Monitoring industrial ecosystems

EU MEMBER STATES FACT SHEETS

France

Author: Agnes Martinelli, PwC

EUROPEAN COMMISSION

Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs
Directorate D – Networks & Governance
Unit GROW.D.2 – Industrial Forum, Alliances, Clusters

European Innovation Council and SMEs Executive Agency (EISMEA)
Unit I.02 – SMP/COSME Pillar
E-mail: EISMEA-SMP-COSME-ECOSYSTEMS@ec.europa.eu

European Commission
B-1049 Brussels

LEGAL NOTICE

PDF ISBN: 978-92-9469-853-7 doi: 10.2826/932313 EA-02-24-726-EN-N

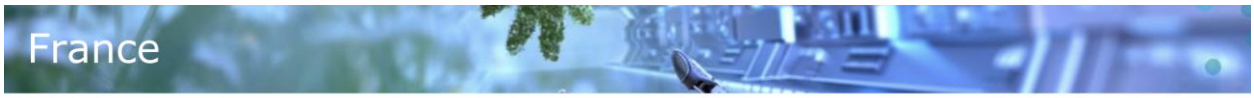
Luxembourg: Publications Office of the European Union, 2024

TABLE OF CONTENTS

TABLE OF FIGURES

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:

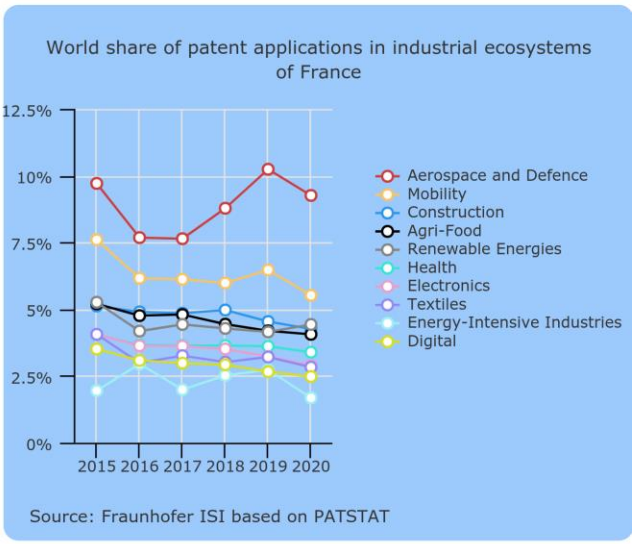


Technological performance in industrial ecosystems:

- France had the highest world share of patent applications in the **Aerospace and Defence, Mobility and Construction ecosystems** in 2020 as captured by patent data. Within the country, it had the highest share in Electronics, Digital and Agri-Food.

Digital and green transition technologies:

- Among the digital technologies monitored in this project, France had the highest country share of patent applications in **Micro- and Nanoelectronics & Photonics and in Advanced Manufacturing and Robotics.** In the field of green transition technologies, France has ranked second among the EU27 Member States in generating technologies related to **Advanced Materials and Biotechnology.**
- Trends in the world's patent applications show that France increased its global share in various fields including **Other Renewable Energies such as geothermal, hydropower and biomass, in Solar energy and in Wind power.**
- In the field of digital technologies, France decreased substantially its world share in Digital Security and in Big Data from 2010 to 2020. It has also slightly decreased its world share in the field of the Internet of Things.



Capacity to produce goods based on digital and green technologies:

- The share of production in a particular technology over France's total production indicates that France has the largest share in the field of **Digital Mobility** (relevant from the perspective of its automotive industry), followed by Digital Security over the period from 2010 to 2021.
- In the field of green transition technologies, France generated most value from **Advanced Materials and Nanotechnology**-based products. Nonetheless, a decreasing trend can be observed in the case of all green transition technologies.

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 Agnes Martinelli, PwC 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.

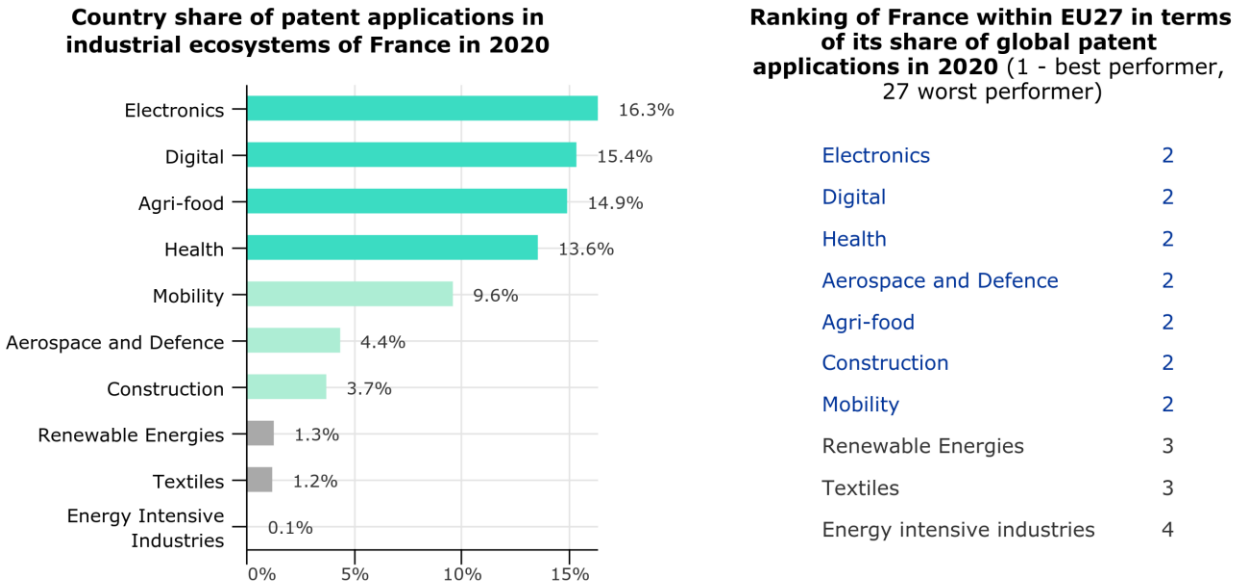
Crunchbase data[5] were used to analyse entrepreneurial dynamics and private equity and venture capital investment. Crunchbase is a widely trusted source of information on venture capital backed innovative companies. Technology startups represent key building blocks in the transition towards a more digital, 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, France had the highest country share of patent applications in the Electronics, Digital, Agri-food and Health industrial ecosystems in 2020 as captured by patent data. In a global comparison, it ranked second within the EU27 countries in almost all ecosystems, with the exception of Renewable Energies, Textiles, and Energy Intensive Industries.

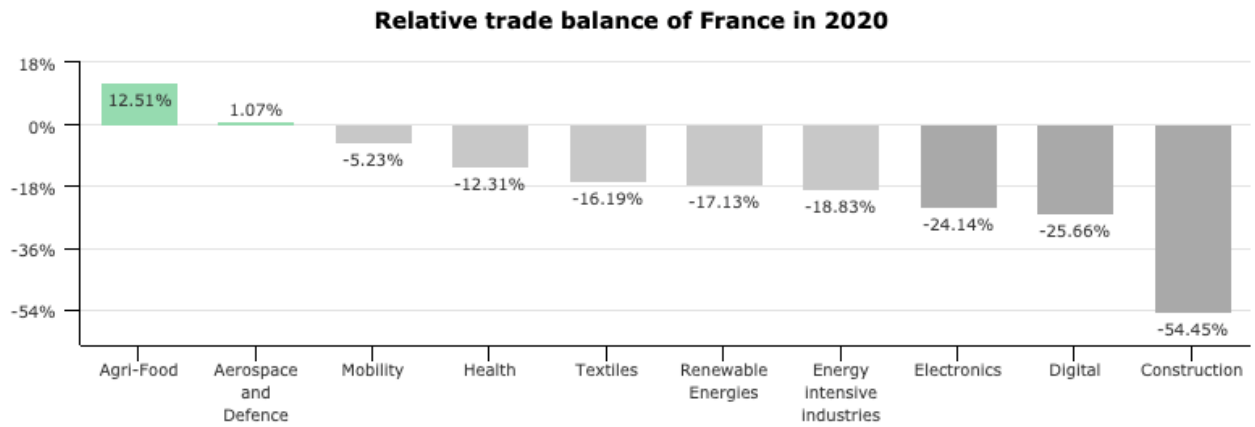
Figure 1: Country specialisation and world share (expressed in terms of ranking) in patent applications in industrial ecosystems related technologies



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. France registered a trade surplus in Agri-Food and Aerospace and Defence. It has been the strongest net importer of technology-based products related to Construction.

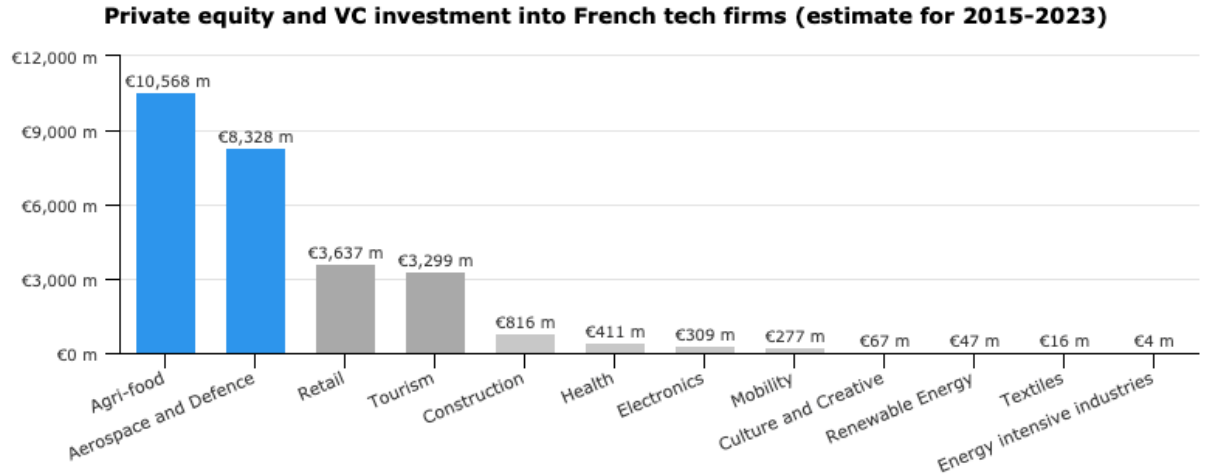
Figure 2: Trade balance in relation to overall trade volume ((exp - imp)/(exp+imp)) (2020)



Source: Fraunhofer ISI based on UNCOMTRADE

Most private equity and venture capital investment in France went into innovative companies operating in the Agri-Food, Aerospace & Defence and Retail industrial ecosystems over the period from 2015 to 2023.

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

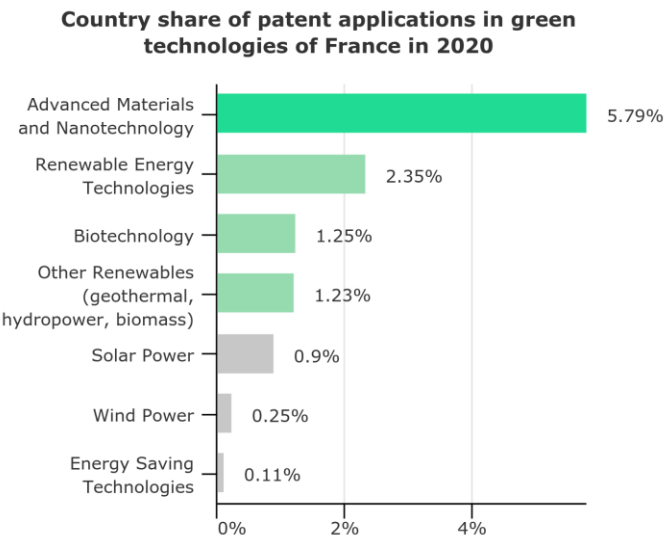


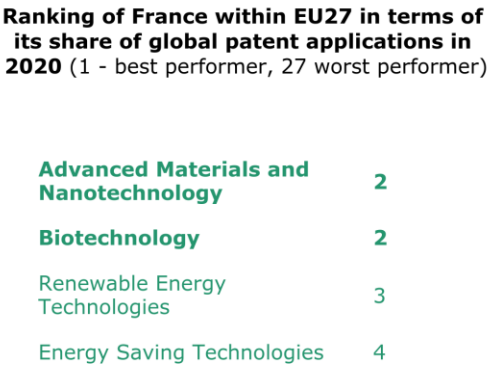
Source: Technopolis Group based on Crunchbase

2.3. Green transformation

Within the country, France had the highest country share of patent applications in generating technologies related to Advanced Materials and Renewable Energy Technologies, which have the potential to drive the green transformation of its industries. In a global comparison, France has ranked second among the EU27 Member States in generating technologies related to Advanced Materials and Biotechnology.

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

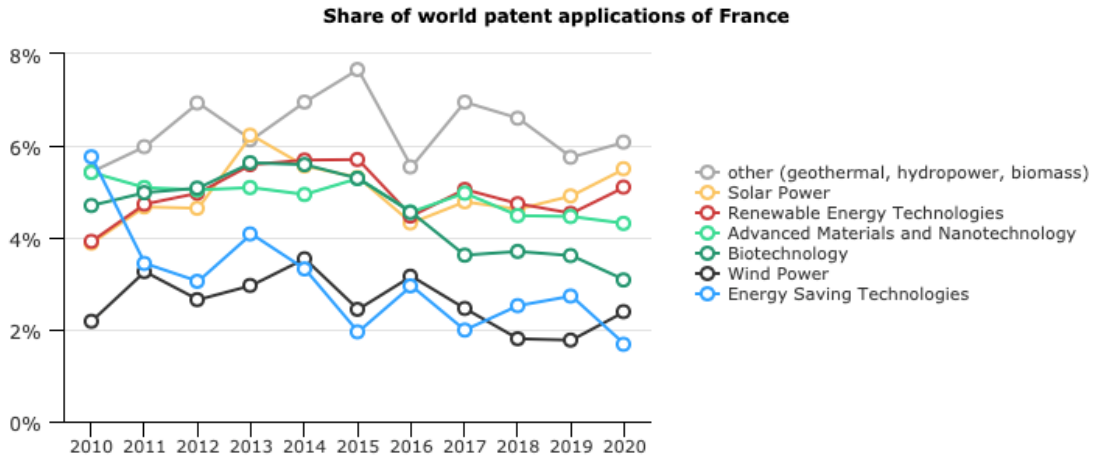




Source: Fraunhofer ISI based on Patstat

Trends in the world's patent applications show oscillating trends over the period from 2010 to 2020, nonetheless France increased its global share in various fields most recently including Other Renewable Energies such as Geothermal, Hydropower and Biomass, in Solar Energy and in Wind Power. In the field of Energy Saving Technologies, the results of the analysis show a decreasing trend in France's global position.

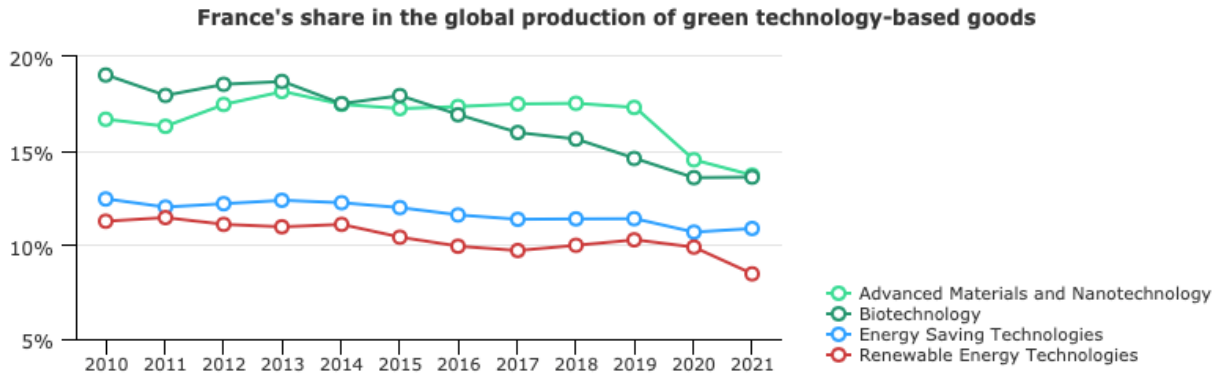
Figure 5: Trends over time in France's share in world patent applications



Source: Fraunhofer ISI based on Patstat

The Prodcom-based indicator measures the share of advanced technology-related production in France for a given year. The share of production in a certain technology over France's total production indicates a decrease for every green technology, with Advanced Materials and Nanotechnology and Biotechnology ranking the highest.

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

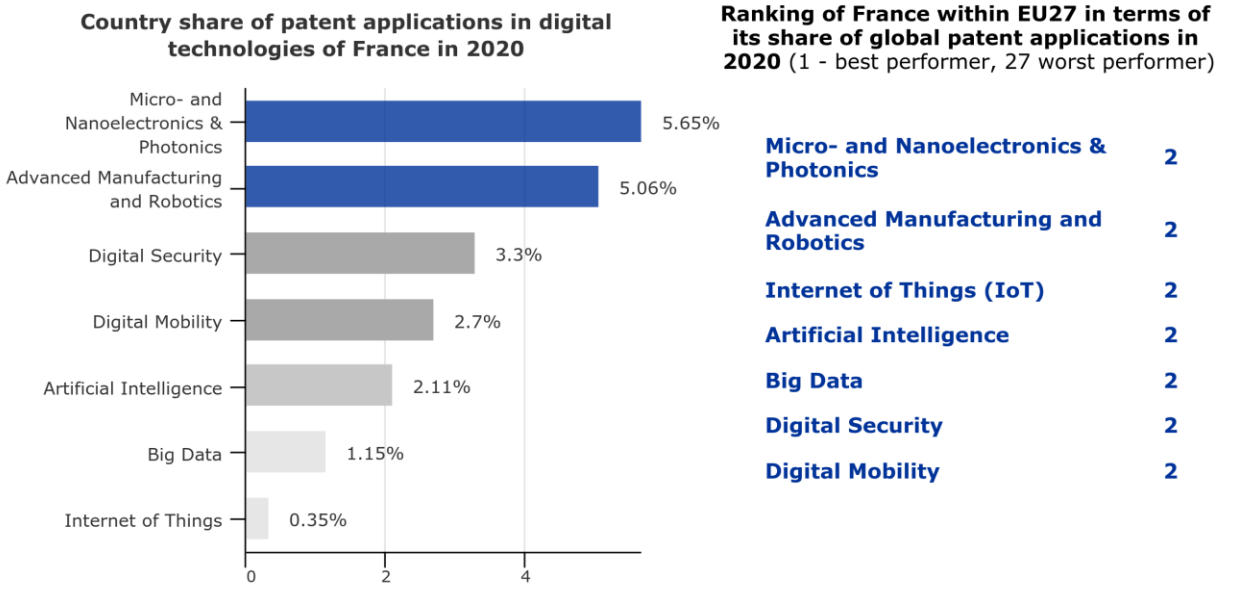


Source: IDEA Consult based on Prodcom data

2.4. Digital transformation

Among the digital technologies monitored in this project, France had the highest country share of patent applications in Micro- and Nanoelectronics & Photonics and in Advanced Manufacturing and Robotics. France ranked consistently at second place across all technologies within the EU27 countries with regard to its share in the world patent applications.

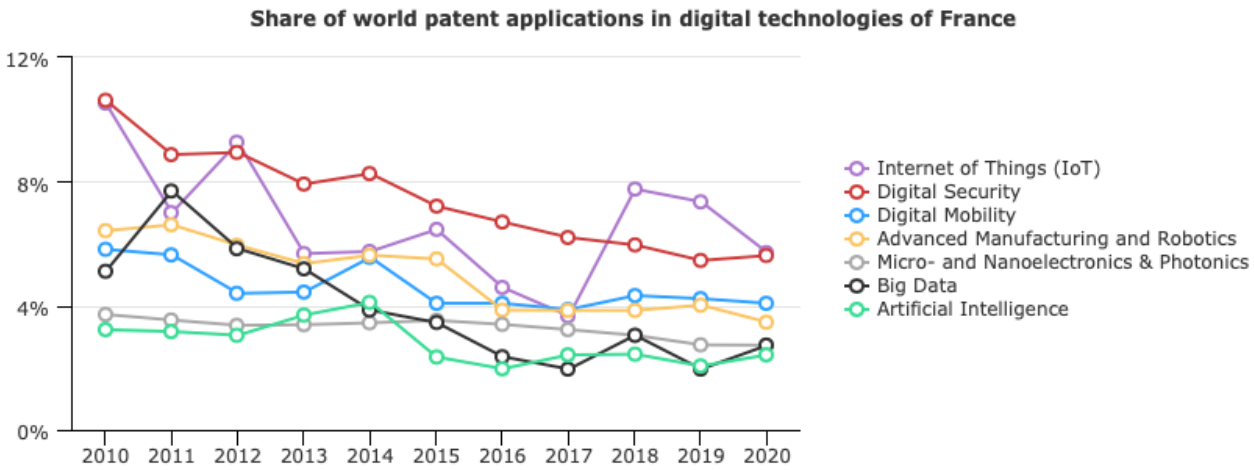
Figure 7: Country share and world share (expressed in terms of ranking) in digital technology related patent applications of France



Source: Fraunhofer ISI based on Patstat

Trends over time indicate a substantial decrease in the world share of France in Digital Security and in Big Data from 2010 to 2020, even if there has been a slight increase in Digital Security from 2019 to 2020. France slightly decreased its world share in the field of the Internet of Things compared to recent years as well. These negative trends are due to the increasing competition from other parts of the world in particular the increasing global share of China. Nevertheless, there are also positive signs in maintaining the current position in Artificial Intelligence.

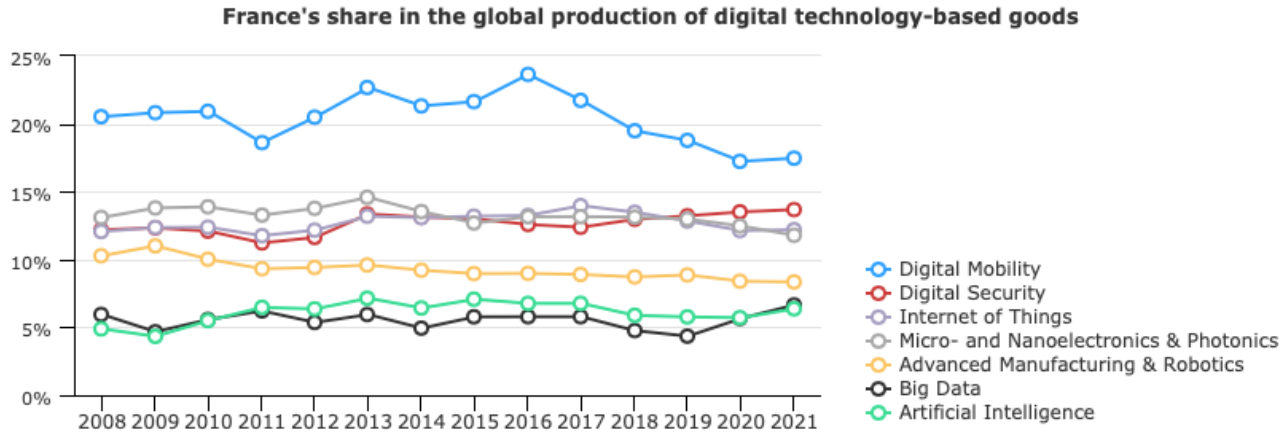
Figure 8: Trends over time in France's share of world patent applications



Source: Fraunhofer ISI based on Patstat

The Prodcom-based indicator measures the share of France in advanced technology-related production for a given year. The share of production in a particular technology over France's total production indicates that France has the largest share in the field of Digital Mobility (relevant from the perspective of its automotive industry), followed by Digital Security over the period from 2010 to 2021.

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



Source: IDEA Consult based on Prodcom data

EA-02-24-726-EN-N

Publications Office
of the European Union

ISBN: 978-92-9469-853-7