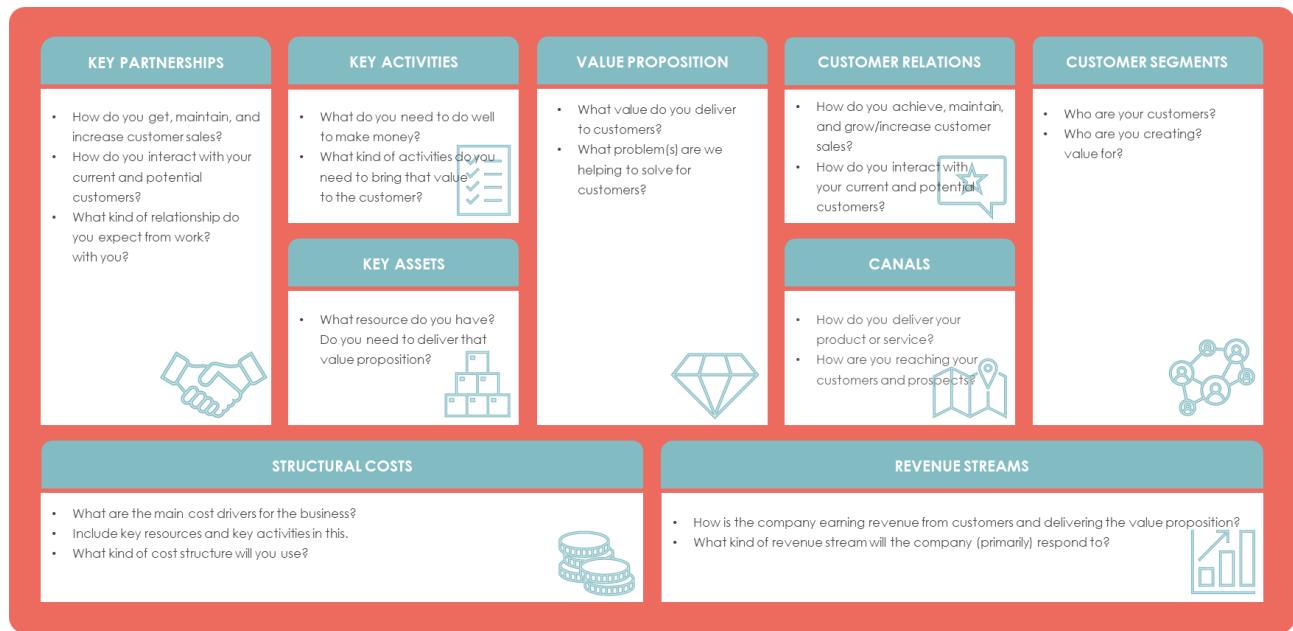


Figure 6. Business Model Canvas. Own elaboration.

5.3.3 Phase III: Actions

Once the evaluation of the current state and the definition of the future vision are completed, it becomes possible to identify the systemic *gaps (technological gaps)*. These gaps represent both challenges to be addressed and opportunities for digitalization and improvement. The identification of opportunities to develop and the challenges to address will have an impact on different areas of the company to achieve the desired level of digitalization. The objective of this phase is to generate a list of actions to be carried out to cover the gaps detected.

After identifying the challenges and opportunities for digitalization improvement, a company can create initiatives to achieve the desired level of digitalization. When generating and agreeing on the initiatives (projects) to be implemented, it is important to involve the largest possible number of department heads and team leaders within the company. In general, this activity may involve several workshops where the diagnostic result(s) (maturity model assessment) are presented in a visual form with current and future desired states as a starting point for discussion. From this point, the workshop will work on the different opportunities identified, thus generating the initiatives (projects) that the company will implement.

Insight : Inspiration and exploration tools

Understanding what is going on in the environment helps to imagine what might work inside. For this reason, it is interesting to carry out an exploration to inspire the participants in the development of initiatives.

Analysing trends, success stories and what other companies are doing, whether they are in the same sector, helps to open the mind to be able to generate ideas and define solutions for the company's needs. Tools that can help during the inspiration and exploration phase:

- The **environment map** helps to understand the scenario in which the user and the company move in the market. With this map, an analysis is carried out under three axes: supply, demand and trends.
 - Trends. Technological, legal, political, economic, social, environmental...
 - Sector (supply). New suppliers, competitors, producers, distributors... What changes or developments may affect the project and the users.
 - Market (demand). What is happening in the demand environment? New consumers, new consumption patterns...
- Compilation of **use cases and good practices** in the application of industry 4.0 technologies.
- **Brainstorming** to collect proposals from the members of the working group once good practices and trends have been identified. There are different ideation [tools](#) and dynamics that can be used to identify actions.
- **Consolidate ideas** by sharing them with the whole team.

Involve technology experts

For this workshop it is important to engage technology experts in different fields related to the nine technologies commonly defined as key drivers in Industry 4.0. In this way, the inclusion of external consultants, digitalization experts or people who have participated in similar digital transformation processes will facilitate the process of generating initiatives. With the combination of internal knowledge of the company and external experience in technology and digital transformation, initiatives will be defined to solve the identified opportunities.

Definition of initiatives (actions or projects)

For each initiative it is important to define as far as possible, its objectives, the steps necessary for implementation, the estimated costs, as well as the expected benefits and risks. One viable way to define initiatives is through a page definition. This could be defined as a visual template (canvas). Canvas is an easy approach to systematically understand, design, and start new projects. It is defined on one page and covers the information necessary for the definition of a project. It uses neutral language and is easy to access and understand by all project stakeholders.

The most common pieces of information presented on a canvas for an initiative definition are:

- Objective: The main objective of the implementation of the initiative.
- Description: Explanation of the initiative. The challenge it intends to solve and how it will be carried out.
- Benchmark: Providers or solutions identified to implement the initiative

- Planned actions: The main steps to carry out the implementation of the initiative.
- Visual representation: Image, diagram, or scheme to help understand the initiative.
- Technology: The technologies that are necessary to carry out the implementation of the initiative.
- Estimated Cost: An estimate of the cost of acquiring and/or implementing the initiative. The most detailed possible. It may also include information on the need for external funding and the time needed to implement it.
- Benefits: The main benefits for the company of implementing the initiative. It is important to be able to estimate a return on investment. This allows the benefit to be quantified and facilitates the subsequent prioritization of initiatives.
- Risk and recommendations: Impediments and problems that may occur during the implementation of the initiative. It also includes dependencies with other initiatives and recommendations for successful implementation.

Toni Pons Case: Digital transformation and cybersecurity

Toni Pons is a Spanish company with more than 75 years of design, production, and marketing of footwear. They create timeless collections made in an artisanal way using high quality materials that are responsible with the environment.

In 2020, the company, together with the Eurecat Technology Centre of Catalonia, carried out a strategic reflection process to define a digital transformation plan for the coming years. They have defined around 30 digitalization initiatives or projects attacking the different business areas of the organization: availability of data, production, logistics and management processes and promotion of sales, among others. These actions have been prioritized and sequenced, having a roadmap for digital transformation in the short and medium term.



Toni Pons has begun to implement initiatives from the same plan to move forward in the digitalization process and increase its efficiency and responsiveness to the changing needs of the environment. In this way, in the first instance, a cybersecurity audit was carried out to evaluate the situation at the IT/OT level and detect vulnerable points in need of action and the implementation of technological and organizational measures to minimize the probability of suffering cyber-attacks or incidents related to cybersecurity.

In a second stage, the company is migrating its business management system to a solution with a greater possibility of business scalability, incorporating warehouse management modules, quality and other elements managed manually until now.

5.3.4 Phase IV: Definition of the roadmap

Having the map of initiatives is not enough to act in terms of digital transformation. The set of initiatives generated must be prioritized, grouped if possible and sequenced over time to create the digitalization roadmap for the company in the short, medium, and long term. This can be a complicated process because each initiative often has its own business case and funding. However, it is essential because the roadmap is the guide and reference to keep the company moving towards its goal. To prioritize correctly, companies must select those projects that generate the maximum impact. However, they must also assess opportunity costs, dependencies between initiatives, and grouping activities that have synergistic opportunities.

When prioritizing initiatives, some criteria that can be considered include:

- **Impact or Benefit:** Each initiative generated must have some impact on the company's progress in the digital transformation process. What is important to assess is how far you are going to move the company forward. The estimation of this impact can be related to the increase in income, the reduction of costs (minimizing time and resources or incidents) or more qualitative elements, such as the positioning of the company.
- **Strategy:** how well the initiative aligns with the business strategy. As most projects claim to be aligned with the digitalization strategy, it is important to identify those initiatives that are strategic and a priority while others may not be interesting to carry out from the business point of view.
- **Cost estimation:** Knowing the economic cost for the implementation of the initiative is essential to carry out the prioritization. Financial resources are limited, so the more realistic the estimate, the more refined the prioritization of projects. However, estimating the cost is not an easy task and a company will need to consider the technologies involved, the workforce, etc.
- **Technology Maturity:** Often the technology solutions required to implement an initiative have been available on the market for several years, with multiple vendors capable of supplying the required technology. However, the required technology may still be a beta version undergoing validation or may not have been developed at all. Therefore, it is important to identify the technology maturity required to implement an initiative, which translates into the technological risk involved in carrying out that initiative.

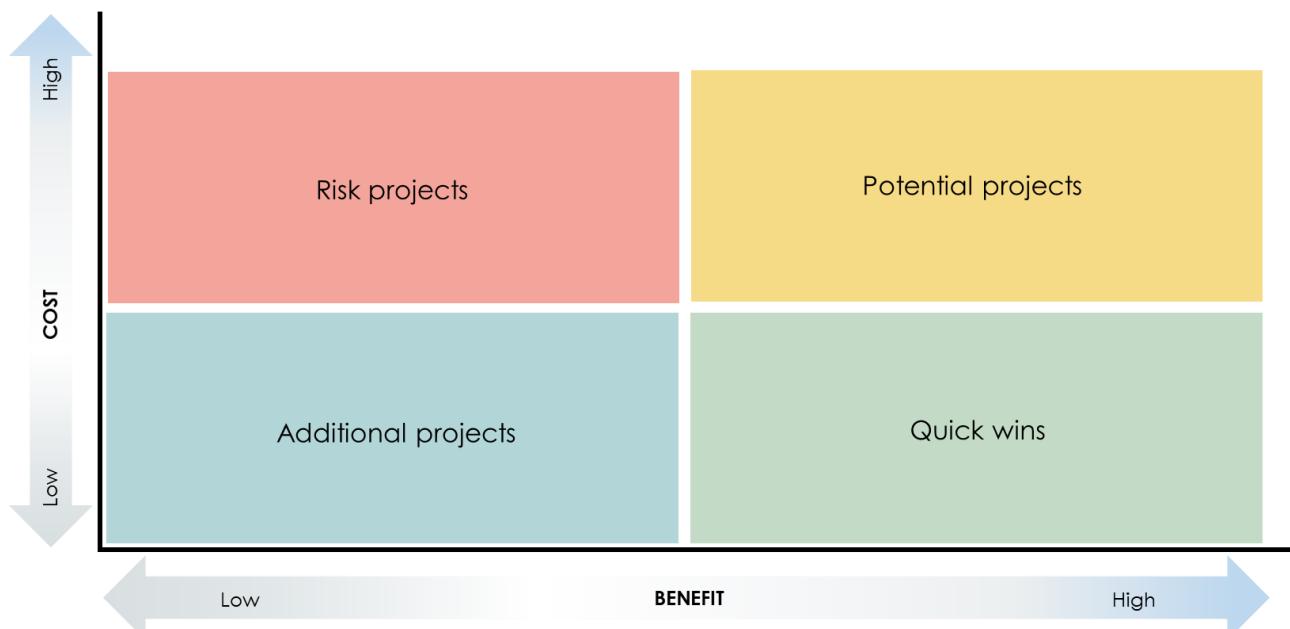


Figure 7. Cost-Benefit Matrix and identification of quadrants for the evaluation of actions. Own elaboration.

An effective approach to prioritizing all initiatives is to assign weighting factors according to their importance and set levels for each of the evaluation criteria. And, through a workshop with the designated people, make a vote for each of the initiatives. A visual matrix can be established to facilitate prioritization and group initiatives into the following typologies, as shown in Figure 4. This matrix is divided into 4 quadrants:

- **Quick wins:** Those initiatives that have high impact with low cost and risk. These are typically the priority initiatives as they deliver results early on and motivate staff/stakeholders and set a pace for the entire transformation process.
- **Potential projects:** Those projects that have a high value impact for the digitalization of the company but that have a higher cost and/or risk associated with them compared to the *quick wins*. The degree of strategic alignment can determine a position of initiatives in the implementation sequence.
- **Additional projects:** Those initiatives with a reduced impact in terms of the digitalization process but have an insignificant risk and cost that make them interesting for implementation in the medium / long term.
- **Risk projects:** Those projects that, due to their minimal impact on digital transformation and their excessive cost and risk, are discarded in the first instance so as not to waste resources on their implementation.

Ideally, initiatives with high impact and low implementation costs and risks would have the highest priority for execution. However, sometimes it is necessary to take a risk and strategically position the company by betting on a high-impact initiative, despite the excessive costs or risks involved.

Phase 1

- Prepare the organization for digital transformation: structure, organization and financing tools.
- Implementation of the main Identified Quick Wins.
- Digitize the main production and operational processes.

Phase 2

- Ensure data connectivity, availability, scalability and integration.
- Thickness of potential and additional projects with better benefit/cost ratio.
- First prescriptive and predictive models using AI.

Phase 3

- Complete the digitization of the organization.
- Other projects according to cost/benefit ratio.

Figure 8. Example of grouping actions by phases. Own elaboration.

The cost/benefit matrix will lead to a first ranking of initiatives that will have quick wins first followed by potential projects and will end with additional projects. However, this provision requires iteration considering dependencies between initiatives. That is, it is possible that some initiatives cannot be carried out if another initiative has not been previously implemented. For example, when creating an algorithm to predict demand, it is impossible to make the model work if historical data (from the organization, the market, productivity information, sales...) has not been previously collected. Similarly, if predictive maintenance is to be performed, it will be impossible without first having the machines connected to a network.

Therefore, considering these dependencies, as well as other organizational and structural considerations or financing possibilities, the definitive prioritization of the initiatives will be carried out at different time horizons, thus defining the strategy for digital transformation.

The roadmap can be visually represented in many ways. Initiatives can be grouped by functional areas (production, sales, product development, quality assessment); by key challenges/objectives (cost reduction, sales increase, development of new products or services); or by key strategic lines (international presence, business expansion, greater production capacity, cost reduction...). There is no right or wrong way to do it, the best way is the one that makes sense for the team. The options are endless, but the key is to keep it clear, simple, and focused so that all parts of the business can immediately understand it.

Each initiative will have a position in the sequence, being placed in a stage where it will be implemented and grouped with other initiatives if so. Initiatives can be linked sequentially or drawn in parallel with one or more initiatives. Figure 9 shows an example of a simplified visual representation of the roadmap.

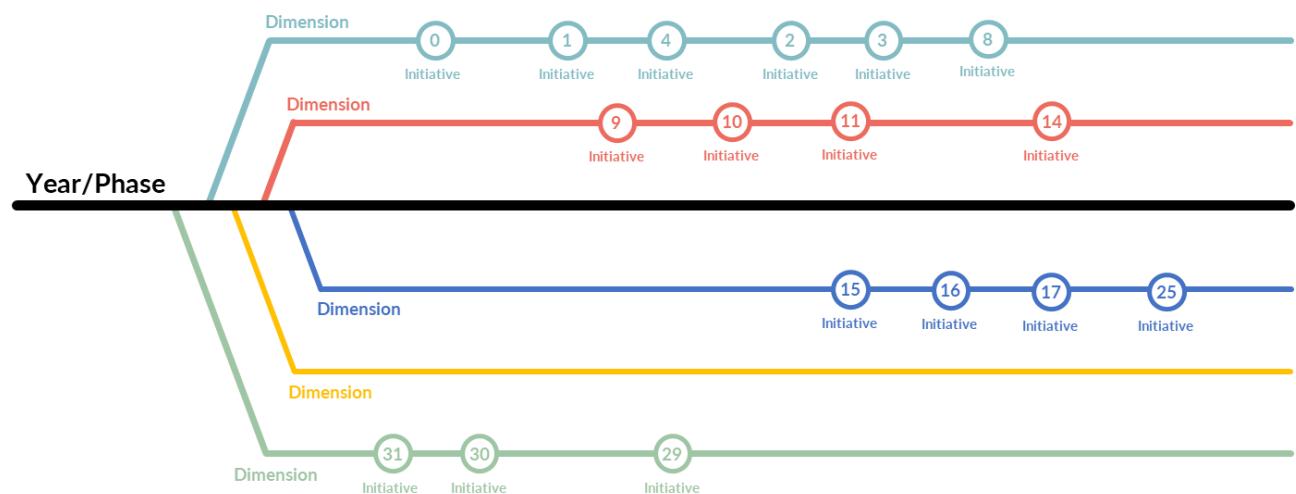


Figure 9. Example of visual representation of roadmap. Own elaboration.

When mapping initiatives it is important to consider the resources available in terms of people, money and time and the pace that is set for the company. Answers to some of the following questions should be considered:

- How many projects can be carried out at the same time?
- Even if I have the funds, do I have the staff to implement it?
- Is the company ready for the change involved in certain initiatives?

Knowing the reality of the company, its willingness to change and the ability to implement projects will define the final roadmap. Carrying out different iterations of the roadmap, with different scenarios at a longer or shorter time horizon, can help define it.

5.4 Communication and implementation

Once the roadmap with the planned digitalization strategy has been developed, it is time for its communication and implementation. For communication, it is recommended that an organization organize events, workshops and collect best practices to inspire its staff, share the common vision and train them on the new tools or technologies.

For implementation, it is necessary to form a process management team, allocate financial resources (including the creation of a financing / financial plan) and identify the right people to implement projects associated with the strategy and make decisions on how to carry them out.

Once the necessary structure to carry out the transformation process has been established, the initiatives proposed in the roadmap must be implemented. Each initiative is a project and should be treated as such. Therefore, from the definition carried out in the roadmap development process, the proposed implementation steps must be followed.

In each case the company must decide how to carry out the implementation. You may acquire technology, develop technology internally, or collaborate with third parties to develop it. The decision will have to be made whether to buy, make or collaborate. Although in many projects the decision may seem obvious, in most cases it is not. Each option has its pros and cons, so the company must weigh in each case which strategy can provide the most value.

Insight: 5 key questions to define transformational KPIs

To monitor the evolution, it is important to define metrics and indicators to detect if the implementation process achieves the desired results and is aligned with the objectives and the business strategy.

To create a transformation KPI, Gartner recommends asking these 5 key questions:

1. **What is being measured?** An example might be the percentage of customer interactions that are virtual/digital.
2. **Where are we today?**
3. **What is our goal?**
4. **What is our desired business outcome/benefit?** For example, 50% better customer results and 20% lower cost.
5. **What is our break-even point?** (A "break-even point" defines the reasons why a company should not go overboard. The law of diminishing returns also applies, and sometimes it does not make sense to target 100%. For example, a South American company might want to move all its customers to mobile transactions, but in some countries 100% of consumers use a smartphone, while in other countries only 15% do).

Although each project is different, the establishment of alliances with technology providers or R&D entities such as technology centres and universities will surely improve the process and provide support in the execution. Furthermore, when the roadmap is put into action and technological or organizational projects and solutions are implemented, it is essential to monitor progress and ensure that it stays on track.

It should also be borne in mind that the roadmap must be a living document that has to adapt and grow with the company. It must be reviewed and analysed frequently to update it according to changes in the company's own business requirements, external influence from competitors, customer demands or the disruption of modern technologies.

Jules Tournier case: Digitalization for capitalization.

Jules Tournier is a family-owned, independent, French textile manufacturer that employs over a hundred people in Mazamet, in the Tarn. With 155 years of experience, Jules manufactures textiles for luxury ready-to-wear and haute couture and has a production unit dedicated to the development and manufacture of technical textiles.

Jules Tournier, as many industrial companies, is facing the problem of the ageing of its qualified workforce and the difficulty of recruiting new workforce to acquire complex know-how that requires long training periods. To professionalize the preservation and transmission of its know-how Jules Tournier is using a digital tool based on video and an intelligent voice assistant in order to get as close as possible to the professional gestures, to be able to describe them, to mobilize them, in order to transmit them for training purposes. The tool will enable the creation of a database of know-how, to maintain, enrich and transmit it.



The implementation of the project must facilitate the transmission of high value-added know-how around the issues of production quality and/or execution speed. It reduces inter-individual variability between operators and accelerates the learning curve in a context of aging experts, recruitment difficulties and high turnover. An industrial e-learning solution reduces the cost of training and offers a tool adapted to new generations.

5.4.1 Financing plan

As has been mentioned, having financing can make the transformation process easier thanks to the incorporation of resources that would otherwise be difficult to obtain. Financing instruments allow organizations, especially SMEs:

- Have the capital to speed up the process by implementing solutions sooner than would be possible.
- Access to expert technology providers to accompany them on the path of digital transformation.
- Carry out concept tests that allow validating technologies for later scaling, ensuring the success of the implementation.
- Incorporate talent, both hiring fresh staff and carrying out training of current employees.
- Implement technologies with a higher technological risk being able to assume the non-achievement of the objectives set.
- Collaborate with companies in the value chain (including competitors) and other stakeholders (clusters, R&D institutions...) to create synergies and develop knowledge of the sector that increases competitiveness.

At this point it is essential to have knowledge of the entities that offer grants and aid in the field of digital transformation to be able to review and map the calls that are being opened and to be able to apply to those that fit the characteristics and objectives of the organization.

The ecosystem of aid and tax tools available to encourage innovation in SMEs is powerful. However, accessing this type of aid is not typically easy, and requires a process that is often long and complex. Thus, it is important to understand what type of aid we can request and draw up a strategy in accordance with the capacity and state of maturity of our organization. It is interesting to go hand in hand with a *partner* (consultant) with knowledge and resources in the field of grants and application processes to increase the chances of success.

Insight: Organisms that promote financing

Below are the main organizations at the state level that offer aid for the digitalization of companies in the Sudoe region. For the details of the programs, they offer and their characteristics, see Annex 9.3 or directly at the organization's link.

Spain



France



Portugal



6 DIGITAL TEXTILE MATURITY MODEL

Next, a proposal for a Maturity Model for the digitalization of the textile value chain is presented. This, based on the Maturity Model for the adoption of Industry 4.0 developed by the Catalan government, aims to serve as a tool to make it easier for any company in the textile/clothing sector to identify the state of digitalization it is in, and define the level that it wants to reach in the medium term to propose a roadmap of actions for the incorporation of technology that allows progress in the process of digital transformation to go from one state to another.

The model proposes 6 areas of action or dimensions of analysis of the organization on which to implement actions to advance in the digital transformation and 5 levels of maturity or degrees of digitalization. These levels range from a minimum stage, in which the company has a traditional behaviour with a basic use of technology, to the ideal situation of a fully digitized company, capable of making the most of the enabling technologies, both for the optimization of its industrial processes, as well as for the adoption and exploitation of new business models. The following figure shows the maturity model matrix that allows the organization to identify the current and future (desired) digitalization states in an easy and visual way.

	Conscious *	Beginner **	Competent ***	Expert ****	Leader *****
Products and services	No digital solutions.	Roadmap for Smart products.	Products with new digital services.	New business models based on data.	Customization at the end. Full traceability.
Production processes	No real-time information. Reactive maintenance.	Digitization roadmap. Preventive maintenance.	Digitized and integrated processes. Control, programming and KPIs in real time. Traceability.	Process optimization (AI). Planning, quality, maintenance, logistics distribution.	Autonomous processes. Self-configuring machines. Prescriptive maintenance.
Ecosystem	No digital channels. Basic website.	CRM. Web 2.0. eCommerce. Intranets and extranets.	Digitalization of order management, traceability through codes and quality controls of suppliers.	Integration of systems with third parties for the exchange of information. Omnichannel for customer management and data capture.	Comprehensive supply chain planning and control. Autonomous and predictive management. Blockchain for traceability certification.
Technology and Infrastructure	Basic communication system.	Management and production system: CRM, ERP, PLM, SCADA	IoT platform integrated with management and production systems.	Expert systems and recommenders.	Plant simulation and virtualization technologies.
Information and data	Scattered, incomplete and in various formats.	Data roadmap. Conceptualization of databases.	Centralized database. Knowledge Data Model.	Analytical tools and machine learning techniques.	Integration of information from external data (ecosystem and environment). Continuous improvement of predictive systems.
Culture, strategy and organization	No digitization strategy.	Digitalization Plan and Roadmap 4.0.	Structure for the management of digitalization and IT/OT coordination.	Training and recruitment of talent in data management and technologies 4.0.	Holistic continuous improvement plan for efficiency and sustainability.

Figure 10. Digital maturity model of the textile sector. Own elaboration based on the Maturity Model for the adoption of industry 4.0.

Next, the six dimensions of analysis or areas of action of the organization are briefly described:

- **Products, services, and new business models:** Digitalization provides the necessary instruments to modify the product produced based on changes in demand, both in terms of volume and design variability. It goes from a production focused on the product to a production focused on the client. In addition, the connectivity of the products adds the possibility of generating new services based on data and information, transferring added value to the customer, and enabling the generation of new Business Models.
- **Production processes:** Activities that include, among others, design, planning, production, quality control, monitoring, and maintenance. Implementing the automation and digitalization of processes will allow a global vision of the entire value chain, maximizing its efficiency, flexibility, and sustainability, producing more and better with less production time and cost.

- **Ecosystem:** Companies are part of larger structures and value chains made up of partners, associations, and suppliers, who need the sharing of information, and, therefore, the integration of data, processes, and management systems with the aim of offering more value, higher quality, and efficiency. The constant exchange of data with suppliers will allow processes to be optimized, ensuring the traceability of the entire value chain. In turn, it is essential to establish communication channels with the client that allow profiling, capturing needs and giving quick responses.
- **Technology and infrastructure:** Digital transformation requires a broad set of technology infrastructures. These infrastructures include both software elements; data processing systems, integration platforms for company processes (customers, stocks, orders, energy expenditure, production time and efficiency), etc. as hardware elements; sensors, PLCs, encoders ... These must provide connectivity to the different machines and equipment to be able to capture, store, monitor and analyse the information they generate and optimize and improve the competitiveness of the company.
- **Information and data:** Data are the key to control, manage and make decisions in the organization. Data must be actively and strategically managed throughout the value chain at all stages of its life cycle. Defining and implementing a plan for the collection, storage, analysis, valorisation and sharing of data is basic and necessary for the success of digital transformation. Data protection is essential at all stages, always guaranteeing their security.
- **Culture, strategy, and organization:** Digital transformation requires a change in mentality throughout the company, which in turn requires new organizational models in which the involvement of management is key. Management must have a broad innovative vision and understand the importance of technology as a factor of competitiveness in the medium and long term. The need to establish roles that allow a correct implementation of digitalization initiatives and that these are fully aligned with the strategic objectives is established. In turn, an increasingly intense specialization in IT is required at all levels of the organization. For this reason, the hiring of qualified personnel in this area, as well as the training and qualification of personnel, is an essential element.

And the five levels of maturity or degrees of digitalization:

- **Aware:** In general, the different functional departments of the company work in isolation and do not have access to integrated information. It works with information in different physical formats (paper) The company does not generate knowledge based on empirical data on the company's production processes, nor on the associated products and services, such as maintenance, inventory management or supplier management, which limits the real capacities to take a leap forward and improve their productivity, the quality offered, the response to demand, product innovation, or the establishment of new business models with new services, among others.
- **Beginner:** The company has the main production and operational processes of the business digitized through information systems (ERP, MES, CRM...). It lacks complete integration between the different systems for the aggregate exploitation of data in storage architectures. The company has the information of the different departments available in the system, allowing to streamline the allocation and consultation and sharing with the ecosystem, minimizing the presence of paper.
- **Competent:** The company has an integrated and scalable technology and systems architecture that enables the automation of information flows between the different corporate management systems (ERP, CRM, MES...), departments and agents in the value chain. In turn, it is possible to define and generate dashboards by department with aggregated business indicators in real time, as well as the generation of automatic reports that facilitate decision making. There is some automation of the different processes in the plant at the level of production, productivity, quality control. Information

integration does not only occur at the factory level, but also at the product and customer level (i.e., machine tool, extrusion line, printing line, etc.).

- **Expert:** The company implements improvements in automated processes. It can optimize processes, introducing elements of prediction and prescription thanks to the implementation of artificial intelligence. This intelligence generates new knowledge by analysing and exploiting the information and data collected. This translates into greater efficiency and productivity, a higher quality product (i.e., a significant reduction in the number of defective products per batch) and the satisfaction of customer needs.
- **Leader:** The company implements continuous improvement to continue advancing both in the concept of smart factory and smart product in its case. The company is part of an integrated ecosystem with its *partners* and suppliers that gives it the option to compete at a much higher level, which would not be possible otherwise. The company can exploit the valuable information and knowledge it obtains because of its business through new business models.

As has been commented throughout the methodology for defining the digital transformation plan, this is a gradual process. The company cannot suddenly go from a conscious level to a leading one. The organization must incorporate and implement technology to add value and allow it to gain competitiveness and efficiency. For this reason, it is essential to define that roadmap that marks the path to continuously advance in those dimensions where it makes sense and generates profit.

6.1 Level of digital maturity of companies in the textile sector

Within the framework of the DigiTVC project, an analysis has been carried out on the digital level of companies in the textile/fashion sector¹⁵. One of the elements evaluated that helps define the degree of digitalization of companies and organizations in the sector is the level of implementation of enabling technologies and information systems. As mentioned, they are essential elements in digitalization, so the degree of knowledge and implementation by organizations is a relevant indicator.

The following figure presents a matrix showing the percentage of implementation and the degree of knowledge of technologies and information systems by department and the location of the company in the value chain. At the same time, it includes technological recommendations to be carried out based on good practices and success stories analysed.

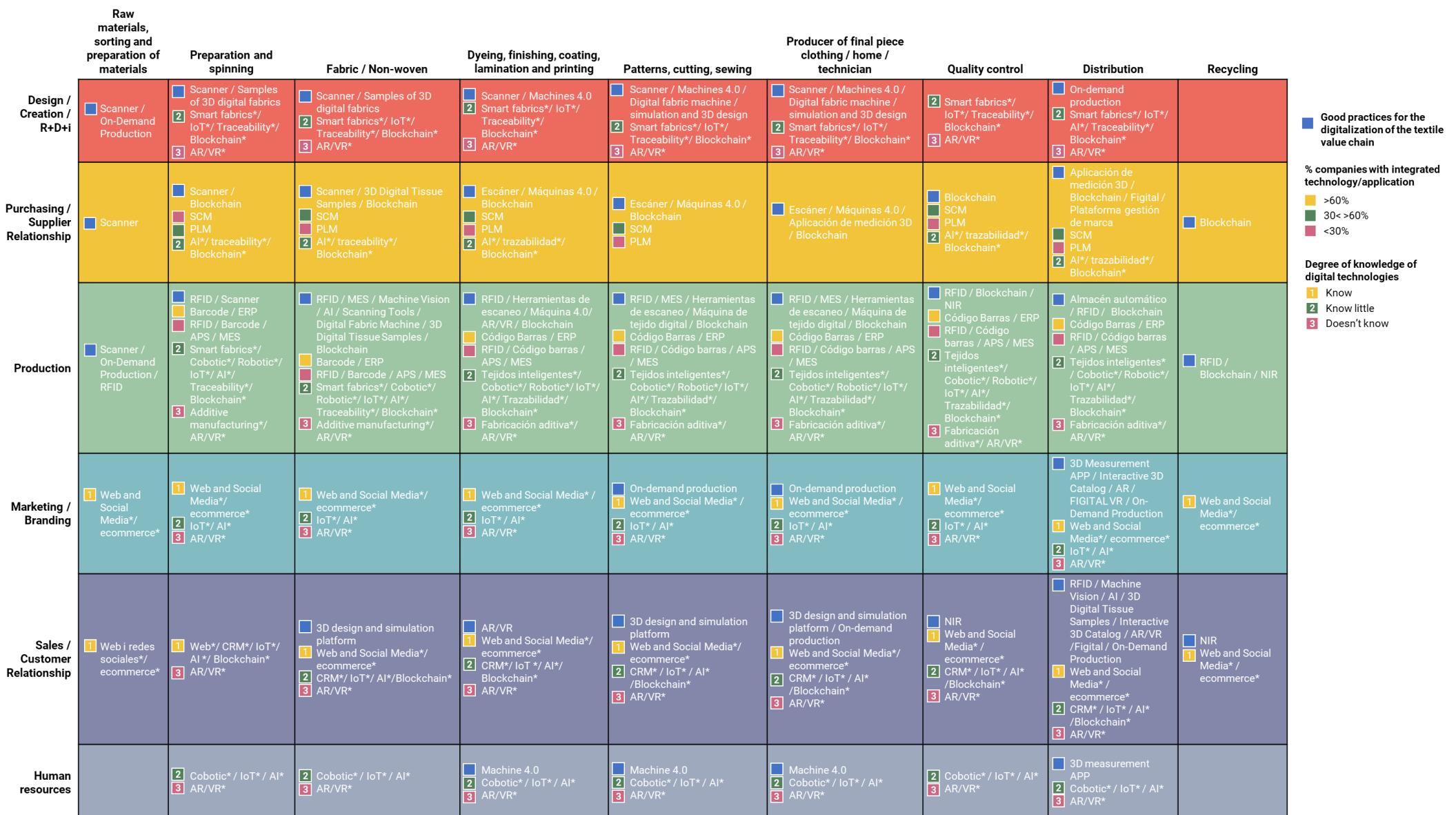


Figure 11. Level of implementation of digital technologies in the textile value chain. Own elaboration.

Based on the survey carried out, some conclusions and statistics are drawn below.

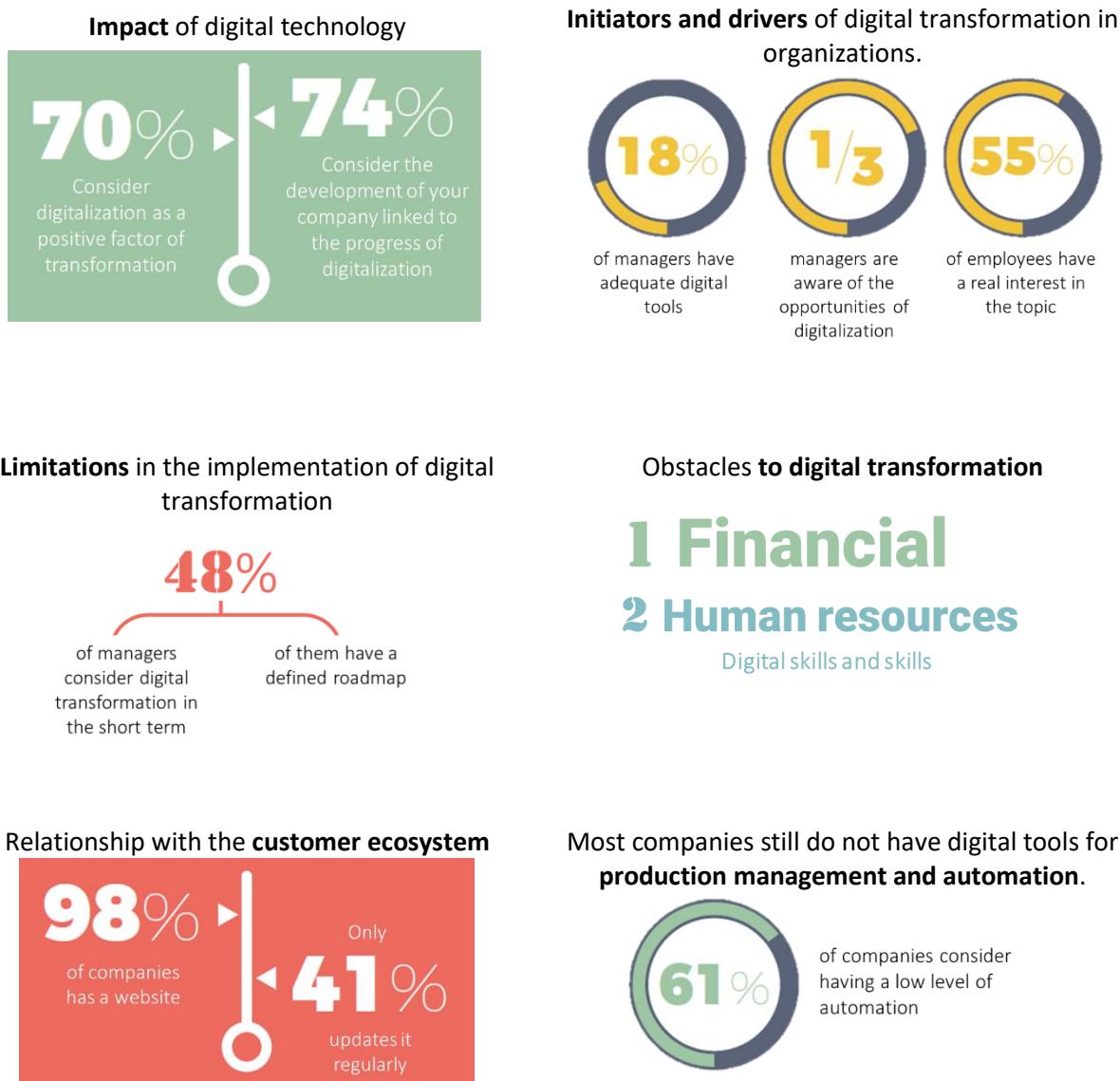


Figure 12. Conclusions and statistics on the level of digitalization of the textile/fashion sector.

If we focus on the digital maturity model for the proposed textile sector, we can estimateⁱⁱ a digital level for the sector. Figure 13 presents the estimation of the current level of digitalization of the textile/fashion sector. As described, the model matrix visually and intuitively presents an approximation to the current situation. This does not go down to an elevated level of detail for each process of the organization, but it does provide an idea of the state of the sector in terms of digitalization. Being a generalization, based on the aggregate exploitation of data, there will be companies that are out of the average and have a higher or lower level than that shown. It is even possible that there are disparities in levels within the value chain depending on the type of activity, the location in the same chain, the business model (B2B or B2C) of the companies...

ⁱⁱEstimation based on the data accumulated by Eurecat through its own tool for analysing the level of digital maturity during the support to more than 200 companies for the definition of the digital transformation plan.

	Conscious *	Beginner **	Competent ***	Expert ****	Leader *****
Products and services	No digital solutions	Roadmap for Smart products.	Products with new digital services.	New business models based on data.	Customization at the end. Full traceability.
Production processes	No real-time information. Reactive maintenance.	Digitization roadmap. Preventive maintenance.	Digitized and integrated processes. Control, programming and KPIs in real time. Traceability.	Process optimization (AI). Planning, quality, maintenance, logistics distribution.	Autonomous processes. Self-configuring machines. Prescriptive maintenance.
Ecosystem	No digital channels. Basic website.	CRM. Web 2.0. eCommerce. Intranets and extranets.	Digitalization of order management, traceability through codes and quality controls of suppliers.	Integration of systems with third parties for the exchange of information. Omnichannel for customer management and data capture.	Comprehensive supply chain planning and control. Autonomous and predictive management. Blockchain for traceability certification.
Technology and Infrastructure	Basic communication system.	Management and production system: CRM, ERP, PLM, SCADA	IoT platform integrated with management and production systems.	Expert systems and recommenders.	Plant simulation and virtualization technologies.
Information and data	Scattered, incomplete and in various formats.	Data roadmap. Conceptualization of databases.	Centralized database. Knowledge Data Model.	Analytical tools and machine learning techniques.	Integration of information from external data (ecosystem and environment). Continuous improvement of predictive systems.
Culture, strategy and organization	No digitization strategy.	Digitalization Plan and Roadmap 4.0.	Structure for the management of digitalization and IT/OT coordination.	Training and recruitment of talent in data management and technologies 4.0.	Holistic continuous improvement plan for efficiency and sustainability.

Figure 13. Estimation of the level of maturity of the textile/fashion sector.

The figure shows how the sector is in a digitalization stage around the beginner level. In general, companies have business management solutions (ERP) for the core business; management of orders, purchases, sales... but it is less common, especially in SMEs, that other management solutions are available for the digitalization of other processes such as customer management (CRM), production management (MES) or product information management (PIM/PLM). It is common to manage these processes using office tools such as Excel or Word templates, even with paper, which prevents the organization from having data related to all its processes in an aggregated way, making it complex to generate dashboards with value indicators. Regarding the relationship with the ecosystem, companies in the sector dedicate efforts to ensure traceability, of their internal operations. Transferring information to the customer about the status of their orders, in addition to establishing channels for communication and product customization, is one of the usual focuses of action, especially in B2C companies. As for the product, it is unusual for the sector to incorporate digital solutions. The exception is textile machinery suppliers that are beginning to incorporate connectivity and management and monitoring platforms to respond to their customers' digitalization needs.

This level of digitalization of the textile sector is like the level of other sectors or industries. Leaving aside sectors that are traditionally tractors in technology such as pharmaceuticals and the automobile industry, the picture we find for SMEs in general is similar.

Considering the current situation, a feasible and desirable level of digitalization to be achieved in the medium term for organizations would be to be able to attack and consolidate the competent level (Figure 14). In this way, companies should complete the digitalization of their processes and ensure the integrity of the architecture to store the data generated in a structured manner and have dashboards with indicators that facilitate decision-making. Reaching this situation allows us to begin considering carrying out actions based on the exploitation of data through artificial intelligence in critical processes. These projects aim to support technology, through valuable information (predictions and prescriptions), to decision making.

	Conscious *	Beginner **	Competent ***	Expert ****	Leader *****
Products and services	No digital solutions.	Roadmap for Smart products.	Products with new digital services.	New business models based on data.	Customization at the end. Full traceability.
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Figure 14. Proposal of the level of maturity to be achieved in the medium term for companies in the textile/fashion sector.

7 INITIATIVE PROPOSALS (TRANSVERSAL AND SPECIFIC)

Digitalization is essential for organizations to be able to compete in an increasingly changing environment. At the same time, it is a complex process that presents a series of challenges to face, making it difficult for most entities, especially SMEs, to attack. Therefore, a strategic plan is required that defines how to gradually and continuously incorporate technological tools that allow the organization to increase its competitiveness.

Next, a set of recommendations and proposals are presented, resulting from the deliberations of experts and the experience of various pilots¹⁶, which seek to define a logical line to follow and respond to the barriers and challenges that the organization faces.

7.1 Recommendations of initiatives to implement

In this sense, 3 phases are proposed for the orderly and successful implementation of a digital transformation strategy in organizations. These phases if put in a temporary context could represent the short, medium, and long term respectively.

Obviously, as stated in the methodology, the strategy and the order and implementation process will be particular to each company, depending, among others, on its current level of digital maturity, its business model, its main processes and activities, and a cost to benefit analysis of each possible action.

7.1.1 First phase: Digitize manual or repetitive key processes.

Implement tools and solutions that centralize information in a structured way, thus minimizing inefficiencies, errors and a multitude of documents circulating (both on paper and in various digital formats). At this point, the implementation of information systems (commercial or custom) is particularly relevant.

- Implement an ERP: for the **management of the main processes of the company**.
- Implement a CRM: to facilitate the **commercial management** of clients, current potentials, and opportunities.
- Implement a MES: for the **management of the production process**.
- Implement a WMS solution: for **stock management**; entries, picking, shipments and movements.

At this point it is key that the information from the different processes is integrated, so each organization can choose between two options: a solution with different modules that cover all needs or different specific and specialized solutions for each operating process that are integrated with each other. therefore, the tools that are implemented must be integrated. There is no easy answer or optimal decision, each organization must assess whether it requires specific solutions that adapt to its operations, or they can use modules with less specialization, adapting their way of working a little. In turn, it is important to evaluate the textile specialization (vertical solution) of the tool or its ability to adapt.

In any case, the selection of an information system to implement is critical, especially for management, production, and logistics processes. These solutions have excessive costs and implementation times and impact the daily operations and way of working of many employees. For this reason, it is necessary to carry out an exhaustive process of benchmarking solutions and suppliers based on very well-defined requirements and needs by those involved to be able to select the best candidates with whom to carry out product demonstrations. and limit to the maximum the *hidden* costs of customization and adaptation that any tool with these characteristics requires.

In this phase, solutions must be implemented that facilitate the daily operations of employees, especially in the processes of entering and consulting information. For this reason, the following are common initiatives:

- **Tablets/** touch screens in the production plant.
- Implementation of **codes** (bars/QR/RFID) and reading **devices** (guns, smartphones) for traceability and logistics.

It is essential to have information and that it is correct, therefore technology must facilitate the tasks of workers in their interactions with the systems. Tablets or screens allow operators to consult manufacturing orders in progress, enter records (production, quality, waste, and incidents, among others) while making inquiries that allow them to gain autonomy (manufacturing guides, support plans, images...). On the other hand, it is essential to control available and ongoing stocks, as well as to have traceability throughout the value chain to detect problems, transfer value to the customer and make informed decisions, which is why codes and readers are elements that facilitate this control and management against the system by the employees.

Digitizing other management processes such as document management, human resources, collaboration, and communication of the different departments... are elements to consider in the short to medium term, usually having an interesting cost-benefit ratio for organizations and providing clear improvements in operations from the workers.

7.1.2 Second phase: Facilitate decision making, automate data capture and connect with the ecosystem.

Digitized the main processes of the company, different lines of progress are proposed in the digital transformation process.

Facilitate decision-making: by exploiting the data collected and stored from the different processes. For this, the data must be stored in a structured and categorized way to automatically generate dashboards and reports adapted to each role within the company. In this way, those responsible for each department will be able to define the key indicators, as well as the data that they need to visualize and analyse to make decisions in their day-to-day activities. Being these dashboards updated in real time based on the activity of the organization and shared (that is, all fed by the same data).

- **Implementation of BI tools (Business Intelligence):** may require the development of ETL solutions (Data Extraction, Transformation and Loading) and databases for subsequent exploitation (*Data Warehouse*).

Promote digital channels of interaction with the ecosystem: to streamline relationships and minimize the burden on employees to manage queries and communications, tools are developed to facilitate interaction and exchange of information with customers and suppliers.

- **Provider extranet:** restricted area for the management of information, historical...
- **Digital sales channels:** own *ecommerce* through different channels and participation in third-party marketplaces.
- Customer extranet: restricted area for the management of confidential information, historical...
- **Omnichannel communication:** for technical service or for customer inquiries.

Automate data capture: proposing tools to facilitate imputation by employees is a first stage, but the ideal is for systems and machines to transfer information automatically. For this reason, the connection of the machines and the capture of information is an important advance when it comes to capturing data for decision making.

- **Automation of flows and alerts based on events:** define alerts based on defined events that give rise to automatic workflows to detect incidents and respond as quickly as possible.
- **Connection of machines;** Ethernet and Wi-Fi networks for the connection of productive resources.
- **Sensorization;** of equipment and environment to capture information relevant to the process, its status, and possible incidents.
- **Development of unstructured data architectures (*data lake*);** to allow storing large volumes of data from diverse sources for later exploitation and analysis.

Hidrocolor case: Sensorization for control and decision making.

Hidrocolor, S.L., is a spanish family-owned company founded in 1978, dedicated to the dyeing and finishing of knitted and woven fabrics. It has established itself as a benchmark of quality and added value in its sector.

The company has installed sensors and a new control system in a technologically obsolete machine turning it into a fully controlled machine. It collects all the consumption data, and it is capable of operating more autonomously. With the data on water, gas and electricity consumption, the CO₂ consumption of the dyeing process can be deduced.



With this project implementation the company got:

- Full traceability in all internal dyeing processes
- Reduction of the amount of CO₂ generated in each dyeing process in a
- Reduction of manufacturing errors.
- Better control of production costs.
- Control of the environmental impact of each production and its reduction by reducing production errors.

7.1.3 Third phase: Process automation and decision support.

Once the organization has its digitized and integrated processes and has an architecture that stores both business and production data and uses it to display dashboards with aggregated indicators, it is ready to start implementing solutions based on artificial intelligence to support decision making.

Automate processes: minimize the burden and dependency on employees, robotizing repetitive tasks of little value:

- **Administrative process automation (RPA):** robots are not only physical, but there are also software robots that allow repetitive administrative processes to be automated, reproducing the actions that an employee can perform on a device.
- **Productive automation:** the incorporation of industrial and/or collaborative robots allows to increase productivity and minimize errors.
- **Predictive quality:** implement artificial intelligence systems for machine self-configuration based on quality data and production parameters.

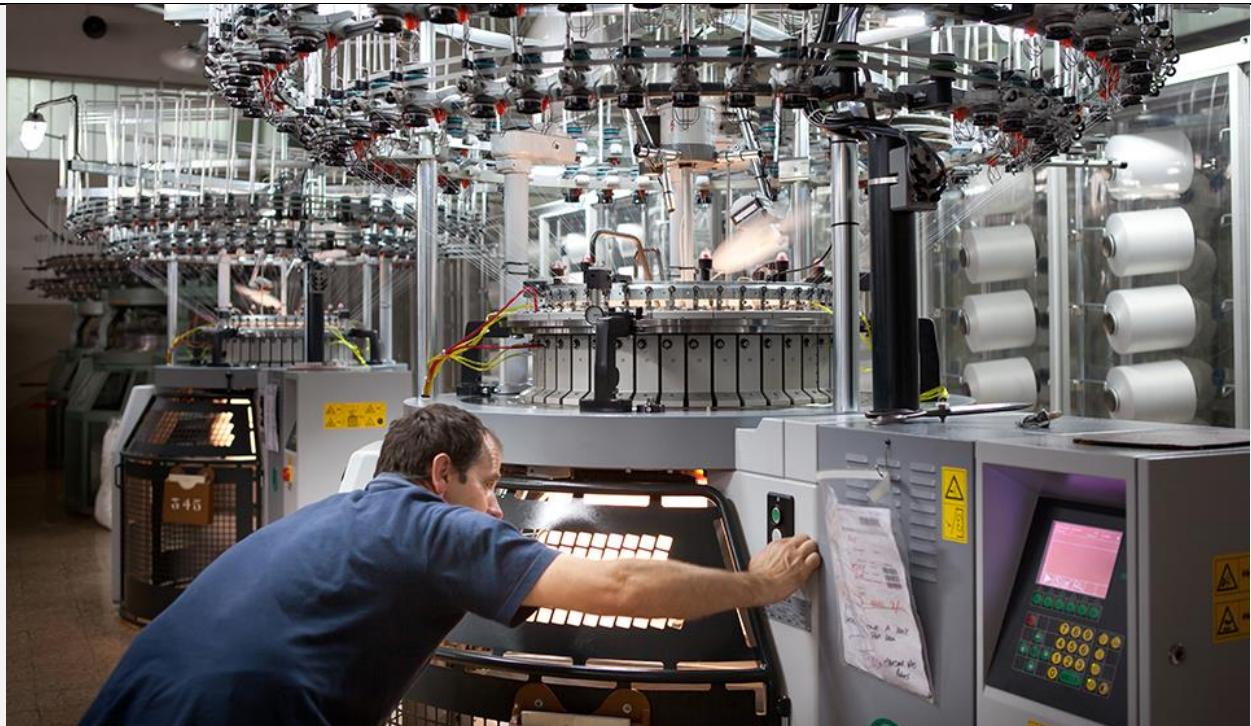
Decision support: using *Big Data* and artificial intelligence to analyse the data and generate information based on predictions and prescriptions that make it easier for the different department managers to make decisions.

- **Demand prediction:** implement models that allow predicting the demand for the company's products at different time periods, allowing better planning of supply and production needs.
- **Dynamic production planning:** support modules for production planning based on multiple criteria in a dynamic way to react and adapt based on urgent orders, incidents...
- **Customer profiling:** develop customer profiles based on aggregated and crossed data that allow detecting behaviour patterns such as risk of loss, recommending products...

Sampaio case: *Machine learning* for quality control

A. Sampaio & Filhos is a Portuguese company with over 75 years of experience, a leader in the production of fabrics using circular knitting. They offer their customers products with the highest quality standards.

For this reason, to maintain the quality of their products, but minimize the resources allocated to control it, they are implementing a pilot for the detection of defects in production. This system is based on a set of cameras that take pictures of the fabric in production and an artificial intelligence algorithm based on *machine learning* to detect defects.



Currently, quality control is carried out with the manufactured product, so defects are detected that result in waste material (or of lower quality - market value) as well as wasted time and energy. The implemented system can detect diverse types of defects in production, stopping the machine and notifying the operator. In this way, the problem is detected at the beginning of the production process, minimizing subsequent impacts. Through this system the company hopes to be able to:

- Maximize the quality of fabrics without increasing resources.
- Minimize the burden of operators to quality control, being able to manage more machines at the same time.
- Reduce materials with defects (less value or waste).
- Reduce energy and water consumption.
- Minimize CO₂ emissions
- Offer higher value-added products linked to better customer service.

7.2 Recommendations for a successful implementation

Beyond the phases and initiatives proposed to carry out and advance in the digital transformation, a series of recommendations are proposed that may be key to success in the process. These recommendations are more at a strategic, cultural, and organizational level with the aim that the implementations come to fruition by allocating the appropriate resources.

Propose the digitalization strategy of the organization prioritizing more strategic projects.

Create a roadmap for digital transformation, as it is proposed, within the company. A key point is to have the participation of the workers so that their point of view is considered, and they feel involved. Involving the people of the organization facilitates the adoption of the proposed solutions, as well as their implementation.

Identify trusted key collaborators.

Both for the definition of the digitalization strategy and for the implementation of each of the solutions, it is essential to have capable *partners* that allow establishing relationships of trust. For this, it is essential to have references, evaluate proposals and draw the bases of the tasks of each one. The organization is the domain expert within its business model and cannot encompass the necessary technological knowledge to carry out a digital transformation without the support of technology *partners* who are experts in their field.

Insight: Key Partners in Digitalization

Below are two figures that a company in the sector can approach to establish collaborations and relationships with which to define and develop the digital transformation strategy:

Digitalization experts:

Technological consultants who are experts in digitalization are a figure that companies, especially SMEs, can turn to for the necessary support in the digitalization process. Within the framework of the DIGITVC project, specialization training is developed in digitalization and in the methodology of strategic reflection of this protocol to enhance the capacities of consultants.

In this way, each territory within the Sudoe region will make available a list of consultants trained and accredited in accompanying digital transformation.

Those responsible for the delivery of training for each region are:

España	Francia	Portugal
ACCIÓ  Generalitat de Catalunya Government of Catalonia  Ajuntament d'Alcoi	 aitex <small>research & innovation center</small> 	 Famalicão <small>CÂMARA MUNICIPAL</small> 

Digital Innovation Hubs (EDIHUBS):

DIH behave as **single windows** that help companies to be more competitive with respect to their business processes, products, or services by encouraging the use of digital technologies and are based on technological infrastructures through the so-called competence centres, which provide access to the latest knowledge, experience, and technology to help their clients pilot and experiment with digital innovations.

In Europe there are around 680 DIHs (Digital Innovation Hubs) active, of which 71 are part of the SUDOE regions. In Annex 10.5 there is the complete list of DIHs.

Set realistic, not too ambitious, flexible, and scalable goals.

Good planning must be defined for the execution of the initiatives to be carried out, limiting the objectives, these being less optimistic than one would like. It is important, if it is not executed internally, to plan and define objectives jointly with the technology providers, to be aligned from the beginning and better limit the possible costs and implications. In this sense, it is important to have internally some skills on project management. At the same time, it is important to try to identify potential risks and *pain*. that may occur during execution, as well as define the contingency plan to solve them. Being clear about the previous requirements is essential to be able to start any implementation on time and properly.

In the same way, it should not be so ambitious in terms of objectives, and it should go more step by step in a scalable way (not wanting to cover everything at once). In this sense, it is recommended to divide the projects into phases, further limiting the scopes *according* to resources that can really be dedicated to each phase: Start with what can be done in the short term according to the greatest benefit that can be obtained and focus thereto.

Definition of the catalogue of data and characteristics of the existing machines.

In any digitalization project that involves the use of data (for its capture, storage, processing, visualization, etc.) the definition of the data and the available infrastructure is a prior requirement. A complete diagnosis of the current situation at the digitalization level must allow identify the available data architecture, the different formats and media used, as well as the IT infrastructure that supports it, to define the appropriate strategy to extract, transform and load the necessary data for each project.

In the case of connecting machines to a network, for example, it must be borne in mind that there may be different machines with several PLCs that must be connected and unified to extract and monitor their data. To do this, a strategy must be considered to unify data formats, connect machines, and centralize their acquisition.

Raise projects on open standards and not closed systems.

Another recommendation when implementing technological initiatives and solutions is to work, as far as possible, with open systems and standards with ease/connectivity instead of highly specialized, proprietary, and closed or inflexible systems.

These systems facilitate the connectivity and integration of systems in addition to usually having cheaper costs. Another advantage is that the result of the development belongs to the organization and minimizes the dependency on certain suppliers. If it is not possible to work with open systems, it is essential that the company has access to its data in one way or another, not only for viewing but for its use and exploitation.

Integrating cybersecurity from design.

Any device connected to the Internet can create an entry point for attacks that access the internal system, steal credentials, plant malware, or collect sensitive data. In any digitization project, cybersecurity must be considered and integrated from the initial design stage. While this is not easy, doing so can keep costs under control and minimize future problems. However, too often security is an afterthought, which is addressed only after the project has already been implemented. That is why it is key to require the technology provider to cover cybersecurity from the beginning and that it contemplates it and includes it from the design itself.

Ensuring the success of project implementation through training and change management.

As mentioned, any transformation has an impact on the way people work. For this reason, it is essential that the workers accept the change and join it, otherwise the implementations and actions that are carried out will not be successful. It is essential to involve people from the beginning of the definition of needs until the end of the implementation and start-up of the pilot. Training is key to the success of the process; both in the use of the tools and solutions that are implemented and in new capacities linked to digitalization.

Identify, know, and take advantage of existing financing tools.

Being aware of the available financing instruments is strategic to move forward in the implementation of the initiatives identified in the digital transformation plan. Leveraging financing helps, especially small and medium-sized companies, to advance in the digitalization process. For this reason, it is important to map the institutions that offer instruments and evaluate the different calls to present the identified projects.

Leverage growth on market trends.

The textile market is seasonal and tends to have marked trends that dictate to a greater or lesser extent the development of the activities of the industry. These trends should not only be considered as the demands of the end customer in terms of parts to be manufactured, but technological, organizational, social or market trends also have a strong impact on the market. Therefore, it is important to have these trends identified and know how to look for points of support in them to leverage the growth of our company.

Invest in assets for the company.

So that business growth does not stagnate, you must have a strategy of constant investment in assets that allow the company to carry out the tasks it needs to produce its products and services in the most efficient way possible. One of the benefits that most digitizing technologies allow is that the time invested in performing certain tasks is reduced, allowing workers to invest this time in other activities. When making these investments, for example, in new software, the total number of people affected by this change, the expected improvement in each of the departments, the cost/benefit ratio of this change and other factors must be considered that will help us make the most appropriate decision according to the current state of the company.

8 RECOMMENDATIONS FOR THE DIGITAL EXPERT/FACILITATOR

As it has been mentioned, it is recommended that the company creates an internal multi-departmental working group, under the direction of management and with the support of an external advisor or technology developer/facilitator entity. This digital expert must facilitate the process of strategic reflection to define a roadmap for the digital transformation of the organization in the short, medium, and long term. Having an external accompaniment allows the company to:

- Minimize the impact on the day to day of the activity.
- Have a neutral and external vision without the vices acquired from the workers themselves.
- Let the facilitator be seen by all in the same way, without prejudice.
- Incorporate technological knowledge and business reflection that facilitates the process.
- Reserve spaces/time to carry out the process.

Next, a framework of interventions/sessions is proposed to carry out the methodology proposed in this protocol and accompany the organization in its strategic reflection process that allows the company to define its digital transformation plan. It is intended to provide the facilitator with tools and advice that allow him to implement the methodology successfully, regardless of the type of client, the context, and his business model within the textile value chain.

The goal is to empower the company so that it can define its path towards digital transformation, being clear about how to add more value, to its customers, but also to its staff, and how to achieve greater competitive differentiation by taking advantage of the advantages these technologies associated with industry 4.0 provide.

It is proposed to carry out five sessions or participatory workshops that structure the development of the four phases of the proposed methodology. The essential elements to carry out the sessions are shared below, as well as useful tips for the facilitator.

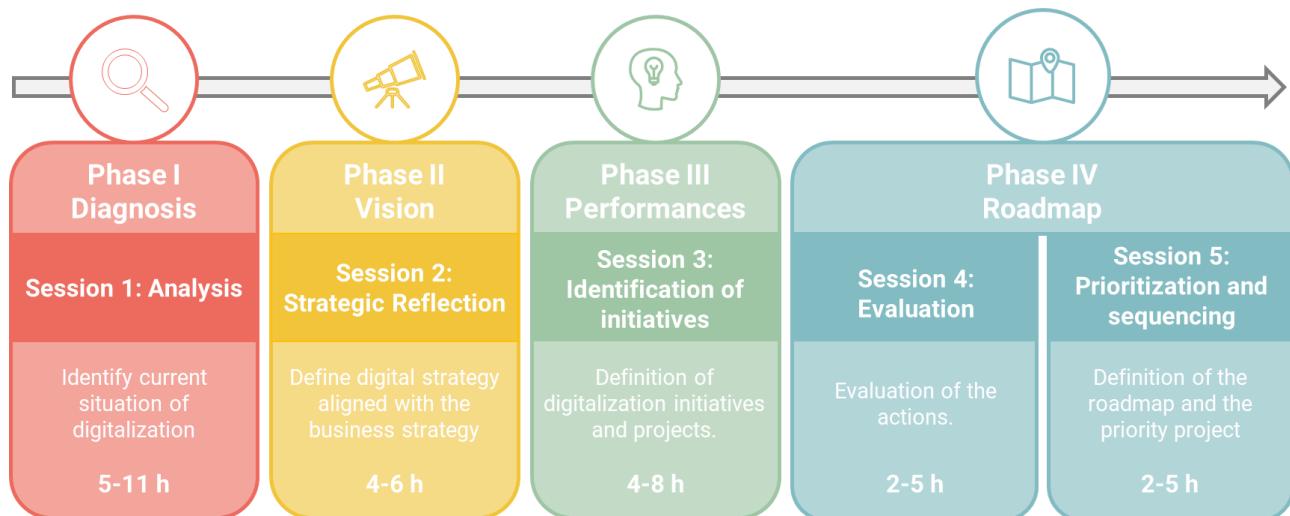


Figure 15. Proposal of sessions and estimated duration to implement the phases of the methodology for defining the digital transformation plan. Own elaboration.

Session 1									
Phase I: Diagnosis	Analysis session								
<p>The objective of this session is to know the current situation of digitalization of the company. Therefore, it is intended to analyse, among other aspects, the current level of digitalization, the sources and supports of data, information, and available technological tools. It is important to understand the processes of the organization, as well as its information flows to detect opportunities for improvement, so visiting the facilities with a special focus on production processes is essential. Having accounting and financial information can help the subsequent prioritization process. Carrying out personal interviews with the main roles that have a vision of the business, and the processes allows to collect the necessary information.</p>									
Previous work	Using a digitalization questionnaire for the company to complete before the session helps to have a preview photo and to advance part of the work.								
Agenda (proposed)	<table border="1"> <tr> <td>30 min</td><td>Presentation and context of the company</td></tr> <tr> <td>1-2h</td><td>Visit to the facilities</td></tr> <tr> <td>1.5h/person</td><td>personal interviews</td></tr> <tr> <td>15 minutes</td><td>Conclusions and next steps</td></tr> </table>	30 min	Presentation and context of the company	1-2h	Visit to the facilities	1.5h/person	personal interviews	15 minutes	Conclusions and next steps
30 min	Presentation and context of the company								
1-2h	Visit to the facilities								
1.5h/person	personal interviews								
15 minutes	Conclusions and next steps								
Useful tools	<ul style="list-style-type: none"> • Digital self-diagnosis tool. • Digital maturity model. 								
Profiles involved	<p>It is recommended to interview a minimum of 2 people from the organization, always depending on the size and production/operational processes. The main profiles should be:</p> <ul style="list-style-type: none"> • IT Manager. • Production manager. • Responsible for product / engineering / ID. • Responsible for purchasing/supply. • Sales manager / customer service. • Maintenance responsible. 								
Expected results	<ul style="list-style-type: none"> • Understand the operational and productive processes of the company. • Identify the sources of data, information and technological tools available. • Define the current level of digital maturity. • Identify needs and opportunities for improvement (<i>pains</i>) 								
Estimated duration	5-11 hours								
Tips	<ul style="list-style-type: none"> • The visit to the facilities is a suitable time to collect relevant information. Asking questions on the spot helps understand processes and capture points for improvement. • It is preferable to conduct interviews individually. The interlocutor will feel freer to express his opinion and point of view. • Having a script with important questions/points can help to carry out the interviews, but it is a conversation to detect points of improvement, it is not an audit or evaluation of the person. • It is important to let the interviewee speak in confidence, if he feels comfortable, he will explain his daily problems as well as possible ideas to solve them. 								

Session 2											
Phase II: Vision	Strategic Reflection Session										
<p>The objective of this session is to define the vision and strategic lines of the company. Identifying the objectives of Corporate Social Responsibility (CSR) is also important in aligning the digitization strategy. For this reason, it is proposed to carry out an interview with management to identify the value proposition and the medium-term business strategy. To analyse in detail the current business model and explore new scenarios based on the incorporation of technology, a participatory workshop is proposed with the multidisciplinary team defined by the organization.</p>											
Previous work	Does not apply										
Agenda (proposed)	<table border="1"> <tr> <td>1.5-2 hours</td> <td>interview with management participatory workshop</td> </tr> <tr> <td>15 minutes</td> <td>Introduction and explanation workshop</td> </tr> <tr> <td>2 hours</td> <td>Current business model canvas</td> </tr> <tr> <td>2 hours</td> <td>Future business model canvas</td> </tr> <tr> <td>15 minutes</td> <td>Conclusions</td> </tr> </table>	1.5-2 hours	interview with management participatory workshop	15 minutes	Introduction and explanation workshop	2 hours	Current business model canvas	2 hours	Future business model canvas	15 minutes	Conclusions
1.5-2 hours	interview with management participatory workshop										
15 minutes	Introduction and explanation workshop										
2 hours	Current business model canvas										
2 hours	Future business model canvas										
15 minutes	Conclusions										
Useful tools	<ul style="list-style-type: none"> • SWOT • CAME • Business Model Canvas • Digital Maturity Model 										
Profiles involved	In this session, the participation and involvement of management or, failing that, of a managerial profile with a general vision of the organization and the business strategy, is key. At the same time, it is important to involve the company's multidisciplinary team to contribute to the definition of current and future business models.										
Expected results	<ul style="list-style-type: none"> • Define the current business model. • Complete the SWOT and CAME based on digitalization. • Propose potential future scenarios for new business models based on digitalization and the incorporation of technologies. • Target digital maturity level (future). • Lines of work for digital transformation. 										
Estimated duration	6-10 hours										
Tips	<ul style="list-style-type: none"> • Having a script with important questions/points can help to carry out the interview with management, but it is a conversation to understand the medium-term business vision and strategy. • Holding sessions virtually is an option (using tools such as Mural or Miro), but participatory workshops are always more dynamic and productive in person. • It is recommended to work the workshop through participatory dynamics using printed canvas in A2 sizes and post-it to complete the different dimensions. • Drawing conclusions from the session and proposing the next steps helps the participants to understand the process and not lose the thread and interest in achieving the objectives. 										

Session 3													
Phase III: Actions	Initiative Identification Session												
The objective of this session is to generate a set of initiatives/actions based on the incorporation of technology that allows the organization to improve its competitiveness by responding to the needs and opportunities for improvement detected.													
Previous work	Reflection by the participants on tools, technologies and actions that allow improving current processes of the organization. Share conclusions from previous sessions with session participants.												
Agenda (proposed)	<table border="1"> <tr> <td>15 minutes</td><td>Introduction and explanation workshop</td></tr> <tr> <td>30 min</td><td>Summary of needs and opportunities detected in phase 1 and of the medium-term strategy defined in phase 2.</td></tr> <tr> <td>30 min</td><td>Benchmarking presentation of successful cases of technology implementation, as well as technological trends.</td></tr> <tr> <td>1.5 hours</td><td>Brainstorming <i>dynamics</i>.</td></tr> <tr> <td>1 hour</td><td>Joint consolidation of ideas.</td></tr> <tr> <td>15 minutes</td><td>Conclusions and next steps.</td></tr> </table>	15 minutes	Introduction and explanation workshop	30 min	Summary of needs and opportunities detected in phase 1 and of the medium-term strategy defined in phase 2.	30 min	Benchmarking presentation of successful cases of technology implementation, as well as technological trends.	1.5 hours	Brainstorming <i>dynamics</i> .	1 hour	Joint consolidation of ideas.	15 minutes	Conclusions and next steps.
15 minutes	Introduction and explanation workshop												
30 min	Summary of needs and opportunities detected in phase 1 and of the medium-term strategy defined in phase 2.												
30 min	Benchmarking presentation of successful cases of technology implementation, as well as technological trends.												
1.5 hours	Brainstorming <i>dynamics</i> .												
1 hour	Joint consolidation of ideas.												
15 minutes	Conclusions and next steps.												
Useful tools	<ul style="list-style-type: none"> • Environment map. • Brainstorming. 												
Profiles involved	The participation and involvement of management and profiles with a general vision of the organization and the business strategy is key. At the same time, it is important to involve the company's multidisciplinary team to contribute to the definition of current and future business models.												
Expected results	<ul style="list-style-type: none"> • Inspire employees through success stories of digitalization and technological trends to think of solutions to problems in the organization's processes. • Generate and consolidate a list of initiatives/actions to incorporate technological tools to improve the organization's competitiveness. • Plant projects that allow progress from the current state to the desired future state. 												
Estimated duration	4-8 hours												
Tips	<ul style="list-style-type: none"> • It is important to transfer the context in a clear and summarized way so that everyone understands the <i>pain. points</i> (problems, needs or opportunities for improvement) to solve. • Using success stories from the company's own sector helps inspire participants, but cases from different sectors that can be extrapolated to their reality also work. • It is important to define the operation and the rules, avoiding value judgments and promoting as many ideas as possible, giving rise to disruption. • The consolidation of ideas aims to group ideas and discard the impossible without the intention of prioritizing or judging the whole. 												

Session 4								
Phase IV: Roadmap	Evaluation session							
The objective of this session is to evaluate the initiatives defined based on agreed cost-benefit criteria to prioritize the set of actions and be able to start drawing the digital transformation roadmap.								
Previous work	Definition of actions to incorporate technology based on the list of ideas generated in the previous session. Joint definition of evaluation criteria.							
Agenda (proposed) <table border="1"> <tr> <td style="text-align: center;">30 min</td> <td>Introduction and explanation of the workshop: operation of the dynamics and agreed criteria.</td> </tr> <tr> <td style="text-align: center;">2 hours</td> <td>Dynamics of presentation of the initiatives and their evaluation.</td> </tr> <tr> <td style="text-align: center;">15 minutes</td> <td>Conclusions and next steps.</td> </tr> </table>			30 min	Introduction and explanation of the workshop: operation of the dynamics and agreed criteria.	2 hours	Dynamics of presentation of the initiatives and their evaluation.	15 minutes	Conclusions and next steps.
30 min	Introduction and explanation of the workshop: operation of the dynamics and agreed criteria.							
2 hours	Dynamics of presentation of the initiatives and their evaluation.							
15 minutes	Conclusions and next steps.							
Useful tools	<ul style="list-style-type: none"> Canvas sheets for the definition and presentation of initiatives. Online voting tools (such as https://www.mentimeter.com/mentimeter https://www.mentimeter.com/) 							
Profiles involved	In this session, the participation and involvement of management and profiles with a general vision of the organization and the business strategy is key.							
Expected results	<ul style="list-style-type: none"> Defined initiatives. Initiatives evaluated based on cost/benefit criteria by different profiles within the organization. Possibility of generating a cost-benefit matrix with all the initiatives proposed for prioritization. 							
Estimated duration	2,5-4 hours							
Tips	<ul style="list-style-type: none"> It is important to present the initiatives in a visual, simple, and easily understandable way. Having a proposal for evaluation criteria facilitates the definition, but they must be agreed upon with the company for it to accept the results. The evaluation of the benefit that the action can bring must disregard its cost. The participants must understand that the evaluation is a first iteration that allows the initiatives to be assessed but that the results are not definitive or binding. Using online voting tools allows the organization to involve more people in the evaluation if it sees fit. 							

Session 5											
Phase IV: Roadmap	Prioritization and sequencing session										
<p>The objective of this session is none other than to consolidate a proposal for a digital transformation plan. For this reason, based on the results of the previous session, an ordering of the actions that the company must iterate to have prioritized and sequenced actions in the short, medium and long term should be proposed. Identifying the priority action or group of them to start the transformation process makes it easier to link with the implementation once the strategic reflection is finished.</p>											
Previous work	<p>Process the results of the evaluation session:</p> <ul style="list-style-type: none"> • Cost-benefit matrix with four project typology quadrants. • Proposal for ordering initiatives according to evaluation and dependencies. 										
Agenda (proposed)	<table border="1"> <tr> <td>15 minutes</td><td>Introduction and explanation of the workshop.</td></tr> <tr> <td>45 minutes</td><td>Presentation of the results of the evaluation session; share cost-benefit matrix and projects by quadrants, dependencies and additional variables.</td></tr> <tr> <td>15 minutes</td><td>Sharing of the initiative management proposal.</td></tr> <tr> <td>1 hour</td><td>Dynamics for the iteration, prioritization and sequencing of initiatives.</td></tr> <tr> <td>15 minutes</td><td>Conclusions.</td></tr> </table>	15 minutes	Introduction and explanation of the workshop.	45 minutes	Presentation of the results of the evaluation session; share cost-benefit matrix and projects by quadrants, dependencies and additional variables.	15 minutes	Sharing of the initiative management proposal.	1 hour	Dynamics for the iteration, prioritization and sequencing of initiatives.	15 minutes	Conclusions.
15 minutes	Introduction and explanation of the workshop.										
45 minutes	Presentation of the results of the evaluation session; share cost-benefit matrix and projects by quadrants, dependencies and additional variables.										
15 minutes	Sharing of the initiative management proposal.										
1 hour	Dynamics for the iteration, prioritization and sequencing of initiatives.										
15 minutes	Conclusions.										
Useful tools	<ul style="list-style-type: none"> • Cost-benefit matrix. • <i>Kanban</i> tools to carry out the session remotely (such as https://trello.com/trello). 										
Profiles involved	In this session, the participation and involvement of management and profiles with a general vision of the organization and the business strategy is key.										
Expected results	<ul style="list-style-type: none"> • Roadmap for digital transformation: initiatives prioritized and sequenced in the short, medium, and long term. • Priority project(s) to start the digital transformation process. 										
Estimated duration	2,5-4 hours										
Tips	<ul style="list-style-type: none"> • Proposing a management proposal based on the evaluation results, dependencies and expert knowledge facilitates the process for the organization. • Using visual and interactive tools facilitates the iteration of the sequencing by the participants. • Positive discussion should be promoted based on the different priorities of the participants, reaching a point of collective understanding. • The resulting roadmap can be iterated as many times as necessary, understanding that it is a living element that must be updated as time goes by. 										

Beyond the advice that is proposed for each of the sessions, below are some generic recommendations for all of them to plan productive and successful workshops in the scope of the specific and global objectives of the strategic process that is pursued:

- Holding sessions virtually is an option (using tools such as [Mural](#) or [Miro](#)), but participatory workshops are always more dynamic and productive in person.
- It is recommended to work the workshop through participatory dynamics using visual elements that facilitate interaction and sharing of ideas among the participants. For this reason, if face-to-face sessions are chosen, it is recommended to work on the printed canvas in A2 sizes and use coloured post- its, as well as adhesives to complete the different dimensions and necessary elements.
- Ending the sessions with a space to draw conclusions and propose the next steps helps the participants to understand the process and not lose the thread and interest in achieving the objectives.

A range of hours has been proposed based on the proposed agenda for each of the sessions, which will vary depending on the complexity and involvement of the company. In addition to this dedication in the group workshops, individual dedication should also be foreseen, both by the company in completing and reviewing the documentation, and by the advisor in preparing the sessions and generating documentation. The estimated time for face-to-face participation in the group workshops can be doubled to estimate the overall time dedicated to carrying out the proposed methodology.

If we place the development of the methodology at calendar level and depending on the frequency of the proposed face-to-face participatory workshops, a range of two to three months can be estimated to complete the diagnosis and have a first digital transformation for the company.

As has already been said, depending on the complexity and the level of detail to be reached in the definition of the actions/projects to be implemented, this indicative period may be extended. The availability of those involved can also delay the execution.

Once the roadmap has been defined, the company must specify work plans and implementation of the prioritized action(s) in the short term, internally or with the supplier or technology advisor with whom the company wants to work.

9 AUTHORSHIP AND ACKNOWLEDGMENTS

This document has been promoted within the framework of the DigiTVC project whose main objective is to improve the competitiveness of companies in the textile and clothing sector in the SUDOE region, through the digitalization of their production processes.

The project is made up of TEXFOR, ACCIÓ agency for the competitiveness of the company of the Government of Catalonia, Icam, CITEVE, AITEX, Familacão and UITSUD.

The Digitalization Protocol of the textile value chain has been prepared with the valuable contribution and advice of several experts in the sector, which has made it possible to capture and analyse the reality of the sector, its needs, experiences, and recommendations. Thank you for your dedication and support in preparing this document. Participation was as follows:

Contributors

- ACCIÓ
- TEXFOR
- EURECAT
- AITEX
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10 ANNEXES

10.1 Digital ecosystem of DIGITVC companies

Currently, because of the results of this project, a digital ecosystem of textile companies has been created, with a total of 87 companies, of which the following information can be seen:

Company Name		
Company Size	Country	
Contact Person	Email	Website
Type of product	Main Sector and application	
Main Activity	Experience in digitalization tools	

The list currently consists of the following companies:

Company	Country	Company	Country
A. Sampaio & Filhos – Têxteis S.A.	Portugal	Lopes & Carvalho, Lda	Portugal
ACC Systems, Lda.	Portugal	LUIS BRITO TEXTEIS SA	Portugal
Advanced Algorithms S.L	Spain	Maccion	Spain
Akanthas	France	Malhas Sonix, S.A.	Portugal
Amaisys Technologies SLU	Spain	MANUFACTURAS ANDREU, S.L.	Spain
ANTONIO GINER S.L.	Spain	MAPEX	Spain
BIONIX SUPPLYCHAIN TECHNOLOGIES	Spain	Medicare System SLU	Spain
Blautic Designs	Spain	MIs Textiles 1992, S.L.	Spain
Bynet – Informatica e Telecomunicações Lda	Portugal	NECHI INGENIERIA S.L.P.	Spain
CADT Software and Drafting SL	Spain	NOU MOSCADA S.L	Spain
consipere	Portugal	PEDROSA & RODRIGUES S.A.	Portugal
DATAMONPLUS S.L.	Spain	Pentamatik SCP	Spain
Devise Solutions, Lda.	Portugal	PIEL, S.A.	Spain
Escarré Automatización y Servicios S.L	Spain	Pink Leaf, Unipessoal, Lda	Portugal
DRACO SYSTEMS	Spain	PiperLab S.L.	Spain
ECUSSLEEP S.L.U.	Spain	proGrow	Portugal
Estamparia Têxtil – Adalberto Pinto da Silva S.A	Portugal	QUANTION	Spain
ETEXA SAU	Spain	REGAIN	France

ETS OLIVIER GUILLE & FILS SA	France	Sage Automotive	France
EXOS SOLUTIONS	Spain	sampLess	Portugal
F3M Information Systems S.A.	Portugal	SENSING TEX, SL	Spain
Fluxodata Aplicações Informáticas Lda	Portugal	Sentinel – a smart vision	Spain
FRANCISCO JOVER, S.A.	Spain	SHIMA SEIKI SPAIN SAU	Spain
GESTIWEB INTEGRACION DE SOLUCIONES WEB SL	Spain	Silvia Manzana	Spain
HEETEE BABY ESPAÑA	Spain	SIMSOFT INDUSTRY	France
Hidrocolor S.L.	Spain	Smartex.ai	Portugal
HISPANO TEX	Spain	Solve Digital	Spain
IBERMATICA, S.A.	Spain	Supplaay Solutions, S.L.	Spain
IMMOGRAF PREMIUM S.L.	Spain	SUSANA PATRICIA FERREIRA MEIRELES	Portugal
INFOS Informática e Serviços SA	Portugal	Tag Ingenieros Consultores S.L	Spain
INLOC ROBOTICS SL	Spain	Tecnologías Aplicadas a la Información SL	Spain
INPROFIT CONSULTING, S.L.	Spain	TEJIDOS CAVITEX S.L.	Spain
Integral Innovation Experts	Spain	Texfire Textils Tecnics SL	Spain
International Austral Sport S.A.	Spain	Texteis LEIPER	Portugal
IOTECH	Portugal	Têxteis Penedo	Portugal
Jac-Mont S.L	Spain	Textil Olius SA	Spain
Jac-Mont sl.l	Spain	TEXTIL ZE.DE. SAU	Spain
JIDOTEX, S.L.	Spain	TEXTILES JOYPER S.L	Spain
JOSE MARIA RIBAS S.L.U.	Spain	MARJOMOTEX II CONFEÇOES LDA	Portugal
JULES TOURNIER	France	Unifardas SA	Portugal
Knowledgebiz	Portugal	Vieira Pinheiro, Unipessoal Lda	Portugal
KT Kortex Technologies, Lda.	Portugal	Welabz	France
LA MAILLE AU PERSONNEL	France		

The data of these companies can be consulted on the [project website](#).

10.2 Success stories

This section collects success stories in good digitalization practices referring to diverse types of company in the fashion textile value chain, with the segmentation of its main activity sector (fashion, home, or technical fabrics) to which it applies or could apply the proposed solution.

10.2.1 Fashion

ANTONI PONS – Technological and organizational cybersecurity measures

COMPANY  Antoni Pons, SA focuses its activity on the production and sale of classic footwear.	FOCUS <ul style="list-style-type: none"> ▪ Prevention. ▪ Digital Infrastructures. 	APPLICATION INDUSTRY  Fashion  Home  Technical MAIN TECHNOLOGIES  Cybersecurity  Cloud
CHALLENGES <ul style="list-style-type: none"> ▪ Improve the current Cybersecurity level of the company. ▪ Harmonized sharing of large volumes of information. 	SOLUTION <p>The objective of this project has been to implement technological and organizational Cybersecurity measures to minimize the chances of suffering a cyber attack or having an incident related to Cybersecurity.</p> <p>The project has gone through an initial phase of evaluation of the current state of Cybersecurity of the company, both at the IT and OT levels, the definition of an action plan to carry out in the short, medium and long term and finally the implementation technological and organizational measures applicable in the short term to improve the company's Cybersecurity.</p>	ADVANTAGES <ul style="list-style-type: none"> ▪ Improvement of the digital security of companies in the face of cyberattacks or other incidents related to cybersecurity.
		

Flick Hockey – Horizontal integration with suppliers

COMPANY

Flick Hockey is a company in the retail sector specializing in the retail sale of products for the practice of field hockey sports, both through physical space and through the online sales channel.



CHALLENGES

- Systems optimization.
- Optimize relationships and communications with customers and suppliers.



FOCUS

- Infrastructure.
- Organization and people.

SOLUTION

Implementation of a horizontal integration system with suppliers with which the seller does not need to have a warehouse and a third party places the order.

The implementation project takes into account aspects related to its business model (internal and external processes), technology (B2B platform, messaging data exchange, horizontal integration of information systems), and economic viability (economic and organizational impact). .

APPLICATION INDUSTRY



Fashion



Home



Technical

MAIN TECHNOLOGIES



System integration



Big Data

ADVANTAGES

- Increased inventory to sell.
- Less inventory value on the company's asset balance.
- Sales increase of 50%.
- Diversification in the market.



Canmartex – Sinker wear measurement system for circular knitting machines

COMPANY

Canmartex Catgrup, SL focuses its activity on the manufacture and sale of machinery for the textile industry.



CHALLENGES

- Process monitoring and control.
- Have a measurement system for the wear of the sinkers for circular knitting machines.



FOCUS

- Cost reduction.
- Intelligent control of production processes/kit for servitization.

SOLUTION

His project is a proof of concept to validate the technology of the sensor chosen to measure the wear of the sinkers in a circular knitting machine. The plates are located inside the machine, with difficult and limited access, a fact that makes it difficult to choose the technology and the medium.

With this solution, an I4.0 integration will be implemented that will allow this wear to be monitored in future projects and also to catalog the damage that a worn platen can generate.

APPLICATION INDUSTRY



Fashion



Home



Technical

MAIN TECHNOLOGIES



System integration



Sensors



Big Data

ADVANTAGES

- Generation of a new digital product (gauge measurement kit) to serve the service.
- Optimization of resources invested in the fabric manufacturing process.
- Reduction of defects in the manufactured fabric.
- Optimization of the ratio of quality and production vs. Costs.



NOPRA – IoT platform for HYDRA machine

COMPANY

Nous projectes ram i aigua, SL is a micro-enterprise focused on the construction of machines for the textile, footwear and leather industries.



FOCUS

- Infrastructure.
- Organization and people.

APPLICATION INDUSTRY

		
Fashion	Home	Technical

MAIN TECHNOLOGIES

		
IoT	Cloud	Big Data

CHALLENGES

- Process monitoring and control.
- Harmonized sharing of large volumes of information.



SOLUTION

This project consists of deploying an IoT Platform in the Cloud and integrating the HYDRA textile processing machine. Thanks to this integration, the data managed by the machine can be collected for its visualization and analysis. This integration also allows for more comprehensive control of production, energy consumption and the condition of machine components.

In the future, this IoT Platform will serve as the basis for the deployment of advanced services based on data analysis that help optimize the use of the machine and open doors to new lines of business.

ADVANTAGES

- Deploy an IoT Platform in the Cloud with the ability to manage heterogeneous data.
- Integrate the different data collected by the HYDRA machine into the IoT platform.
- Develop a visualization interface that allows displaying the data published on the platform.
- Optimization of the operation of the HYDRA machine.



SEÑOR – “Track & Trace” System

COMPANY

Señor is a small company that markets both men's and women's clothing and makes custom-made dresses, mainly for the Catalan market.



FOCUS

- Improvement of service quality and control of internal processes
- Improvement in decision making

APPLICATION INDUSTRY

		
Fashion	Home	Technical

MAIN TECHNOLOGIES

		
System integration	IoT	Sensors

CHALLENGES

- Real-time control of all the traceability of the production process and product flow.
- Real-time inventory control, error minimization and cost optimization



SOLUTION

The project is part of the development of a digital control system for all the traceability of the production process, from the generation of the order and the taking of measurements made in the store, the planning of series of pieces, the cutting workshop, and the preparation and management of arrangements until the entrance to the client or to the logistics warehouse.

The system will have an impact on optimizing process times, management of finished or semi-finished parts, logistics costs or arrangements and, in turn, provide a better service in terms of quality, response time and information to the end customer

ADVANTAGES

- Cost reduction of 5% in the FASHION section
- Increase in billing in the MEASURED section between 3% and 6%
- Cost reduction and arrangement costs
- Reduction of direct and indirect transport costs by 5%.
- Improvement in the location, control and valorization of finished, semi-finished and fabric raw material stocks.



HATA – Automated quality control

EMPRESA

Hata, Lda, is a weaving company located in Viana do Castelo, in the north of Portugal, and is owned by another company, Tintex, Lda, a dyeing and finishing company. Hata works almost exclusively for Tintex.



FOCUS

- Production control.
- Real-time data with high reliability value.
- Reduction in manufacturing defects.

RETOS

- Quality control, although part of quality management, is a critical operation for any company, and so is it for Hata, Lda. In this particular case, the focus is on circular knitting machines and defect detection during their operations.



DESCRIPCIÓN DE LA SOLUCIÓN

The main practice to highlight in this case is experimentation. Hata/Tintex contacted Smartex after the first public announcement of the creation of the start-up and the first prototype of this technology was made.

As for the exploitation of the technology itself, now the company has data in greater quantity and quality about its weaving process. This feeds business processes, such as production management and quality management, with better data and enables more effective continuous process improvement.

At the moment, the newest version of the system is installed on 5 circular machines.

As for the inspection technology installed, it allows the Hata company to have a more accurate defect detection, saving with savings in waste material and components, energy consumption and human labor.

SECTOR DE APLICACIÓN



Fashion



Home



Technical

TECNOLOGÍAS PRINCIPALES



AI



Sensors

BENEFICIOS

- Transform the ways in which they manage and operate their industrial process,
- Gain valuable knowledge and therefore a competitive advantage through production data.
- Reduce waste due to functions such as automatic machine shutdown if a serious defect is detected.
-

PROVEEDOR

SMARTEX.AI

CONFETIL – 3D design and simulation platform

EMPRESA

Confetil S.A. is a company specialized in circular knitted garments.



FOCUS

- 3d design
- Real-time data with high reliability value.
- Production chain reduction
- Faster interaction with client

RETOS

- Garments are 3D objects that are essentially designed from a 2D perspective only due to the technical limitations of the tools used. Switching between 2D and 3D demands a change in the way people think and view both the product and the process at the design/prototype stage.



DESCRIPCIÓN DE LA SOLUCIÓN

The CLO3D platform allows CONFETIL and its customer to share the same virtual product, collaborating effectively on the same digital sample. In addition, CLO3D offers simulation functions, allowing both CONFETIL and its customer to test and stress the digital prototype. 3D modeling is a significant improvement on the more traditional 2D views of the garment.

As a result of this transformation, the CONFETIL design and modeling team has been formed and a library of materials has been built. This database contains data on the nature of the tissues, data that includes information about the performance of the fabric, such as tensile properties. This database allows a quick exchange between two tissue options and observe the difference in real time between them.

SECTOR DE APLICACIÓN



Fashion



Home



Technical

TECNOLOGÍAS PRINCIPALES



IoT



Cloud



Big Data

BENEFICIOS

- Initiate the interaction between your client and the CONFETIL design teams from a virtual prototype
- change one material for another and see, dynamically, how that change affects the look and fit of the new garment
- Reduce the cost of sample production
- Shorten the distance between customer and CONFETIL computers

PROVEEDOR

CLO

Grupo Valérius – On-demand production

EMPRESA

"Valérius Group" is a group of companies with a strong industrial character in the production of clothing, capable of a production level of 25,000 pieces per day.



FOCUS

- New sales channels
- Better relationship with final consumer
- Co-design introduction
- Increased brand awareness through new partners

SECTOR DE APLICACIÓN



Fashion



Home



Technical

TECNOLOGÍAS PRINCIPALES



IoT

RETOS

- Use of experimentation as a tool to test and emphasize new ideas. With digital technologies and new digital business models, experimentation is key to testing an idea before making investments and organizational changes.



DESCRIPCIÓN DE LA SOLUCIÓN

As a digital influencer, a blogger can be a powerful element in brand and product communication and therefore turn that into sales. This business model also gave greater prominence to the blogger, involving him in the creative and design process of the garments, in order to have a strong connection between the product, the blogger and his followers, so the brand is the blogger. Communication and marketing are in charge of the blogger, being the company responsible for shipping and distribution.

BENEFICIOS

- The first was the exploitation of new online channels
- alliance with a non-traditional client/partner, in this case the blogger.

PROVEEDOR

Alliance with British bloggers

10.2.2 Home

BEDDING INDUSTRIAL– RFID Traceability

COMPANY

Bedding is an innovative company that is part of the MITSA group in Spain, specializing in the manufacture of custom fabrics for bedding, among others. His brand is B-Sensible.



FOCUS

- RFID traceability of all internal processes from the cutting of the fabric to the finished product.
- Real-time control of products in stock.
- Validation of shipment content.

APPLICATION INDUSTRY



Fashion



Home



Technical

MAIN TECHNOLOGIES



System integration



Robotics

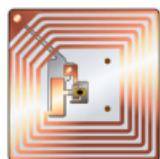


Sensors

CHALLENGES

- Total automation of the logistics of internal processes from product preparation to dispatch: Complete traceability with RFID, use of automated vertical warehouses (KARDEX) and robotics in internal traceability.

B-Sensible
IN BEDDING PROFESSIONALS YOU NEED



SOLUTION

Since 2009, Bedding has been implementing a flexible and scalable internal traceability solution based on RFID with different control points in the reception of materials, product preparation, stocking and dispatch, which in interconnection with its enterprise resource management system (ERP). It allows you to know at all times what references and in what quantities are currently in stock, check and validate the content of shipments prior to their departure and have complete traceability of each item produced at all times. Other technologies are integrated into the traceability solution, such as KARDEX's vertical rotating warehouses, and robots for handling product boxes as part of internal logistics.

ADVANTAGES

- Complete traceability in all internal logistics processes.
- Stock inventory automation.
- System integration: ERP, RFID traceability (MES).
- Reduction of shipping errors.

eurecat
Centre Tecnològic de Catalunya

ADS
Anàlisis i Disseny de Sist.

10.2.3 Technical

PENTRILLO – MES System

COMPANY

PENTRILLO is a company dedicated to the manufacture and sale of tools for painting and decoration



FOCUS

- Processes
- Infrastructure decisionmaking strategy



Fashion



Home



Technical



System integration



IoT



Sensors

CHALLENGES

- Process monitoring and control.
- Optimize relationships and communications with customers and suppliers



SOLUTION

The solution consists of implementing a MES system, a natural bridge between ERP management systems and plant control systems, which has a server-client architecture.

It requires installing software on one of the plant's corporate servers, or in the cloud, and installing client terminals in the plant to interact with the operators and send the information to the server. Automatic acquisition of MES data is done with sensors. From the data collected, the main KPIs are calculated and graphed, which serve as support for decision-making about the production process.

ADVANTAGES

- 20% improvement in process efficiency
- Reduction of 90% of staff time allocated to document management
- 20% reduction in stops and breakdowns
- 10% reduction in leadtime



VELUTEX – IoT Platform

COMPANY

Velutex Flock, SA is a company with more than 70 years of experience that focuses its activity on the production of Flock (textile fiber).



FOCUS

- Processes
- Infrastructures



Fashion



Home



Technical



IoT



Cloud



Big Data

CHALLENGES

- Process monitoring and control.
- Improve effectiveness and efficiency in decisionmaking



SOLUTION

Velutex has carried out a proof of concept to integrate a sieve shaker into an IoT platform in the Cloud. This integration allows data to be collected from the process managed by the machine for its subsequent visualization and analysis, thus allowing a more exhaustive control of production, energy consumption and the state of the machine components.

In the future, this IoT platform will serve as the basis for deploying advanced services based on data analysis that help optimize the use of the machine and open the door to new lines of business

ADVANTAGES

- Greater control of production processes
- Identification of improvements in the production process of the sieve shaker



VELUTEX – Advanced maintenance system

COMPANY

Velutex Flock, SA is a company with more than 70 years of experience that focuses its activity on the production of Flock (textilefiber).



FOCUS

- Optimization of the production process.
- Predictive, preventive and corrective maintenance

CHALLENGES

- Comprehensive control of the operating parameters of the production process.
- Digitization of content to implement the management of predictive, preventive and corrective maintenance



SOLUTION

The company wants to implement a solution based on SAAM, a solution designed to support maintenance and manufacturing through AR and mixed using tablets and HoloLens glasses

This solution is the basis on which the customized solution that will make the company evolve will be built; have tools that allow maintenance personnel to be provided with highly efficient resources to improve operations in terms of quality and time.

APPLICATION INDUSTRY



Fashion



Home



Technical

MAIN TECHNOLOGIES



System integration



Cloud



VR / AR

ADVANTAGES

- Cost savings related to the optimization of the maintenance of manufacturing machinery
- Improve response time to incidents.



HILATURAS ARNAU – Recycled fabrics and yarns

COMPANY

Hilaturas Arnaud is one of the best-known European recycled textile brands. They work with both natural and synthetic fibers to turn waste into an asset



FOCUS

- Final product for B2C consumer
- Brand digitization

CHALLENGES

- Transformation of the business model, replacement of the new brand, supplier/company and client/company relationship
- Fully digital environment, direct management and through multiple channels with customers/users



SOLUTION

BRE BCN FASHION is a spin-off of HILATURAS ARNAU BARCELONA that stems from its know-how in recycling and new applications of conventional, technical and natural fiber fabrics

A continuity project to reach the final consumer with the commercialization of products based on natural materials and respectful of the environment

Sustainable and ecological products made from recycled or organic materials, without losing sight of their functionality, comfort and design

APPLICATION INDUSTRY



Fashion



Home



Technical

MAIN TECHNOLOGIES



System integration



Cloud



ADVANTAGES

- 100% ethical products manufactured in Barcelona
- Products based on the circular economy and zero waste that take care of the planet and people so that the new generations, and life in general, enjoy a healthy and sustainable future.



HIDROCOLOR – Sensorization for machine control

COMPANY

Hidrocolor, S.L. is a family business (1978) dedicated to technical services for dyeing and finishing fabrics.



FOCUS

- Sustainability
- Production control.
- Traceability
- Improved decision-making

CHALLENGES

- Automatic data capture
- Reliability, robustness and scalability.



SOLUTION

The solution consists of installing sensors and adding a new control system in the machine to reconvert a technologically obsolete machine into a fully controlled machine, capable of operating more intelligently and collecting all the consumption data of the same. With water, gas and electricity consumption data, the CO₂ consumption of the dyeing process can be deduced.

APPLICATION INDUSTRY



Fashion



Home



Technical

MAIN TECHNOLOGIES



IoT



Cloud



Sensors

ADVANTAGES

- Complete traceability in all internal dyeing processes
- Reduction of the amount of CO₂ generated in each dyeing process
- Reduction of manufacturing errors.
- Better control of production costs.
- Control of the environmental impact of each production and reduction of it by reducing production errors

SUPPLIER



Invent the future

TEXTIL OLIOUS – IIoT for the production control

COMPANY

Textil Olius is a Spanish company specialized in natural wool felts. They provide efficient and innovative solutions to the decoration, industrial goods and consumer goods sectors.



FOCUS

- Cost reduction.
- Production control.
- Traceability
- Improved decision-making

APPLICATION INDUSTRY



Fashion



Home



Technical

MAIN TECHNOLOGIES



IoT



Cloud



Sensors

CHALLENGES

- Automatic data capture.
- Reliability, robustness and scalability.



SOLUTION

Implement an industrial Internet of Things (IIoT) environment through a platform (PTC Thingworx) to which multiple sensors and meters are connected to capture process data automatically and granularly. Some of the data that is collected are:

Process time: allows you to optimize scheduling, provide accurate delivery times and meet customer service expectations and flexibility.

Water and energy consumption: detect inefficiencies, adapt production to valley rates, size photovoltaic infrastructure, forecast costs...

In order to achieve the success of the project, the company has implemented a training program for staff to develop IoT knowledge and learn how to use the platform. In this way the team feels more qualified for the digital transition.

ADVANTAGES

- Complete traceability in all processes.
- Time control and improvement of customer service.
- Better control of production costs.
- Control of the environmental impact of each production and reduction of the same by the reduction of inefficiencies

SUPPLIER



JULES TOURNIER – Knowhow Digitalization

COMPANY

Jules Tournier is a 155-year-old French textile manufacturer that manufactures luxury ready-to-wear and haute couture textiles and has a production unit dedicated to the development and manufacture of technical textiles.



FOCUS

- Formation
- Retention of know-how.
- Generational replacement

APPLICATION INDUSTRY



Fashion



Home



Technical

MAIN TECHNOLOGIES



Cloud



IA

CHALLENGES

- Capture know-how.
- Reduce learning curve



SOLUTION

Jules Tournier, like many industrial companies, faces the problem of the ageing of its skilled workforce and the difficulty of hiring new labour to acquire complex know-how that requires long periods of training.

To professionalize the preservation and transmission of its know-how Jules Tournier is using a digital tool based on video and an intelligent voice assistant in order to get as close as possible to professional gestures, to be able to describe them, to mobilize them, in order to transmit them for training purposes.

The tool will allow the creation of a database of know-how, to maintain, enrich and transmit it.

ADVANTAGES

- Transmission and conservation of know-how (high-value know-how).
- Reduce variability between operators.
- Reduce learning curve.
- Facilitate the attraction and conservation of talent (of the new generation).

SUPPLIER



SAMPAIO - Machine learning para control de calidad

COMPANY

A. Sampaio & Filhos is a Portuguese company of more than 75 years leader in the production of fabrics by circular knitting. They offer their customers products with the highest quality standards.



FOCUS

- Quality
- Optimization of resources.
- Cost reduction.

CHALLENGES

- Detect defects as soon as possible.
- Optimize staff resources. Minimizing "manual" quality controls and managing several equipment at once



SOLUTION

With the desire to maintain the quality of their products, but minimize the resources allocated to the control of this, they are implementing a pilot for the detection of defects in production. This system is based on a set of cameras that takes photographs of the fabric in production and an artificial intelligence algorithm based on machine learning for the detection of defects.

Currently the quality control is carried out with the manufactured product so defects are detected that result in waste material (or lower quality – market value) in addition to wasted time and energy. The implemented system is capable of detecting different types of defects in production, stopping the machine and notifying the operator. In this way, the problem is detected at the beginning of the production process, minimizing the subsequent impacts.

APPLICATION INDUSTRY



Fashion



Home



Technical

MAIN TECHNOLOGIES



Sensors



Cloud



BigData & IA

ADVANTAGES

- Maximize the quality of fabrics without increasing resources.
- Minimize the load of the operators to the quality control, being able to manage more machines at the same time.
- Reduce materials with defects (less value or waste).
- Reduce energy and water consumption.
- Minimize CO₂ emissions.

SUPPLIER

SMARTEX.AI

10.3 Tools

10.3.1 Self-diagnostic tools

There are various tools that allow you to carry out a self-diagnosis of the level of digital maturity. Thus, by means of an extensive questionnaire that the user answers based on the current situation of their company, guidance is obtained on the current level of maturity of their organization. In some cases, these tools offer comparative information about the company with respect to the rest of the companies diagnosed (always anonymously), allowing it to be in the context of similar organizations. In turn, some of the tools convey generic recommendations to improve the current state of digitalization and advance in each of the areas of analysis.

Although there is no specific self-diagnosis tool for the textile sector, those that are known and presented below allow diagnosing the level of digital maturity of companies in all sectors:

- **Interreg Europe - Digital maturity self-assessment tool:** identify the stage of development of the company in various dimensions based on three main pillars: organization, technology and processes¹⁷.
- **ADMA:** focused on the manufacturing industry, evaluation of the company's level in 7 dimensions of transformation; advanced manufacturing technologies, digital factory, eco-factory, customer focus, people-centered organization, smart manufacturing and open factory¹⁸.
- **ACCELERA PYME:** to find out the degree of digitalization of SMEs¹⁹.
- **DIH4CAT:** self-guidance tool to determine the state of digital maturity²⁰
- **HADA:** Advanced Digital Self-diagnosis Tool of the Ministry of Industry, Commerce and Tourism of Spain within the framework of the Connected Industry 4.0 strategy²¹.
- **THEIA:** self-diagnosis and planning tool for digital innovation management created within the scope of the Portuguese Industry 4.0 Platform Project, which allows measuring the level of digital maturity of the organization and supporting the improvement process by identifying critical areas for the anticipated digital transition²².
- **Shift2future:** tool to discover the digital level of SMEs and prepare them for the new digital economy²³.
- **France Num:** French Government Digital Maturity Assessment Toolkit to Drive Strategy²⁴.
-

10.3.2 Tools for strategic business analysis

The business strategy consists of many facets, and to help carry out these analyses there are different tools available to companies that help set a reference and work framework on which to start analysing each section of a business. Here are some of the most popular tools categorized according to their purpose:

Strategic analysis	External analysis	Market analysis
Heptalysis	PESTLE (LongPESTLE and DESTEP)	Porter's Three Tests
business model canvas	Porter Five Forces	4P's of marketing
Lafley and Martin's Five-Step Strategy Model	CAGE distance framework	product analysis
Hambrick and Fredrickson's strategy diamond	Internal analysis	BCG Matrix
Porter's Generic Strategies	SWOT (Talk about CAME, SOAR)	TDA Matrix

Grand Strategy Matrix	Strategy Canvas	Ansoff Matrix
Miles and Snow Strategy	Value Proposition Canvas	Moscow
GE Matrix	VRIO	Value chain analysis
SFA Matrix	Value Disciplines Model	Porter's Value Chain
SCRSAnalysis	Buyer utility map	Competitor analysis
Business Motivation Model	McKinsey's 7s Model	Four Corner Analysis
		Perceptual Map

The tools that appear in this table make it possible to identify the essential aspects of a business model, presenting them in a structured manner, so that it is possible to find those activities that are relevant, points for improvement, and alternatives to the activities and model used. Currently in a company.

10.4 Financing instruments

10.4.1 Spain

The Spanish state ecosystem of aid and fiscal tools available to encourage innovation by SMEs in the territory is among the most powerful within the EU. However, accessing this type of aid is not easy, and requires a process that is often long and complex. Thus, it is important to understand what type of aid we can request and draw up a strategy in accordance with the capacity and state of maturity of our organization. In this sense, the specific aid for the digital transformation of the business stands out: Digital Kit, *Cupons Acció*, CDTI, Chambers of Commerce, etc.

In Spain, the "Corporate Tax Law" establishes important tax deductions to develop Research, Development and Technological Innovation (R+D+i) activities specific to companies belonging to the textile sector, typifying the realization of samples of the textile sectors, footwear, furniture, leather, leather goods and toys as a "technological innovation" activity. The deductible items are personnel expenses, amortization of equipment and material assets, the expense of consumable materials, expenses in external collaborations and other expenses directly involved.

The following table summarizes the main organizations that offer aid for digitalization in Spain as well as the basic characteristics of the main aid they grant.

	Diagnosis / initial advice	Business model validation	Digital transformation	R+D+i project	Investment for process improvement
Agent	ACTION	ACCIO / CDTI / Horizon Europe	Red.es	CDTI / MICINN	CDTI
Performance	Strategy and innovation coupons / I4.0	Start-up Capital / NEOTEC Grants	DIGITAL-KIT	PID Projects / Cervera Network / PCPP	CDTI Innovation Projects (LIC)
max help	€6,000 (E&I) €8,000 (I4.0) €20,000 (implementation)	€75,000 (Start-up Capital) €250,000 (NEOTEC)	€12,000 (PIME <50 workers) €6,000 (microenterprise) €2,000 (self-employed)	TNR 33% (CDTI); 100% help subcontract. IPO/TC (PCPP)	CDTI funds: 2% ERDF funds: 5%
Duration (months)	3-6	6-18	6-12	12-36	6-18

10.4.2 France

In France, the aid is granted by the organizations of each region, each of them having its own regional body that develops the most appropriate programs for the digitalization of the companies in its region. In this case, the regions of the south of France have been considered, respecting the territorial focus of the project. Some of these organizations and the programs they offer are:

- “Minalogic Auvergne Rhone Alpes” and “Caisse d'Epargne Rhone Alpe” offer the [Le prêt numérique program](#), which finances digitalization projects in companies from €50,000 to €500,000 per project. The innovation of these projects is valued among other characteristics for the granting of these grants.
- [Garantie France Num](#) is a program promoted by the French government with the help of various French banks (Banques Populaires, La Banque Postale, BPIFrance, BTP Banque, Crédit Agricole, Crédit

coopératif, Caisses d'Epargne, Crédit Mutuel and Memo Bank) in the which financial benefits are granted to obtain credits that will be dedicated to the digital transformation of companies.

- [AmbitionEco](#) has programs directed from micro-companies to large companies, through associations and other communities, including specific aid that focuses on the digitalization of companies.
- The [Conseil en stratégie numérique](#) program of the Nouvelle-Aquitaine Region aims to support the financing of studies and consulting services (diagnosis, expertise, AMOA) to define the digital transformation strategy and/or the cybersecurity strategy of companies.
- [PASS OCCITANIE](#) of the Occitanie Region which aims to provide financial support to companies that need to develop. This support applies to all digital transformation projects
- [Chambre des Métiers et de l'Artisanat](#) are organizations that offers various grants for the digitalization of French companies focused on diagnosing the digital status of companies, training them and accompanying them when executing digital projects.
- The [WiziShop & Ecommerce Solidaire organization](#) offers an online sales support service for businesses that do not have it, offering this service nationwide.
- [ENE Enterprises & Numerique](#) has a list of digitalization aids, from accompaniments and diagnoses to financial aid for the implementation of projects with a digitalization focus:
 - Numerical Atouts
 - Ambition Eco Numérique
 - Ambition cybersecurity
 - Industry of the Future
 - Industry of the Future
 - UNR Connect
 - Action télétravail
 - Debt Info

In a more basic, but also important way, France offers aid at the state level in the form of a subsidized check to install fibre optic lines in rural areas or the acquisition of computer equipment and smartphones for the development of business activities.

10.4.3 Portugal

Aid for digitalization in Portugal is promoted by the Portuguese government through different organizations. In its [Portugal 2020 proposal](#), the Portuguese government offers different operational programs that include aid for the digitalization of companies. These programs are divided into the following categories:

- Thematic Operational Programs in the Continent
- Regional Operational Programs
- Rural Development Programs
- Program for the European Maritime and Fisheries Fund
- Technical Assistance Operational Program
- European Territorial Cooperation Operational Programs
- Other programs

Initiatives such as [Portugal Digital](#), promoted by the Portuguese government, have aid to Portuguese companies and professionals divided into professional training in digital issues, evaluations and diagnoses of the digitalization of companies and projects whose focus is to promote digitalization initiatives with financial incentives, networks of sectoral help, laboratories and spaces to work on new digital solutions or help in obtaining financing through private investors.

[Portugal Ventures](#), on the other hand, offers specific calls that promote multi-sector initiatives that focus on specific technologies or specific regions.

IAPMEI is an organization promoted by the Portuguese government that focuses its activities on promoting the business growth of industrial companies, focusing its proposals on SMEs. Its main programs are [Capacitar i4.0](#), [InCoDe.2030](#) and [Indústria 4.0 / Incentivos](#).

initiatives by private organizations include [SHIFT2Future](#) (a continuation of the SHIFTTo4.0 project), which focuses on offering support in the digitalization of companies, with diagnoses, awareness-raising and training actions, technological roadmap services and other aid. [StratupPortugal](#) offers services focused on start-ups, with programs such as the Road 2 web Summit, in which the most promising Portuguese start-ups are selected, and various aids are offered to them throughout a program that contains mentoring and financing.

10.5 DIHs SUDOE

Portugal

- Algarve Smart Destination, Digital Innovation Hub
- HUB for Agriculture (HUB4AGRI)
- iMan North Hub - Digital Innovation Hub for Customer-Driven Manufacturing @ North
- inNOVA4TECH hub – inNOVAtion Hub for TECHnology Transfer
- Madeira Digital Innovation HUB
- PRODUTECH Digital Innovation Hub National Platform
- DIGI4FASHION

France

- DIHNAMIC - Digital Innovation Hub for Nouvelle-Aquitaine Manufacturing Industry Community
- Agri Sud Ouest Innovation

Spain

- AIR4S - Artificial Intelligence & Robotics for Sustainable Development Goals
- AI4GALICIA: Artificial Intelligence for Galicia
- Andalusia Agrotech Digital Innovation Hub
- Barça Innovation Hub (BIHUB)
- Barcelona Activa SA SPM
- Basque Digital Innovation Hub (BDIH)
- BIC EURONOVA SA
- Canary Island Digital Innovation Hub (CIDIHub)
- Catalonia AI DIH
- Catalonia Digital Innovation Hub (DIH4CAT)
- Center for Innovation and Technology of the UPC (CIT UPC)
- National Center for Irrigation Technology (CENTER)
- Connected Mobility Hub
- Cybersecurity Innovation HUB
- Data Science and Artificial Intelligence (DASAI)
- DATA life
- DIGIS3 - Smart, Sustainable and cohesive Digitalization
- Digital Health-Biosciences (DIH bio)
- Digital Impulse Hub
- Digital Innovation Hub on Livestock, Environment, Agriculture & Forest (DIH-LEAF)
- Digital Silver Economy (DIHDSE)
- Digital Water Innovation Hub (Digital Water)
- DIH-BAITUR: Digital Innovation Hub of the Balearic Islands for Artificial Intelligence and Tourism
- DIHBU Industry 4.0
- DIHGIGAL - Digital Innovation Hub of Galician Industry
- Dynapsis DIH
- Espaitec Science and Technology Park
- ETICOM, Digital economy cluster in Andalusia

- Experience-based industries Hub (e!xperience)
- FIWARE Space
- FIWARE Zone
- GALician manufacturing Innovation Consortium (GALACTICA)
- Granada Health Technology Park
- Granada Technological and Biotechnological Plaza
- HPC-Cloud and Cognitive Systems for Smart Manufacturing processes, Robotics and Logistics.
- Hub 4.0 of Manufacturing Sectors in Valencian Region
- Industrial Ring
- Industrial Technology Knowledge Linares DIH
- Innovalia ZDM Digital Innovation Hub
- Innovation for Manufacturing in the South (I4MSOUTH)
- Insomnia Digital Innovation Hub
- Intelligent Urban Lab, Alcobendas
- International Advanced Manufacturing 3D Hub (IAM 3D HUB)
- IoT Catalan Alliance
- IoT DIH
- IoT-SmartSantander DIH
- IRIS: European Digital Innovation Hub Navarra
- ITI Data Hub (The Data Cycle Hub)
- i4CAM HUB (Innovation for competitiveness and advanced manufacturing)
- La Salle Technova Barcelona
- MaDIH: Manufacturing Digital Innovation Hub
- National Digital Contents Hub, POLO
- Andalusia Technology Park (PTA)
- REIMAGINE Textile
- RIOHUB
- RoboCity2030
- Robotics Digital Innovation Hub
- SmartCityTech

¹See deliverable GT1.A1.4 Strategic assessment document. www.digitvc.eu.

²All the results of the DigiTVC project can be found at www.digitvc.eu

³European Commission Internal Market Report, 2020

⁴ <https://euratex.eu/trade-and-internal-market/>

⁵Spain data: INE, [Structural Business Statistics](#); data France: [Union Française Mode & Habillement](#); Portugal data: [Bank of Portugal](#)

⁶ Intelligent Manufacturing in the Context of Industry 4.0: A Review, Zhong et al., 2017

⁷Morgan, S. (2020, November 13). Cybercrime To Cost The World \$10.5 Trillion Annually By 2025. [Cybercrime Magazine](#)

⁸Arcserve (2020). The 2020 Data Attack Surface Report. [arcserve](#)

⁹Morgan, S. (2021, January 21). 2021 REPORT: CYBERWARFARE IN THE C-SUITE. [Cyber Security Ventures](#)

¹⁰Capitalizing on the Internet of Things, [Bosch](#), White Paper Series, Part I

¹¹Global Industry 4.0 Survey, [PricewaterhouseCoopers](#).

¹²Connected Product Maturity Model, <https://silo.tips/download/connected-product-maturity-model> Axeda
<https://silo.tips/download/connected-product-maturity-model>, white paper

¹³The Connected Enterprise Maturity Model, [Rockwell Automation](#),

¹⁴INDUSTRY 4.0, [Switzerland Global Enterprise](#), Whitepaper-Opportunities for the Swiss Export Industry

¹⁵Survey within the framework of the DigiTVC project: 66 companies in the Textile / Fashion sector (26 from France, 20 from Portugal and 20 from Spain) responded to the online diagnosis on the level of digitalization. More in <https://digitvc.eu/documents/>.

¹⁶See deliverable GT4.A4.1 Recommendations and good practices. www.digitvc.eu.

¹⁷Digital maturity self-assessment tool. [Interreg Europe](#).

¹⁸Advanced Manufacturing company scan. [ADMA](#).

¹⁹Know the degree of digitalization of your company. [Accelerate SME](#)

²⁰Self-guidance of the state of digital maturity. [DIH4CAT](#)

²¹Advanced Digital Self-diagnosis Tool. [FAIRY](#).

²²Digital innovation management self-diagnosis tool. [THEIA](#)

²³Level of digital maturity of SMEs. [Shift2Future](#)

²⁴Digital maturity tools. [France Num](#)