

The Bioeconomy in Europe - 9th Report

Executive Summary

In 2022, according to the State of the Climate Report of the World Meteorological Organisation (WMO)¹, the average global temperature was about 1.15 degrees above the 1850-1900 average. The years 2015 to 2022 were the eight warmest in the 173-year instrumental record. 2022 was also characterised by other climate records: from the extreme heat waves in Asia and Europe to the record rainfall in Pakistan and the drought in East Africa. Arctic and land ice melting and rising sea and ocean levels also continued, despite the presence, for the third year running, of La Niña, a condition normally associated with cooling. The recent announcement of a return to El Niño conditions, characterised by rising temperatures, will make further warming and extreme events even more likely, significantly affecting the overall sustainability of the system, starting with global agricultural production and, with it, the downstream sectors that use its resources.

In this context, the role of the Bioeconomy, understood as "the production of renewable biological resources and the conversion of these resources and waste streams into value added products, such as food, feed, bio-based products and bioenergy"² becomes even more crucial. The increasing use of bio-based and renewable inputs, in fact, makes it possible to reduce the use of non-renewable resources, ensuring greater efficiency and sustainability of supply chains.

The Bioeconomy in Europe Report, now at its ninth edition, confirms the relevance of this metasector in the economic context of the main European countries (Chapter 1) and explores two of the main non-food uses of natural and biological resources: **energy** (Chapter 2), an extremely topical issue subject to strong discontinuities both in terms of legislation and technology, and the **textile-clothing supply chain** (Chapters 3, 4 and 5), which has undergone a real transformation in recent decades that has altered its balance worldwide. These are very much debated and controversial topics: the aim of this Report, as in past editions, is above all to attempt to provide a complete overview of the different aspects and to quantify the phenomena under analysis, as far as possible seeking to consider the systemic and complex nature of the relations between the different sectors of the Bioeconomy, with a particular focus on the downstream closure phases.

As in previous years, the Report is the result of the work of an extensive group of researchers and institutions: in addition to the historical partners (**Cluster Spring** and **Assobiotec/Federchimica**) in this edition **SRM, Studi e Ricerche per il Mezzogiorno (Studies and Research for Southern Italy)** contributed to Chapter 2 and an in-depth study on the fashion supply chain in Southern Italy (contained in Chapter 4), and the **Centro Studi G. Tagliacarne**, which kindly anticipated the information on the textile-clothing supply chain used in Chapter 3, extracted from the survey they conducted in collaboration with Cluster Spring on a large sample of enterprises (briefly presented in the focus in Chapter 1).

As usual, the scope of our analysis includes both upstream sectors in the production chain (such as agriculture, forestry and fishing, the wood and paper industry, the chemical and rubber-plastics industry) and downstream sectors in the process (such as food, clothing, furniture, pharmaceuticals). Bioenergy and biofuels and the water cycle are also considered in the definition of the Bioeconomy adopted. Finally, in a logic of closing the circle and circular economy, the bio-based component of waste is also included in the analysis: recycling, waste treatment and biomass are extremely topical and of great interest, also due to their considerable economic value and relevance for the sustainability of the development model.

¹ World Meteorological Organization, "State of the Global Climate 2022", 2023

² European Commission, "Europe's Bioeconomy Strategy", Brussels, 2018

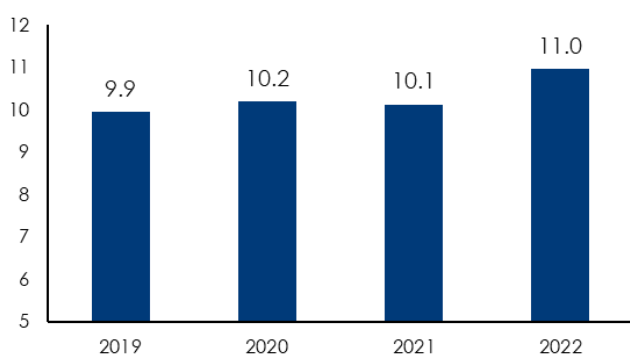
The estimates on the value of the Bioeconomy, contained in **Chapter 1**, have been conducted with a methodology that is partly different to that of previous years, both in a logic of continuous refinement and updating of the analyses, and due to the different availability of updated data underlying the estimates per variable, sector and country.

In 2022, all activities related to the Bioeconomy in Italy generated an output of 415.3 billion euros and provided jobs to approximately two million people.

After the rebound in 2021, when the value of the Bioeconomy's output was estimated at 358.2 billion euro, up 12.1% on 2020, development trend continued in 2022 with an increase in output of 15.9%, confirming signs of growth in all segments of the metasector. Performance in 2022 (as well as, to a certain extent, in 2021) was significantly affected by the dynamic of producer prices, which accelerated sharply during the year as a result of commodity price increases. Employment is more stable, at levels of around 2 million employed throughout the period considered (2019-2022).

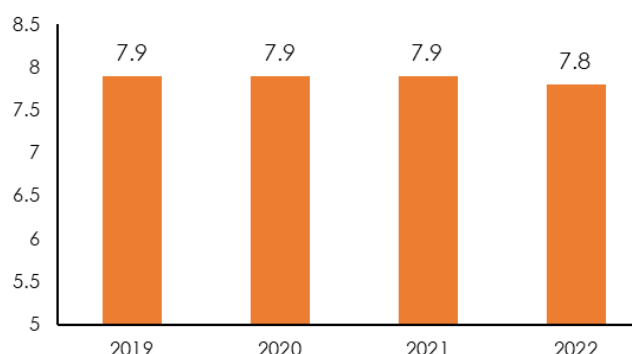
The evolution observed in 2022 brings the Italian Bioeconomy to weigh 11% of total output, up from the previous three years. The share of employees in the bioeconomy in the national total is 7.8%, in line with previous years.

Fig. 1 - Evolution of the weight of the Bioeconomy in Italy in terms of production value (% of total economy)



Source: Intesa Sanpaolo processing of data obtained from various sources

Fig. 2 - Evolution of the weight of the Bioeconomy in Italy in terms of employment (% of total economy)

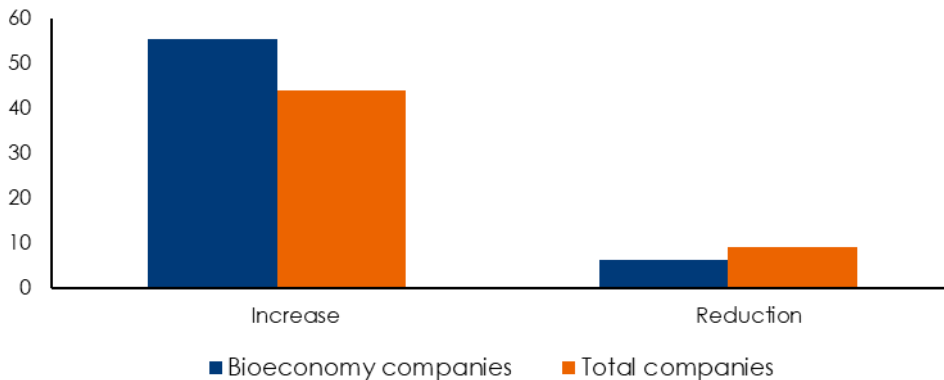


Source: Intesa Sanpaolo processing of data obtained from various sources

The higher growth at current prices demonstrated by the bio-based metasector in 2022 compared to the rest of the economy is also confirmed in the Tagliacarne, Unioncamere, Cluster Spring survey. Data on the expected development of turnover for 2022 shows a higher portion of companies in the manufacturing and service sectors related to the Bioeconomy estimating growth than the sample of companies surveyed in the annual survey conducted by the Tagliacarne Study Centre³ (55.4% vs 44%).

³ Reference is made to the 2022 Unioncamere-Tagliacarne Annual Survey addressed to a sample of 4,200 companies representative of the world of industrial enterprises, with between 5 and 499 employees.

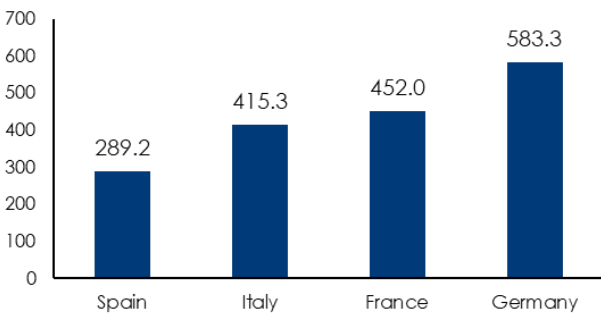
Fig. 3 - 2022 turnover development (% share of companies)



Source: Centro Studi Guglielmo Tagliacarne processing of data obtained from Tagliacarne Survey, Unioncamere, Cluster Spring 2023

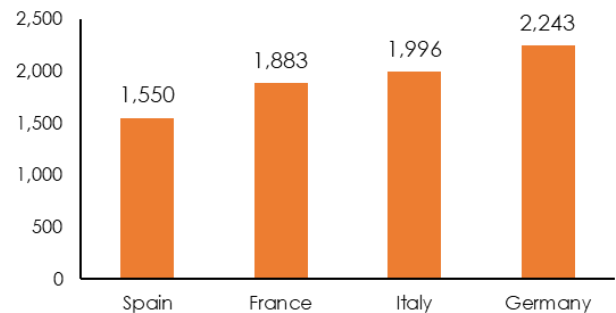
In the other European countries considered in the Report, the Bioeconomy also experienced significant growth in 2022. In France, Germany, Italy and Spain as a whole, the bioeconomy generated an output of around 1,740 billion euros in 2022, employing more than 7.6 million people. Estimates for 2022 confirm the findings of previous editions of the Report. In absolute terms, the German bioeconomy stands out, ranking first in terms of production value (583.3 billion euros) and number of employees (2.2 million). In terms of output, France ranks second (452 billion euros), followed by Italy (415.3 billion euros) and Spain (289.2 billion euros). Italy ranks third in terms of production value and second in terms of employment, with around 2 million employees, followed by France (1.9 million) and Spain (1.6 million).

Fig. 4 - Estimated value of Bioeconomy production in 2022 in the main European countries (billion euros)



Source: Intesa Sanpaolo processing of data obtained from various sources

Fig. 5 - Estimated employment in the Bioeconomy in 2022 in the main European countries (thousands of people employed)



Source: Intesa Sanpaolo processing of data obtained from various sources

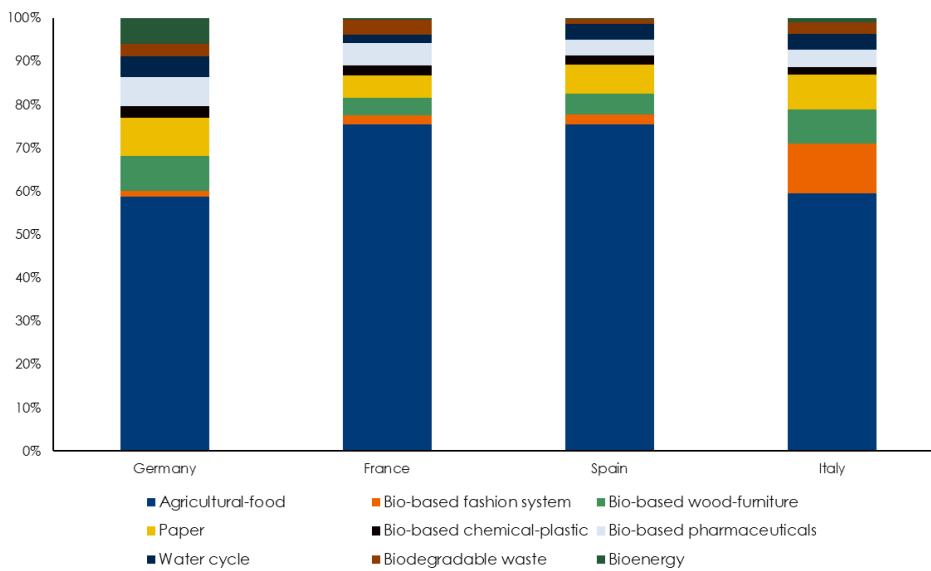
A major contribution in driving the 2022 performance in the different countries came, as already mentioned, from the significant increase in prices, especially energy prices, brought about by the conflict between Russia and Ukraine, as well as from the transition to renewable sources.

In this context, **alternative fuels**, which include both **biofuels** and **synthetic fuels**, can represent an interesting technological area of development for the goal of decarbonisation. As can be seen from the SRM analysis presented in **Chapter 2**, the development of alternative fuels may represent an opportunity for both transport (in particular air and sea transport) and high-emissions sectors, such as steel, cement, etc., which require energy sources with high calorific value, referred to as "hard-to-abate". More specifically, future developments could be a significant growth driver for the southern regions, in a logic of increasing collaboration and integration

between the northern and southern shores of the Mediterranean, which are characterised by complementary natural, economic and technological resources.

Currently, bioenergy does not represent a significant share within the perimeter of the Bioeconomy in any of the countries considered, where the agricultural food chain dominates.

Fig. 6 - % breakdown of the Bioeconomy by sector (production value, 2022)



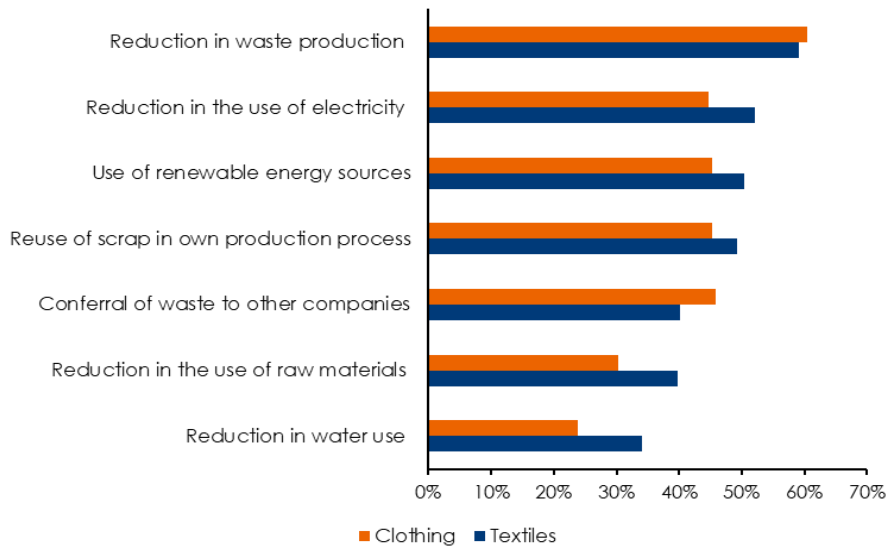
Source: Intesa Sanpaolo processing of data obtained from various sources

An analysis of the sectoral composition of the Bioeconomy sees Italy stand out for the relevance of the **fashion supply chain**, which accounts for over 11% of the total Bioeconomy, compared to values of just over 2% in Spain and France, and less than 2% in Germany. All three sectors of the bio-based fashion system (textiles, clothing, tanning/leather goods) are more important in Italy than in other countries, reflecting both our country's specialisation in this sector and a higher share of bio-based production in the total. **The bio-based share of the Italian fashion system (which includes the textile-clothing and leather chain) is just under 50%**. This is followed by France and Spain, with a bio-based weight of around 40%, and finally Germany, where the bio coefficient on total production is less than 40%.

The second part of the Report is dedicated to the fashion supply chain, and more specifically to **textiles-clothing**. **Chapter 3** presents the results of the above-mentioned survey conducted by Tagliacarne, Unioncamere, Cluster Spring for the specifics of the enterprises operating in this sector. For the first time, the survey provides a more detailed analysis of Italian companies belonging to the Bioeconomy, analysing their characteristics, strategies and future plans.

This is a sample of companies with an evolved strategic profile, as evidenced by the significant share of subjects with their own R&D activities, with a strong focus on innovation, also directed towards reducing the impact of production on the environment, experienced primarily as a strategy to stand out from the competition and gain an important reputation.

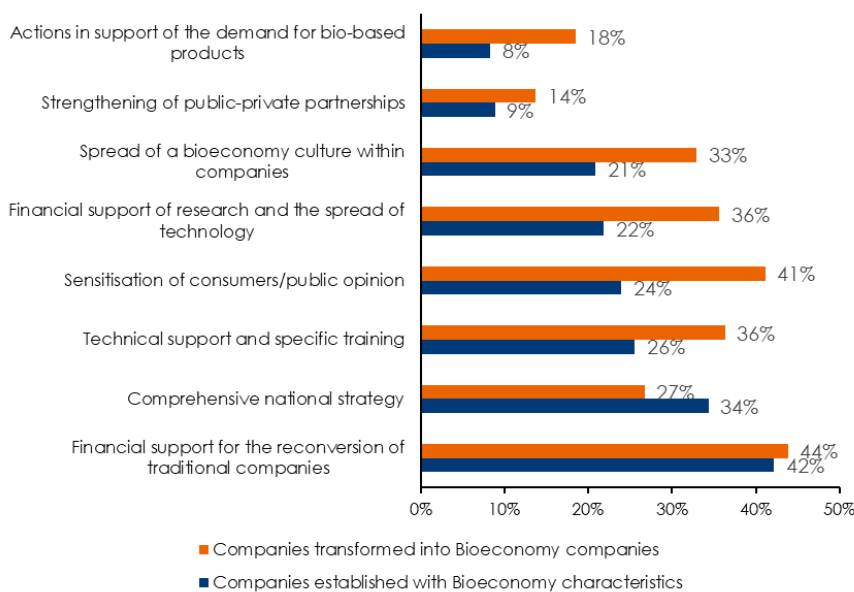
Fig. 7 - Which of the following types of bio-based innovation have been introduced by textile-clothing companies? (%)



Source: Intesa Sanpaolo processing of data obtained from Tagliacarne Survey, Unioncamere, Cluster Spring 2023

Confirming the importance of environmental sustainability issues for the fashion supply chain, a significant development potential emerges: **more than 40% of companies say they intend to expand their bio-based production over the next 3 years**. However, these companies are the ones that most frequently report difficulties related to the use of bio-based raw materials. It should be noted that the **high costs** appear to be the main obstacle, followed by supply difficulties and regulatory and bureaucratic aspects. The role of policy for companies that intend to expand bio-based production is significant: these companies give greater prominence to the introduction of the National Strategy as an enabler indicating the need for a comprehensive intervention in the metasector. In a parallel fashion, these companies report significant use of public funds.

Fig. 8 - What needs to be done to increase the number of Bioeconomy companies and consolidate those that exist? (% answers “a great deal” and “quite a lot” of textile-clothing companies)



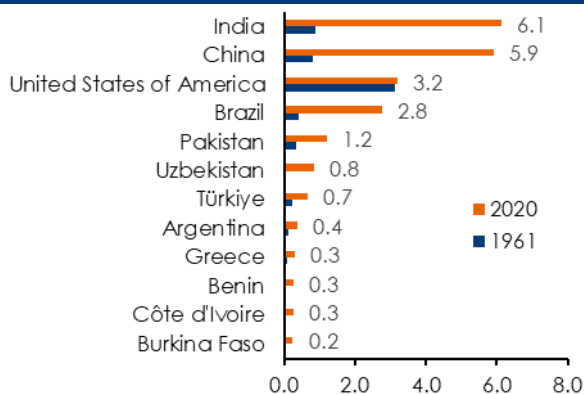
Source: Intesa Sanpaolo processing of data obtained from Tagliacarne Survey, Unioncamere, Cluster Spring 2023

The analysis also shows how the conversion of non-bio-based production to more sustainable logics entails greater difficulties than those experienced by production that is born bio-based and, in a parallel fashion, greater demand for support. In actual fact, companies that have subsequently turned into bio-based enterprises place greater emphasis on financial support, research activities and technology dissemination to enable the development of bio-based production. Further useful building blocks for development are the dissemination of the culture of the Bioeconomy within companies and the provision of technical support and specific training. Moreover, these companies indicate a more significant use of public funds than native bio-based companies, underlining the importance of policy in supporting transformation pathways.

The significant sensitivity shown by the Italian companies of the textile-clothing chain appears even more significant if interpreted in light of the major changes recorded in the sector in the last ten years, discussed in **Chapter 4**. This complex process was driven by regulatory changes, new production structures to respond to cost efficiencies, new consumption habits (fast fashion) and changes in the distribution system, also affected by the development of new sales channels (e.g. on-line sales). The pandemic crisis has had a major impact on the sector (closure of distribution stages, stoppage of tourism and social activities), but it does not seem to have altered the major trends that have been ongoing for several decades now.

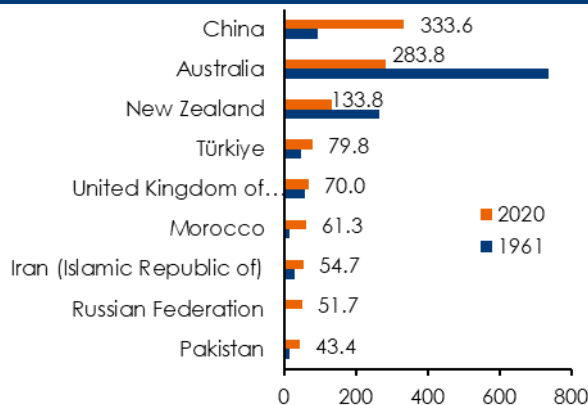
The main element that emerges is a progressive shift in relevance towards emerging economies and a downsizing of the role of advanced economies. China emerges strongly as the leader in all segments of the supply chain, starting with upstream production of natural inputs, where, in addition to traditional silk production, it has almost caught up with India in cotton production and has overtaken Australia and New Zealand to take first place in wool production. In addition to the other Asian countries (Bangladesh, Vietnam, India), the role of Turkey is also clearly growing, climbing up the world rankings along all links of the supply chain.

Fig. 9 - Cotton: production by country (millions of tonnes)



Source: FAOSTAT

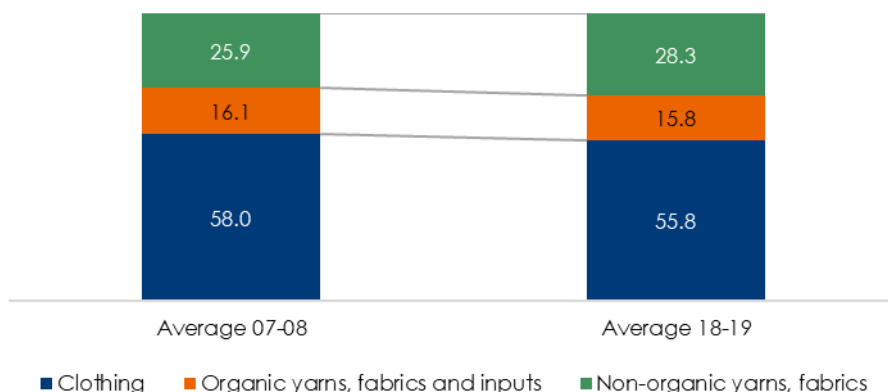
Fig. 10 - Wool: production by country (thousands of tonnes)



Source: FAOSTAT

Changes in the logic of production and distribution have been accompanied in recent decades by a strong growth in chemical fibres, with bio-based inputs and yarns having seen their role diminished (with the partial exception of cotton, which is expanding strongly). In international trade as a whole, the share of fibres, yarns and fabrics using natural raw materials fell below 15% of the total value in 2018-19.

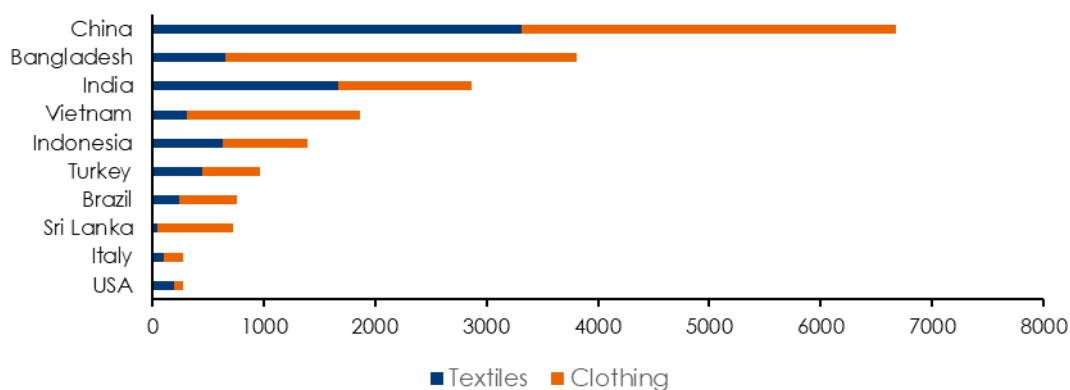
Fig. 11 - The international trade of the textile-clothing industry: breakdown by sector (%)



Source: Intesa Sanpaolo processing of BACI data

In this context, Italy has succeeded in being confirmed as a major player: the ninth largest producer worldwide in terms of number of employees, fifth in terms of production value and market share in high-end products and fourth largest global exporter of bio-based fibres, yarns and fabrics.

Fig. 12 - Employment in the textile-clothing chain by country (thousands of employees, 2018)



Source: Intesa Sanpaolo processing of UNIDO data

One key element has been to direct production towards the high quality segments, relying above all on an extraordinary wealth of expertise, continuously renewed to maintain a high level of competitiveness. In recent years, Italy has thus carved out a role for itself as the main production base for luxury goods, particularly in the industrial districts, which continue to represent privileged places where technological innovation coexists with traditional artisan know-how.

Table 1 - Italian positioning in high-end textile-clothing exports (position; %)

	Position 2007-08	Position 2018-19	Portion 2007-08	Portion 2018-19
Total	2	3	11.7	8.8
Clothing	2	3	12.0	10.4
Organic yarns, fabrics and inputs	2	4	15.2	7.5
Non-organic yarns and fabrics	3	5	9.0	5.9

Source: Intesa Sanpaolo processing of BACI data

Looking ahead, the textile-clothing industry will be called upon to address the growing consumer focus on environmental and sustainability topics, which will be the main challenge for companies throughout the supply chain.

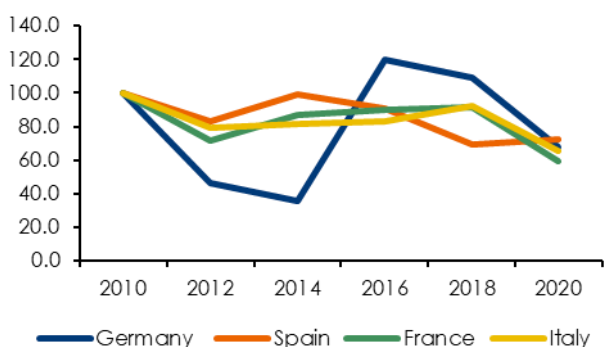
The Italian districts, with their localised and therefore potentially more traceable production, constitute, also from this standpoint, an important competitive lever in a context that will see circularity at the centre of efforts to minimise environmental impacts throughout the life cycle.

Each stage of the textile-clothing supply chain creates waste and refuse in changing quantities and qualities. The sustainability of the supply chain and the closing of the circle call for the promotion and development of all those activities that reduce and limit the production of waste, and for the promotion and dissemination of circular practices: in the pre-consumer phase through the most appropriate forms of industrial osmosis, in the post-consumer phase through the reduction of waste and the reuse of products. **Chapter 5** provides as complete and comprehensive a mapping of the current situation as possible, highlighting possible and desirable development paths.

Textile waste produced by the fashion supply chain amounts to 510 thousand tonnes at European level, decreasing over the last 10 years. The country with the largest quantity collected is Italy, 200 thousand tonnes. Spain, Germany and France are positioned on relatively similar and much smaller quantities both in absolute values and with reference to values weighted on the number of employees in the industry.

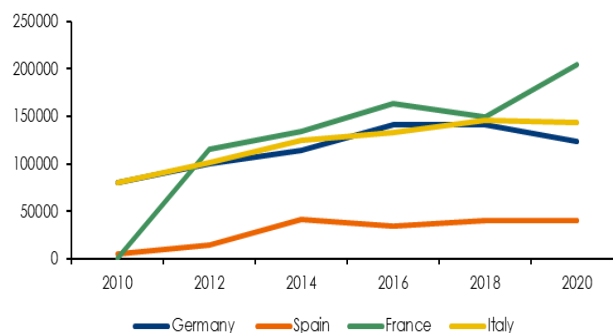
In the production phase, not all scrap effectively ends up as waste; a substantial portion is, in fact, regenerated and becomes a secondary raw material that can be reused either by the company itself or marketed in a typically circular manner. The analysis of trade flows of by-products of production processes highlights the liveliness and relevance of the market for secondary raw materials (SRMs). However, according to the European Environment Agency (EEA), international trade is the only dimension, of those analysed, that appears to be adequate, whilst on other aspects, the textile secondary raw materials market does not function correctly or adequately. The scope for improvement in terms of the size and structure of the market itself, prices, policies and technical specifications is therefore extensive.

Fig. 13 - Generation of textile waste by the textile, clothing and footwear industry (2010=100)



Source: Intesa Sanpaolo processing of Eurostat data

Fig. 14 - Generation of textile waste by households (2010=100)

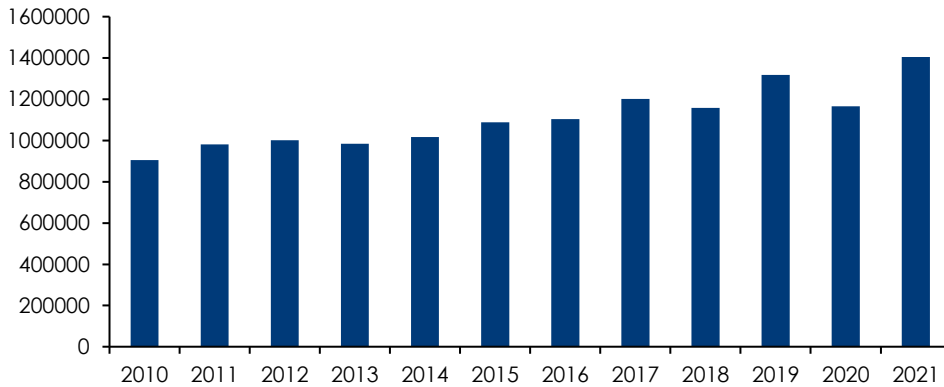


Source: Intesa Sanpaolo processing of Eurostat data

The component of textile waste collected from households is growing in all countries surveyed, despite the absence of regulatory obligations, which will, in fact, come into effect in all European countries on 1 January 2025. Separately collected post-consumer waste amounted to a total of 790,000 tonnes in the EU-27 in 2020 and is still only a small fraction of the goods released for consumption, indicating that, despite the positive dynamics, a large part of textile waste is still

being delivered to the undifferentiated waste stream. In addition, large quantities of used textiles are currently exported from the EU, mainly to Asia and Africa. The fate of these products is rather unclear because only some are reused and recycled: instead, a large portion are disposed of in the destination countries, and often in an unsustainable manner.

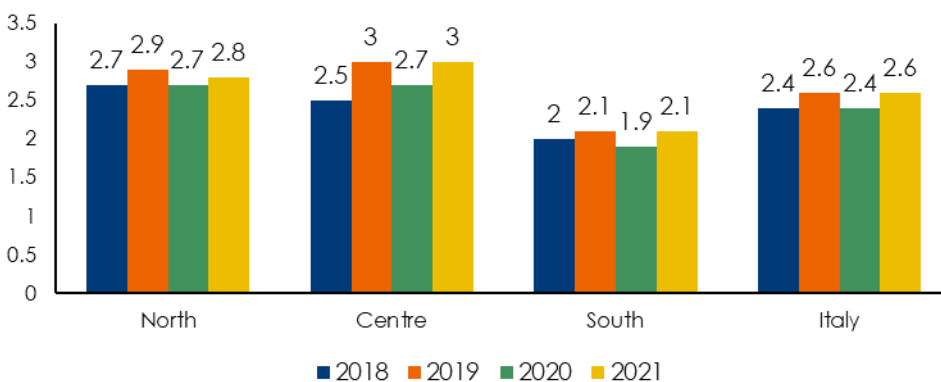
Fig. 15 - Exports of used textiles from the European Union to the rest of the world (EU27, tonnes)



Source: Intesa Sanpaolo processing of Comtrade data

In 2022, a separate collection obligation for post-consumer textile waste was introduced in Italy, ahead of the European time-line. The latest available data refers to 2021, prior to this obligation, and indicates the progressive expansion of differentiated collection and significant territorial differences: 72% of Italian municipalities have in fact intercepted shares of this waste in a differentiated form, with values ranging from 66% of municipalities in Southern Italy to 79% of those in Central Italy. The amount of textile waste per inhabitant collected in the South is 2.1 kg, compared to 2.8 kg per inhabitant recorded in the North and 3 kg in Central Italy. However, according to Ipsra estimates, the textile waste that ends up in undifferentiated waste is more than 4 times as much as the waste intercepted by separate collections. This figure suggest the potential that can be activated through the increased spread of separate collection that will follow the introduction of compulsory collection.

Fig. 16 - Italy: municipal textile waste collected by geographical area (kg per capita)



Source: Intesa Sanpaolo processing of Ipsra data

With the introduction of mandatory separate collection of textiles, which has already started in Italy and will soon be implemented throughout the European Union, the issue of closing the loop and reuse and re-use of textile waste and used textiles will become even more relevant.

There will be an increase in the amount of waste to be processed and managed, and the waste mix will also change, with a rise in the incidence of poorer quality and worthless textile waste with important consequences for the economic sustainability of downstream stages.

The sustainability of the supply chain and the closing of the circle will therefore increasingly require the promotion and development of all those activities that first and foremost actually reduce and limit the production of waste, in line with the waste hierarchy. In this context, the ability to recover material in a "fibre-to-fibre" logic, which is currently limited, will become crucial. The European Strategy for Sustainable and Circular Textiles aims to create a coherent framework and vision for the transition of the textile sector by ruling that by 2030, products placed on the market should be of higher quality in order to increase their durability and enable reuse. The aim is also to promote the use of recycled fibres, eliminating the use of hazardous substances in the knowledge that the negative impacts of the current production and consumption model stem from a linear model characterised by low rates of use, reuse, repair and "fibre-to-fibre" (closed loop) recycling of textiles. The Strategy also identifies the need to prevent waste streams from being falsely labelled as second-hand goods and thus escaping the waste regime. The textile supply chain has a high potential for circularity which, to date, is only partly exploited.

