Monitoring industrial ecosystems

EU MEMBER STATES FACT SHEETS

Italy

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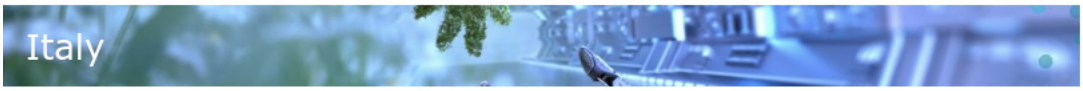
Key Highlights

This country report has been developed as part of the '**European Monitor of Industrial Ecosystems'** project of the European Commission, Directorate General for Internal Market, Industry, Entrepreneurship and SMEs and the European Innovation Council and SMEs Executive Agency. It provides data insights into the twin transition and the technological performance of industrial ecosystems. The key findings of the report are summarised below:

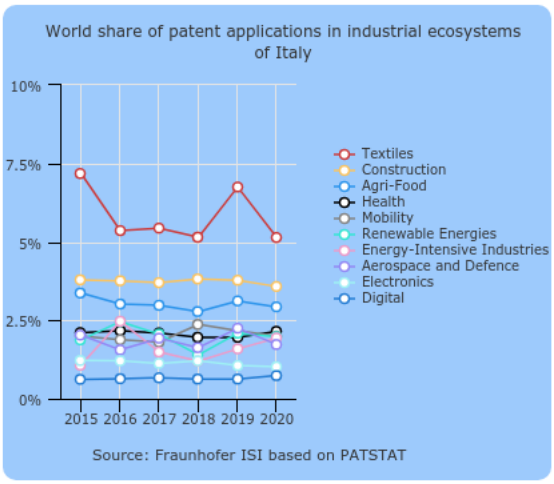


Technological performance in industrial ecosystems:

- In a global comparison, Italy ranked within the top countries in **Textiles, Agri-Food, Construction, Energy Intensive Industries and Mobility** in terms of its share of world patent applications among the EU27 countries.

Digital and green transition technologies:

- Within the EU27, Italy ranked among the top countries in generating digital and green technologies in **Energy Saving Technologies and Advanced Manufacturing and Robotics.**
- It has dynamically increased its relative strengths in **Other Renewable Energies such as Geothermal, Hydropower and Biomass, and in Solar Power and in Energy Saving Technologies.** Nonetheless, the results of the analysis show a decreasing trend in Italy's global position in Wind Power.
- In the field of the digital transition, Italy has dynamically increased its global share of patent applications in the fields of the **Internet of Things, Big Data and Artificial Intelligence.** Nevertheless, it has been continuously decreased its world share in the field of Advanced Manufacturing and Robotics.



Capacity to produce goods based on digital and green technologies:

- Italy's share of production in digital technologies over global production indicates that it created the highest value by the deployment of **Micro-and Nanoelectronics and Advanced Manufacturing and Robotics** related products. Trends over time show a dynamic increase in global share in Artificial Intelligence and Digital Mobility, however, a decrease or stagnation in all other digital technology related goods.
- In the field of green transition technologies, Italy created the highest value by the deployment of **Energy Saving, Renewable Energy and Advanced Materials,** where its global share shows an increasing trend.

1. Introduction

This country report has been prepared within the '**European Monitor of Industrial Ecosystems' (EMI)** project, initiated by the European Commission, Directorate General for Internal Market, Industry, Entrepreneurship and SMEs and the European Innovation Council and SMEs Executive Agency (EISMEA). The overall goal of the project is to **analyse the green and digital transformation of industrial ecosystems**.

The EU's updated industrial strategy from May 2021[1] has outlined 14 industrial ecosystems that are in the focus of the project. The 14 industrial ecosystems include *aerospace and defence, agri-food, construction, cultural and creative industries, digital, electronics, energy intensive industries, energy-renewables, health, mobility – transport – automotive, proximity, social economy and civil security, retail, textile and tourism.* The industrial strategy defined industrial ecosystems as encompassing all players operating in a value chain: from the smallest startups to the largest companies, from academia to research, service providers to suppliers[2].

The objective of this report is to **present key findings from data** collected within the framework of this project at country level notably on **patent applications, production data, trade** (available only for ten industrial ecosystems)**, private equity and venture capital** investments. Nonetheless, this report does not aim to be comprehensive; the data presented here only complement other important statistics on technology development in each country.

The monitoring framework has a technological focus. Industrial transition is driven by technological, economic, and social changes, and in particular by digital technologies and the shift to a green and circular economy. The green and digital technologies that have been taken into account are presented in the table below.

Table 1: Technologies monitored in the project by patent, trade and prodcom data

Green technologies
Advanced Materials and Nanotechnology
Biotechnology (for sustainability)
Energy Saving Technologies
Renewable Energy Technologies
Solar Power
Wind Power
other (geothermal, hydropower, biomass)

Digital technologies
Advanced Manufacturing & Robotics
Advanced Manufacturing
Robotics
Artificial Intelligence
Big Data
Digital Security & Networks/ Cybersecurity
Digital Technology for Mobility
Internet of Things
Micro- and Nanoelectronics & Photonics
Micro- and Nanoelectronics
Photonics

Source: Technopolis Group, IDEA Consult and Fraunhofer ISI

The methodological report that sets the conceptual basis and explains the technical details of each indicator is available on the EMI website. This report was prepared by Tiago Pereira, IDEA Consult, for the European Commission. However, it does not necessarily reflect the views of the European Commission.

2. Advanced technologies fostering the green and digital transition of industrial ecosystems

2.1. Data sources

This chapter outlines a set of indicators that capture the capacities of EU Member States to generate technologies that foster the green and digital transformation of industrial ecosystems. Industries that are underpinned by a strong technology basis and supported by vibrant entrepreneurial communities have better conditions for success. The production of technology-based products indicates that technologies are commercialised, while a positive trade balance in technologies is a sign of international competitiveness.

Patent analysis is a widely used method for tracking technological development activities. With a view to industrial ecosystems under study in this project, technology generation and hence patenting takes place in a relatively limited number of ecosystems, while others mainly profit from technologies generated elsewhere. Technology development drives industrial transformation in a general way. The patent analysis is based on transnational patents, notably those filed through the WIPO PCT procedure[1] or at the European Patent Office[2] directly. They have been localised based on the address of the applicant. The different advanced technologies have been identified based on International Patent Classification (IPC) codes and keyword searches.

Trade data, more specifically export data, is a further relevant indicator to document industrial development at higher technology readiness levels. It informs on countries' competitive advantage in specific technology-based product areas. While somewhat simplistic, export strengths in certain technological areas still mark a specific relevance of technology relevant goods for the economy and remain among the reliable indicators of performance. The analysis focuses on trade balances based on UN Comtrade[3] statistics processed specifically for the purposes of this project. The trade balance can help reveal how nations are intricately involved in supply chains with substantial imports and relevant exports. By putting exports in relation to parallel imports, it is possible to assess whether a country displays strength in production.

Prodcom data[4] allows the monitoring of technology diffusion. Prodcom provides statistics on the production of manufactured goods carried out by enterprises on the national territory of the reporting countries. It helps measuring the uptake of technology through the production of manufactured goods by focusing on the specific components and elements enabled by green and digital technologies. Production data allows to measure to what extent technology-related products are being produced in the country. The production indicators are calculated based on product-level data from the Eurostat's Prodcom database.

Crunchbase data[5] were used to analyse entrepreneurial dynamics and private equity and venture capital investment. Crunchbase is a widely trusted source of information on venture capital backed innovative companies. Technology startups represent key building blocks in the transition towards a more digital, green and resilient economic model. Entrepreneurial activity helps accelerate the diffusion of technologies in industrial ecosystems and startups that provide green and digital solutions are relevant indicators of how the industrial ecosystem is transforming itself to reach environmental sustainability objectives. More information about these data sources can be found in the methodological report of the project.

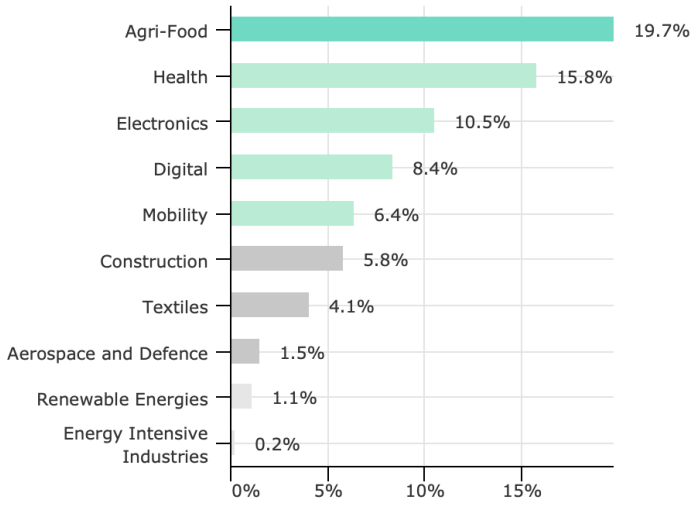
[1] World Intellectual Property Organization, WIPO Patent Cooperation Treaty (PCT) https://www.wipo.int/pct/en/
[2] European Patent Office, Supporting Innovation and Patents in Europe https://www.epo.org/en
[3] United Nations Comtrade, UN Comtrade Plus-International Trade Data Platform https://comtradeplus.un.org/
[4] Eurostat, Eurostat PRODCOM-European Union Production and Trade Statistics https://ec.europa.eu/eurostat/web/prodcom
[5] Crunchbase, Business Information and Networking Platform https://www.crunchbase.com/

2.2 Technology development in industrial ecosystems

Regarding technology development, Italy had the highest share of its patent applications in the Agri-Food, Health and Electronics industrial ecosystems in 2020 as captured by patent data. In a global comparison, it ranked at the second place in Textiles within the EU27 countries, and third in Agri-Food, Construction, Energy Intensive Industries and Mobility, Transport and Automotive.

Figure 1: Italy's country share and world share (expressed in terms of ranking) in patent applications in industrial ecosystems

Country share of patent applications in industrial ecosystems of Italy in 2020



World share of patent applications of Italy within EU27 (1 - best performer, 27 worst performer)

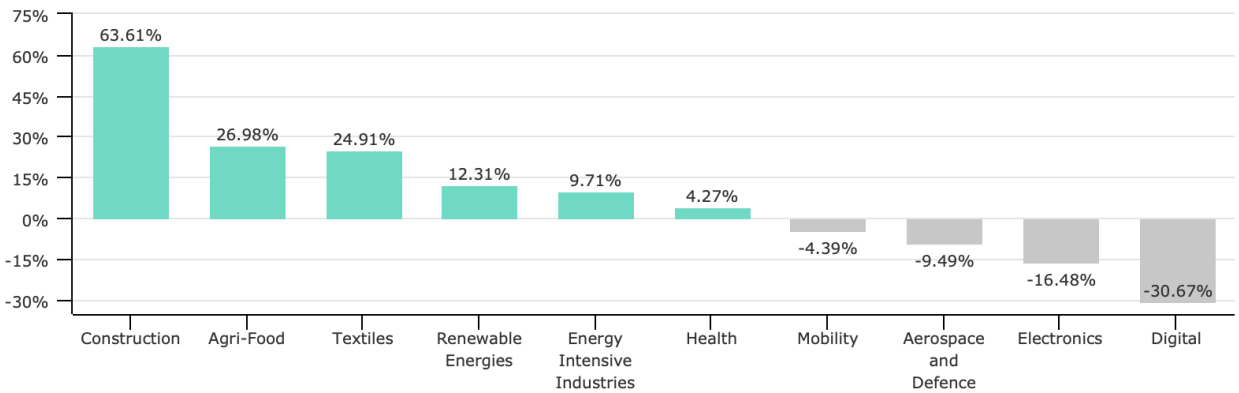
Textiles	**2**
Agri-Food	**3**
Construction	**3**
Energy Intensive Industries	**3**
Mobility	**3**
Aerospace and Defence	4
Health	4
Electronics	6
Digital	6
Renewable Energies	6

Source: Fraunhofer ISI based on Patstat

Trade is a common indicator of international competitiveness because it shows how attractive a country's products are outside of its domestic market. Total exports provide evidence about a country's role as a producer, and trade balance captures its sovereignty in certain areas of production. Figure 2 displays the trade balance in relation to overall trade volume by technology development in industrial ecosystems. Italy registered a trade surplus in technology-based products related to Construction, Agri-Food, Textiles, Renewable Energies, Energy Intensive Industries and Health in 2020.

*Figure 2: Trade balance in relation to overall trade volume ((exp. - imp.-1)*100) (2020)*

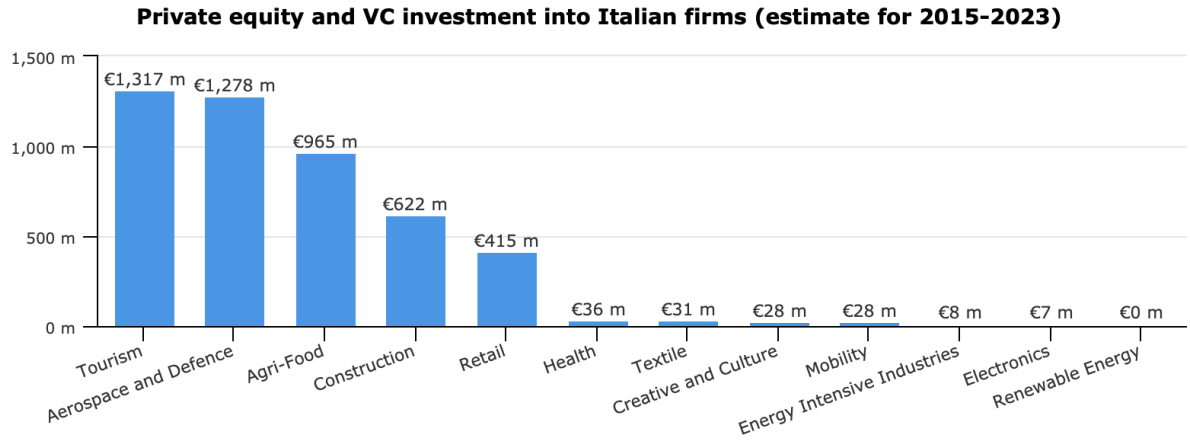
Relative trade balance of Italy in 2020



Source: Fraunhofer ISI based on UNCOMTRADE

Most private equity and venture capital (VC) investment went into innovative Italian tech companies operating in the field of Tourism, Aerospace and Defence and Agri-Food over the period from 2015 to 2020. For example, in the field of aerospace, some of the highest VC investment went into companies developing a constellation of nanosatellites to provide IoT connectivity or a service provider and technology platform for microsatellite operators.

Figure 3: Private equity and venture capital investment into tech companies related to industrial ecosystems in Italy

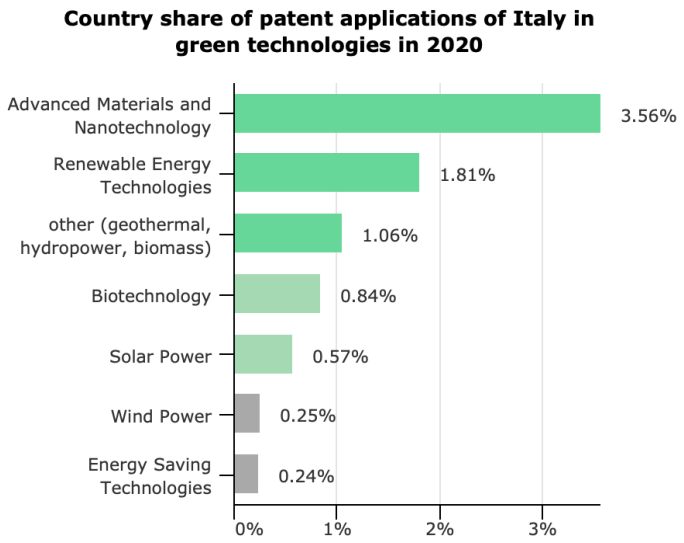


Source: Technopolis Group based on Crunchbase

2.3 Green transformation

Italy has been the most specialised in generating technologies related to Advanced Materials and Nanotechnology within its economy, which have the potential to drive the green transformation of its industries. Similarly, Italy ranked at the third place among the EU27 Member States in Energy Saving Technologies and at the fourth place in Advanced Materials and Nanotechnology regarding its world share of patent applications.

Figure 4: Country share and world share (expressed in terms of ranking) in patent applications of Italy



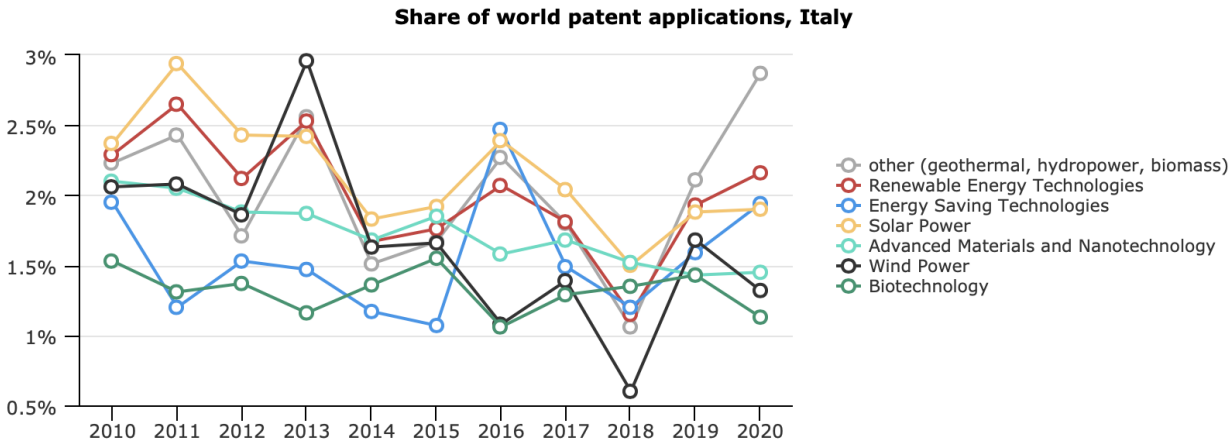
Ranking of Italy within EU27 in terms of its share of global patent applications in 2020 (1 - best performer, 27 worst performer)

Energy Saving Technologies	**3**
Advanced Materials and Nanotechnology	**4**
Biotechnology	**5**
Renewable Energy Technologies	6

Source: Fraunhofer ISI based on Patstat

The trends in global patent applications indicate that Italy's overall share in green technologies decreased between 2010 and 2018, but has been growing again since then. Italy has seen an increase in its global share specifically in various Renewable Energy Technologies, especially in Other Renewable Energies like Geothermal, Hydropower, and Biomass. Additionally, there has been a sharp rise in Energy Saving Technologies since 2018.

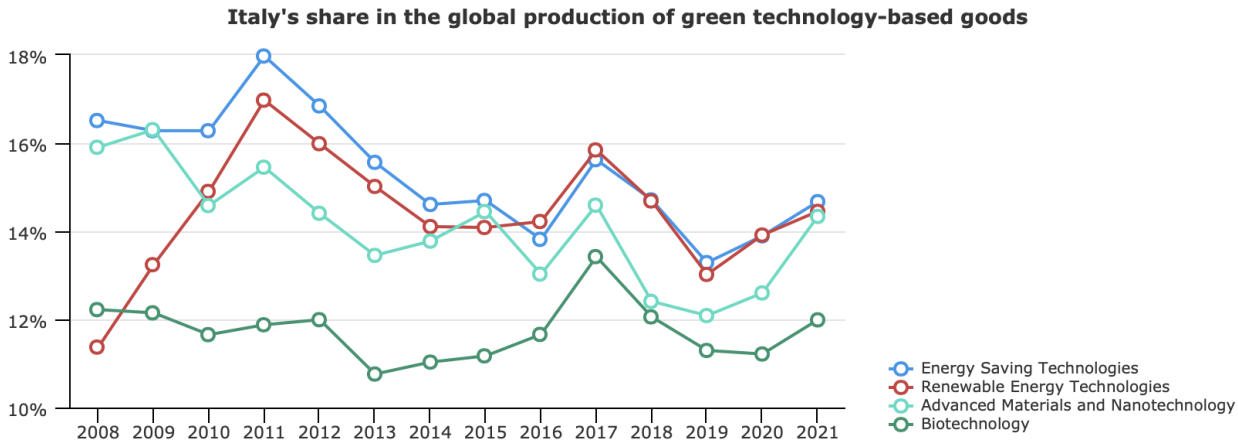
Figure 5: Trends over time in Italy's share in world patent applications



Source: Fraunhofer ISI based on Patstat

The Prodcom-based indicator (presented in the Figure below) measures the evolution of advanced technology related production in Italy for a given year. The share of production in a certain technology over Italy's total production indicates an overall negative trend since 2010, but a new growth since 2019 in various fields such as Enegy Saving Technologies and Renewable Energy Technologies.

Figure 6: Production of advanced technology-based products in Italy

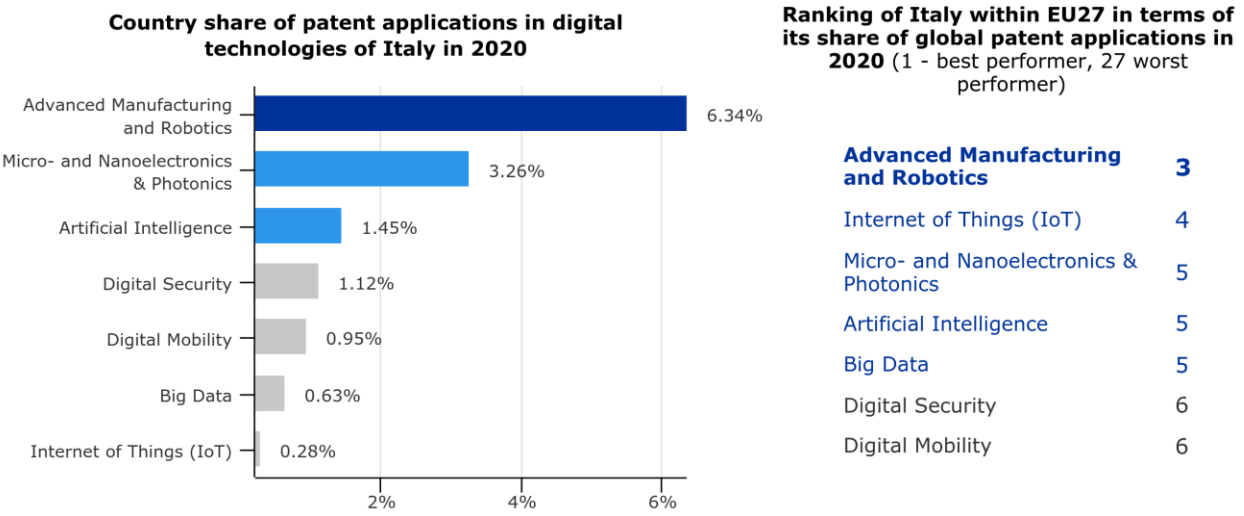


Source: IDEA Consult based on Prodcom data

2.4 Digital transformation

Among the digital technologies monitored in this project, Italy has been the most specialised in Advanced Manufacturing and Robotics and Micro-and Nanoelectronics. It ranked at the third place in Advanced Manufacturing, and at the fourth place in the Internet of Things in terms of its world share of patent applications among the EU27 Member States. It has been also performing relatively well in Micro-and Nanoelectronics, Artificial Intelligence and Big Data.

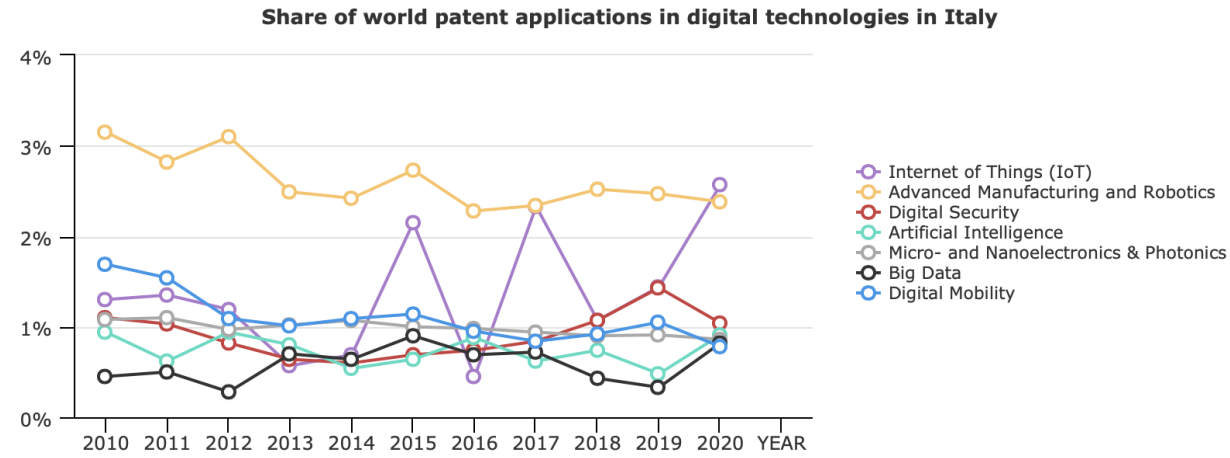
Figure 7: Country specialisation and world share (expressed in terms of ranking) in digital technology related patent applications of Italy



Source: Fraunhofer ISI based on Patstat

Over the period from 2010 to 2020, trends show that Italy has strengthened its global presence in the Internet of Things, Big Data, and Artificial Intelligence. However, its share in the field of Advanced Manufacturing and Robotics has been consistently declining.

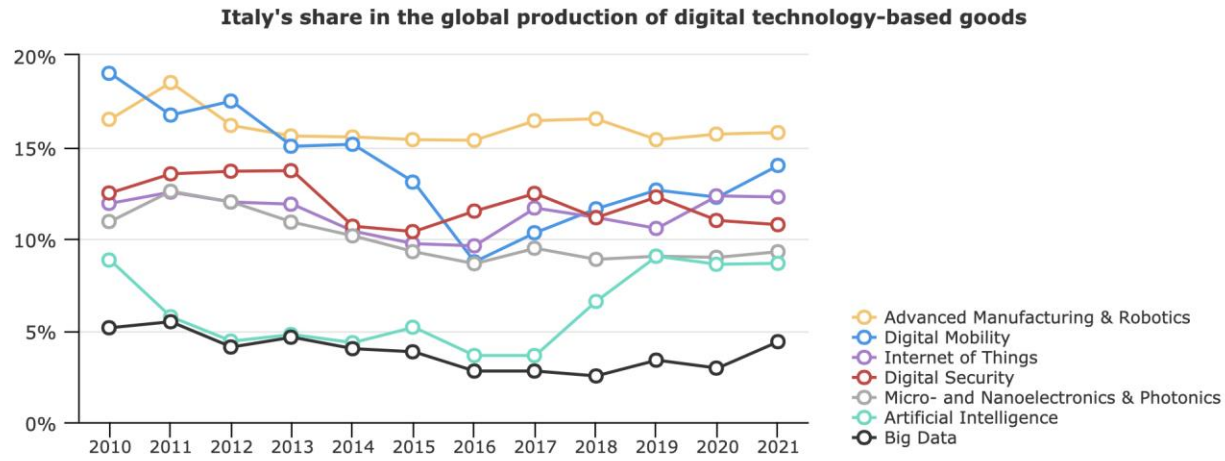
Figure 8: Trends over time in Italy's share of world patent applications



Source: Fraunhofer ISI based on Patstat

The Prodcom-based indicator measures the share of Italy in advanced technology-related production for a given year. The share of production in a particular technology over Italy's total production indicates that it has the largest share in the field of Micro-and Nanoelectronics and Advance Manufacturing and Robotics related products. In these technologies, Italy has been also a technology developer, which suggests that it has managed to turn these into commercialised products. Italy has the lowest share of production in Digital Security related products.

Figure 9: Production of digital technology-based products in Italy



Source: IDEA Consult based on Prodcom data

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