



European
Commission



Monitoring industrial ecosystems

EU MEMBER STATES FACT SHEETS

Spain



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EUROPEAN COMMISSION

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PDF	ISBN: 978-92-9469-741-7	doi: 10.2826/245894	EA-06-24-015-EN-N
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Luxembourg: Publications Office of the European Union, 2024
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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:

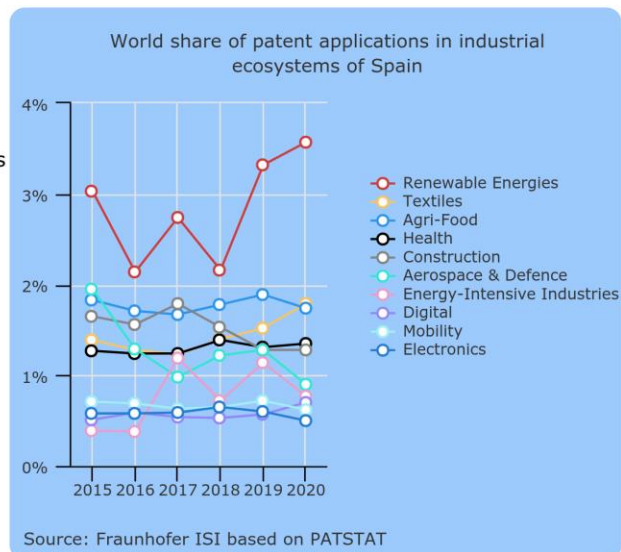


Technological performance in industrial ecosystems:

- Spain had by far the highest share of its patent applications in the **Renewable Energy** industrial ecosystem. In addition, the global share shows an upward trend over time.

Digital and green transition technologies:

- Among the digital technologies monitored in this project, Spain had the highest country share of patent applications in **Advanced Manufacturing and Robotics**. In the field of green transition technologies, Spain has generated most technologies related to **Renewable Energy Technologies**.
- Trends in the world's patent applications show that Spain increased its global share in various fields including Wind Power, Solar Power and Renewable Energy Technologies from 2018 to 2020.
- In the field of digital technologies, an overall decreasing trend can be observed with a recent surge in the world share of Spain in the Digital Security from 2019 to 2020.



Capacity to produce goods based on digital and green technologies:

- Spain's share of production in digital technologies over global production indicates that it created the highest value by the deployment of **Advanced Manufacturing and Robotics**, and **Micro- and Nanoelectronics & Photonics** technologies across all manufactured goods in the economy in 2021. Trends over time show a decrease or stagnation in all digital technology related goods.
- In the field of green transition technologies, Spain created the highest value by the deployment of **Biotechnology**.

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 2021¹ 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 suppliers².

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	Digital technologies
Advanced Materials and Nanotechnology	Advanced Manufacturing & Robotics
Biotechnology (for sustainability)	Advanced Manufacturing
Energy Saving Technologies	Robotics
Renewable Energy Technologies	Artificial Intelligence
Solar Power	Big Data
Wind Power	Digital Security & Networks/ Cybersecurity
other (geothermal, hydropower, biomass)	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 Lidia Núñez and Irene Zulueta, IDEA Consult for the European Commission. However, it does not necessarily reflect the views of the European Commission.

¹ European Commission (2021). Communication on Updating the 2020 New Industrial Strategy, COM(2021)350 final https://commission.europa.eu/system/files/2021-05/communication-industrial-strategy-update-2020_en.pdf

² European Commission (2020). A New Industrial Strategy for Europe, COM/2020/102 final [Commission Communication: A New Industrial Strategy for Europe | European Commission \(europa.eu\)](#)

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 procedure³ or at the European Patent Office⁴ 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 Comtrade⁵ 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 data⁶ 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 Eurostat's Prodcom database.

Crunchbase data⁷ 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.

³ World Intellectual Property Organization, WIPO Patent Cooperation Treaty (PCT) <https://www.wipo.int/pct/en/>

⁴ European Patent Office, Supporting Innovation and Patents in Europe <https://www.epo.org/en>

⁵ United Nations Comtrade, UN Comtrade Plus-International Trade Data Platform <https://comtradeplus.un.org/>

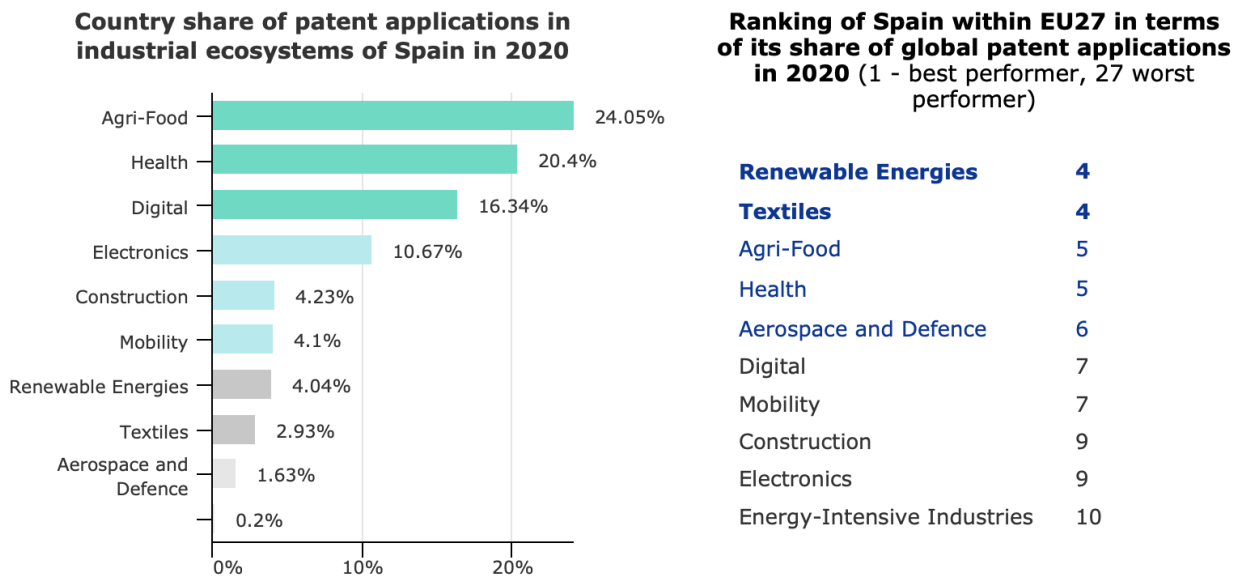
⁶ Eurostat, Eurostat PRODCOM-European Union Production and Trade Statistics <https://ec.europa.eu/eurostat/web/prodcom>

⁷ Crunchbase, Business Information and Networking Platform <https://www.crunchbase.com/>

2.2. Technology development in industrial ecosystems

Regarding technology development, Spain had the highest share of its patent applications in technologies related to the Agri-Food, Health and Digital industrial ecosystems in 2020. In a global comparison, it ranked the highest notably at the 4th place in Renewable Energy and Textiles industrial ecosystems within the EU27 countries.

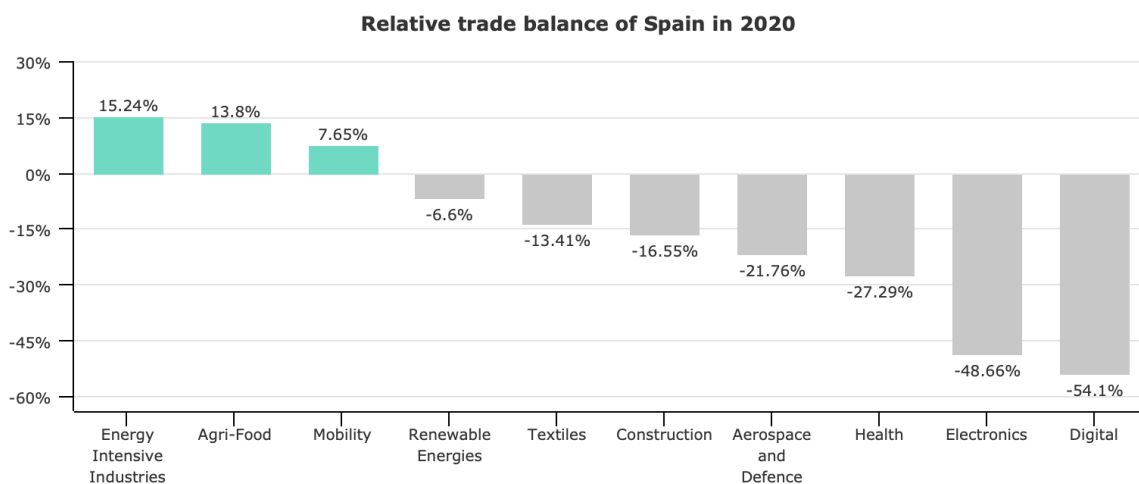
Figure 1: Spain's country share and world share (expressed in terms of ranking) in patent applications in industrial ecosystems



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. Spain registered a trade surplus in technology-based products related to Energy-Intensive Industries, Agri-Food and Mobility in 2020.

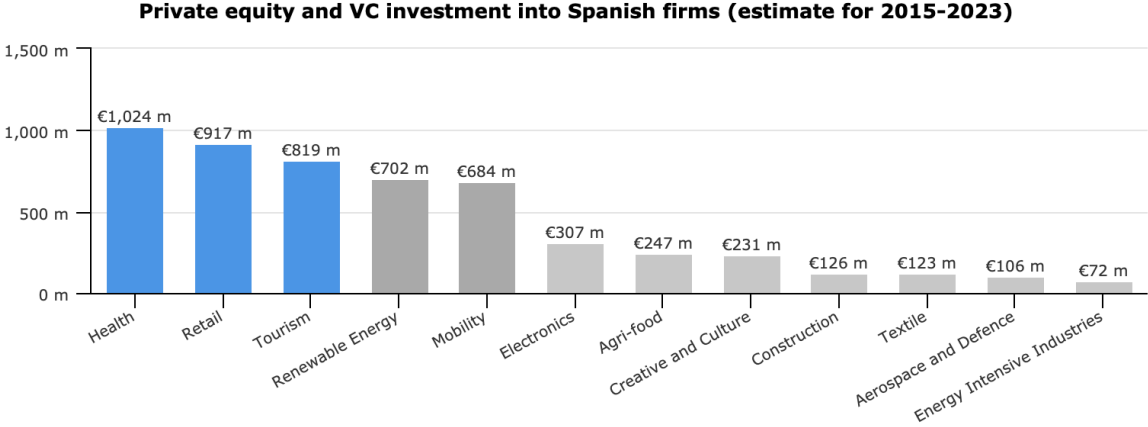
Figure 2: Trade balance in relation to overall trade volume $((exp - imp)/(exp+imp))$ (2020)



Source: Fraunhofer ISI based on UNCOMTRADE

Most private equity and venture capital investment went into innovative Spanish tech companies operating in the field of Health, Retail and Tourism over the period from 2015 to 2023.

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

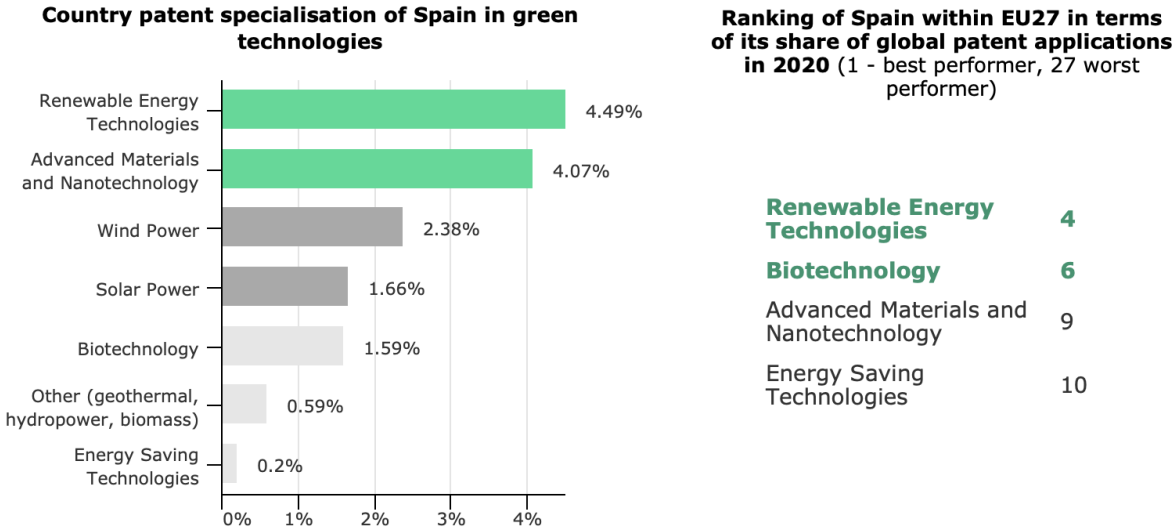


Source: Technopolis Group based on Crunchbase

2.3. Green transformation

Spain has been the most specialised in generating technologies related to Renewable Energy Technologies and notably Solar Energy, in which field it occupied the 4th position among the EU27 countries. It ranked 6th in Biotechnology.

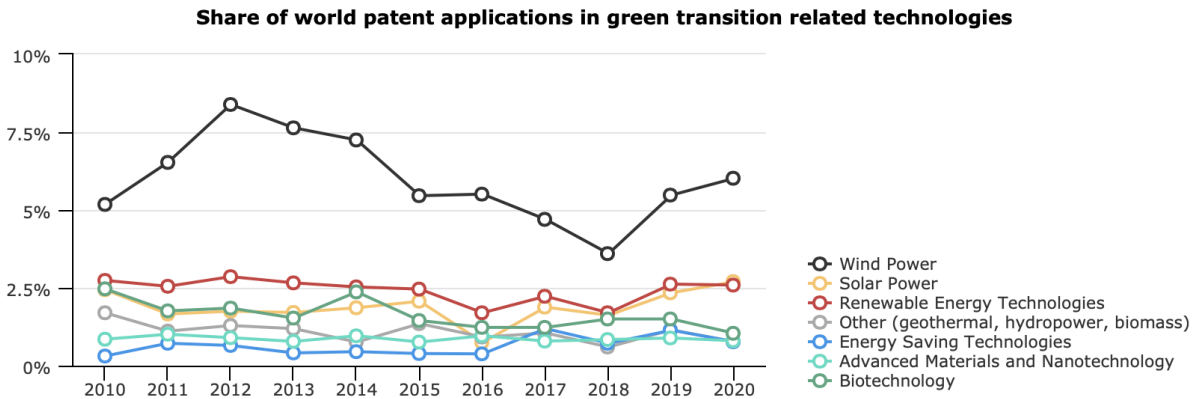
Figure 4: Country share and world share (expressed in terms of ranking) in patent applications of Spain



Source: Fraunhofer ISI based on Patstat

Trends in the world’s patent applications show that Spain increased its global share in various green technologies over the period from 2018 to 2020 such as Wind Power and Solar Power. The results of the analysis indicate that Spain's global position has been maintained over time in Energy Saving Technologies and Advanced Materials but has slightly decreased in the field of Biotechnology.

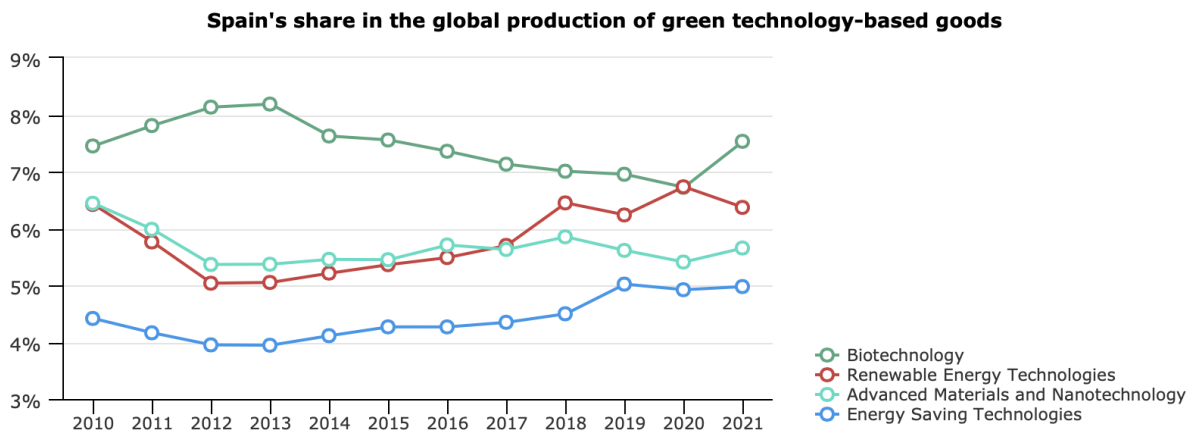
Figure 5: Trends over time in Spain's share in world patent applications



Source: Fraunhofer ISI based on Patstat

The Prodcom-based indicator (as presented in the Figure below) measures the evolution of advanced technology related production in Spain for a given year. The share of production in a certain technology over Spain's total production indicates that Spain has the highest production in Biotechnology related products, however, it shows a decreasing trend over the period from 2013 to 2020. In other technologies such as Renewable Energy, Advanced Materials, and Energy-Saving Technologies, there is a growing trend, although there have been some slowdowns in certain years.

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

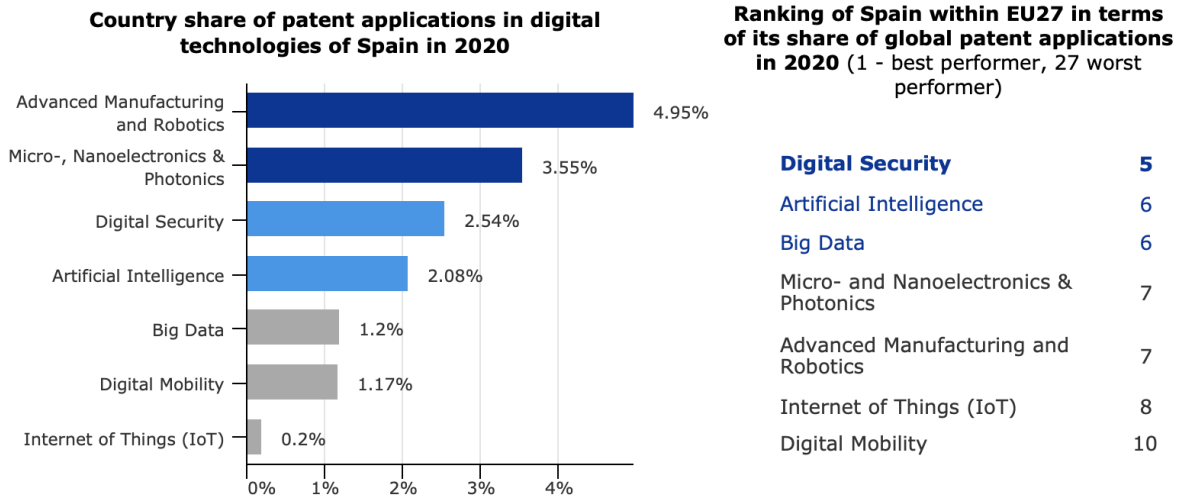


Source: IDEA Consult based on Prodcom data

2.4. Digital transformation

Among the digital technologies monitored in this project, Spain has been the most specialised in Digital Security, followed by Advanced Manufacturing and Robotics. It ranked at the 5th place in Digital Security in terms of its world share of patent applications among the EU27 Member States.

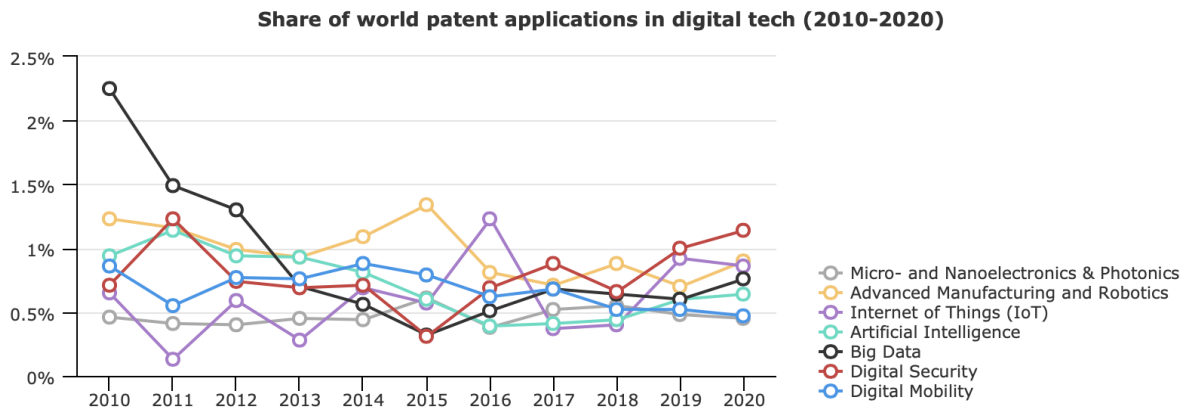
Figure 7: Country share and world share (expressed in terms of ranking) in digital technology related patent applications of Spain



Source: Fraunhofer ISI based on Patstat

The share of global patent applications over time shows a mixed trend. Spain increased its global position in Digital Security and kept stable in Micro- and Nanoelectronics between 2010 and 2020. In other technologies it has been losing its share.

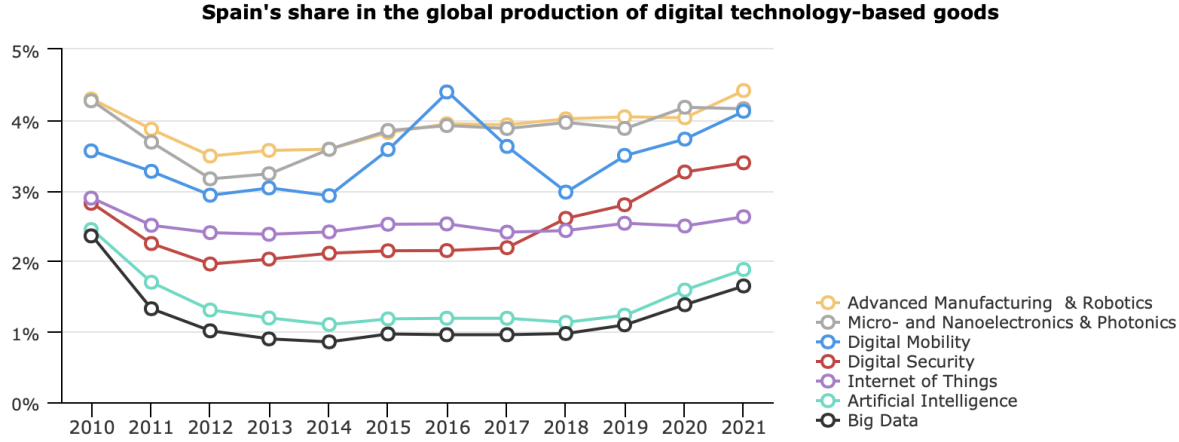
Figure 8: Trends over time in Spain's share of world patent applications



Source: Fraunhofer ISI based on Patstat

The Prodcom-based indicator measures the share of Spain in advanced technology-related production for a given year. The share of production in a particular technology over Spain's total production indicates that it has the largest share in Advanced Manufacturing and Robotics related products. Overall, the trend shows a steady increase in most digital technology-related products.

Figure 9: Production of advanced technology-based products in Spain



Source: IDEA Consult based on Prodcop data

