



Monitoring industrial ecosystems

EU MEMBER STATES FACT SHEETS

Ireland



EUROPEAN COMMISSION

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TABLE OF CONTENTS

Key Highlights	4
1. Introduction	5
2. Advanced technologies fostering the green and digital transition of industrial ecosystems.....	6
2.1. Data sources	6
2.2 Technology development in industrial ecosystems.....	7
2.3 Green transformation	8
2.4 Digital transformation.....	9

TABLE OF FIGURES

Figure 1: Ireland's country specialisation and world share (expressed in terms of ranking) in patent applications in industrial ecosystems.....	7
Figure 2: Trade balance in relation to overall trade volume ((exp - imp)/(exp+imp)) (2020)	7
Figure 3: Private equity and venture capital investment into tech companies related to industrial ecosystems in Ireland	8
Figure 4: Country specialisation and world share (expressed in terms of ranking) in patent applications of Ireland	8
Figure 5: Trends over time in Ireland's share in world patent applications	9
Figure 6: Production of advanced technology-based products in Ireland	9
Figure 7: Country specialisation and world share (expressed in terms of ranking) in digital technology related patent applications of Ireland	10
Figure 8: Trends over time in Ireland's share of world patent applications	10
Figure 9: Production of advanced technology-based products in Ireland	11

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:

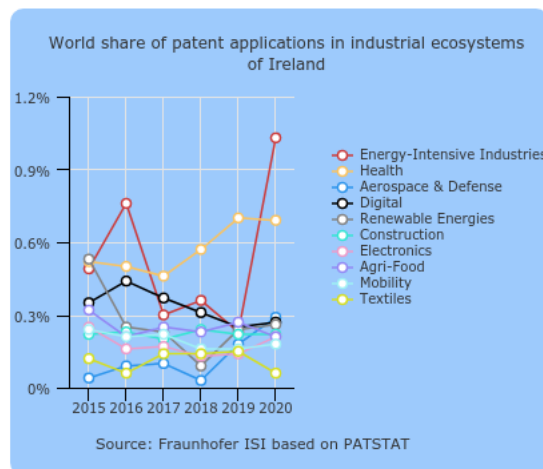


Technological performance in industrial ecosystems:

- Ireland had by far the highest share of its patent applications in the **Energy Intensive Industries and Health** industrial ecosystems based on patent data, where it also shows some strengths within the EU27.

Digital and green transition technologies:

- Among the digital technologies monitored in this project, Ireland had the highest country share of patent applications in **Micro and Nanoelectronics and Photonics**, and in **Advanced Manufacturing and Robotics**. In the field of green transition technologies, Ireland has generated most technologies related to **Advanced Materials and Nanotechnologies**.
- Over time, Ireland's share in the world patent applications shows an oscillating trend in green transition technologies, with a recent surge in Energy Saving Technologies from 2019 to 2020.
- In the field of digital technologies, a decreasing trend can be observed with a plunge in the world share of Ireland in **Big Data** from 2015 to 2020.



Capacity to produce goods based on digital and green technologies:

- Ireland's production share in digital technologies globally shows that it has created significant value by implementing **Big Data** and **Artificial Intelligence** technologies across all manufactured goods in the economy in 2021.
- Over the period from 2014 to 2021 Ireland's share has substantially decreased in Big Data and in Artificial Intelligence.
- In the field of green transition technologies, Ireland 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 Cecilia Rolla, Technopolis Group 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 procedure¹ or at the European Patent Office² 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 Comtrade³ 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 data⁴ 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 data⁵ 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/>

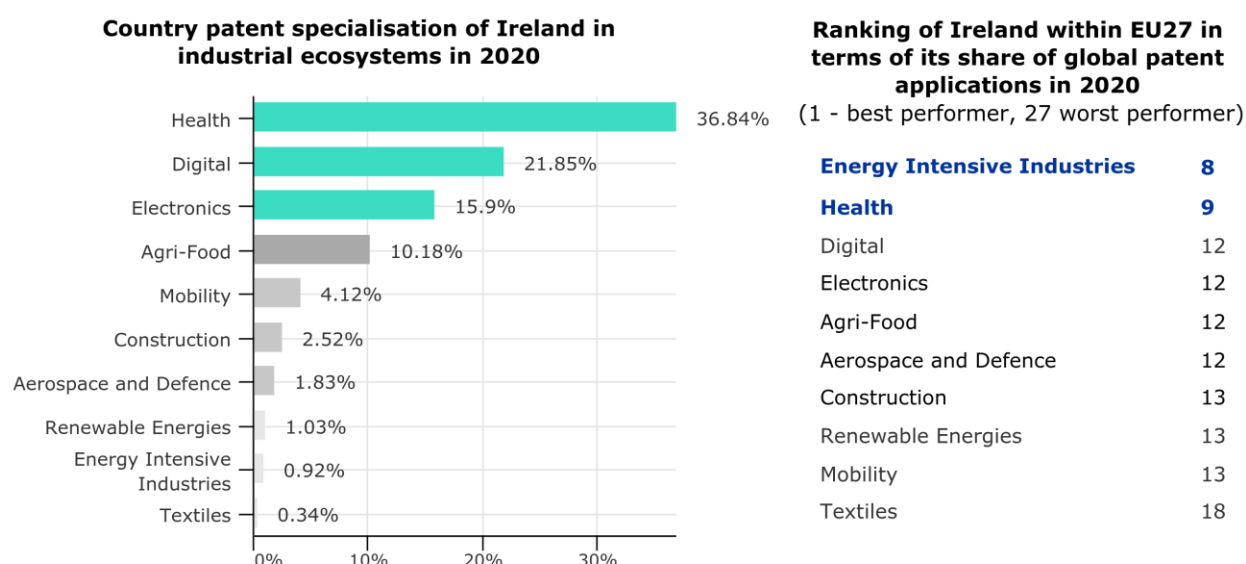
⁴ Eurostat, Eurostat PRODCOM-European Union Production and Trade Statistics <https://ec.europa.eu/eurostat/web/prodcom>

⁵ Crunchbase, Business Information and Networking Platform <https://www.crunchbase.com/>

2.2 Technology development in industrial ecosystems

Regarding technology development, Ireland has been the most specialised in the Health, Digital and Electronics industrial ecosystems in 2020 as captured by patent data. In a global comparison, it ranked at the eighth place in Energy Saving Technologies within the EU27 countries, and ninth in Healthcare.

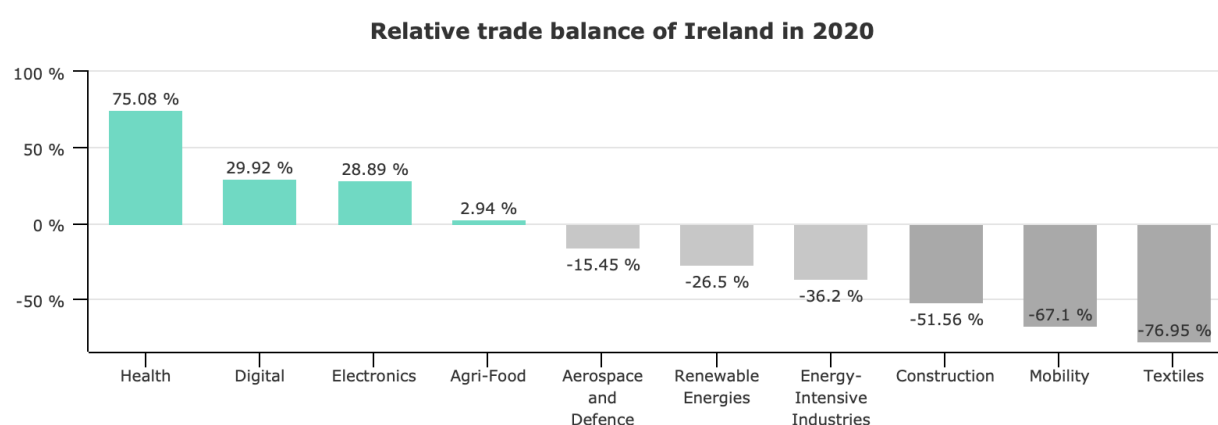
Figure 1: Ireland's country specialisation and world share (expressed in terms of ranking) in patent applications in industrial ecosystems



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. Ireland registered a trade surplus in Health, Digital, Electronics and Agri-Food.

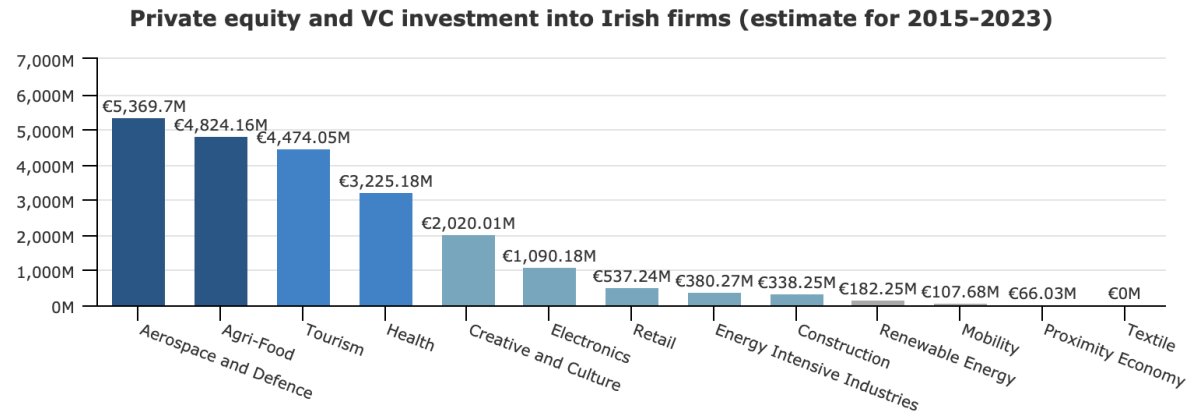
Figure 2: Trade balance in relation to overall trade volume $((exp - imp)/(exp + imp))$ (2020)



Source: Fraunhofer ISI based on UNCOMTRADE

Most private equity and venture capital investment went into innovative Irish tech companies operating in the field of Aerospace and Defence and Agri-Food, followed by Tourism and Health, over the period from 2015 to 2023.

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

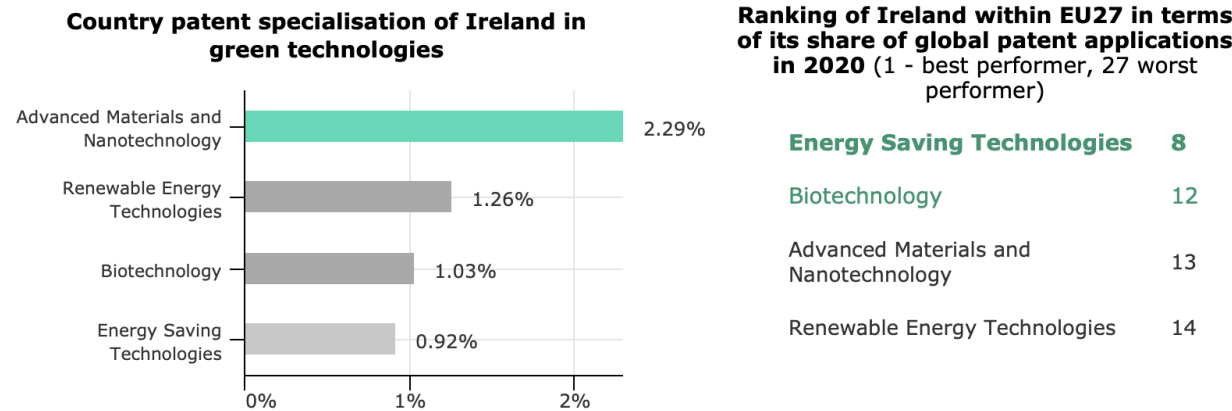


Source: Technopolis Group based on Crunchbase

2.3 Green transformation

Ireland has been the most specialised in generating technologies related to Advanced Materials and Nanotechnology, followed by Renewable Energy Technologies, which have the potential to drive the green transformation of its industries. Ireland ranked eighth place among the EU27 Member States in Energy Saving Technologies and twelfth place in Biotechnology regarding its world share of patent applications.

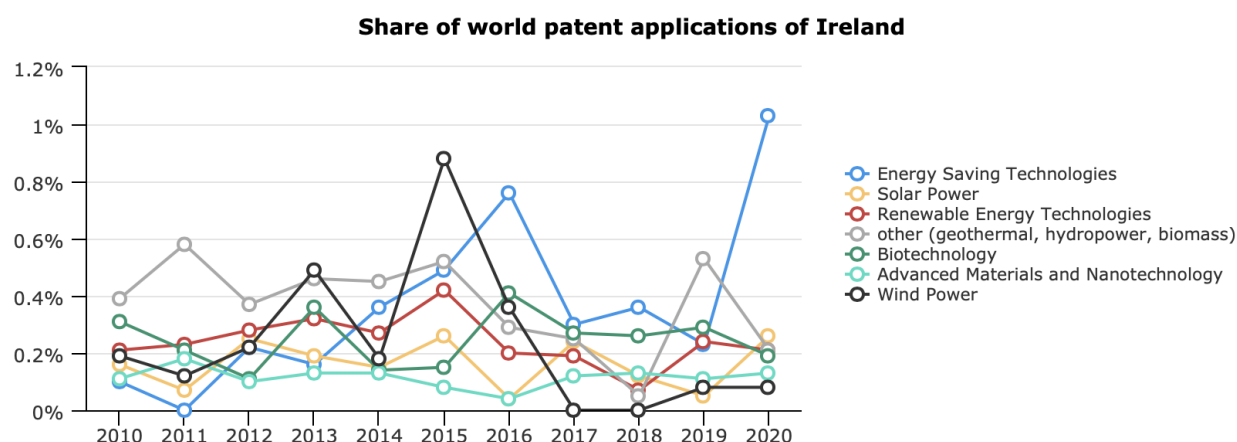
Figure 4: Country specialisation and world share (expressed in terms of ranking) in patent applications of Ireland



Source: Fraunhofer ISI based on Patstat

Trends in the world’s patent applications show that Ireland increased its global share in Energy Saving Technologies from 2019 to 2020. Nonetheless, the results of the analysis show a decreasing trend in Ireland’s global position in Wind Power.

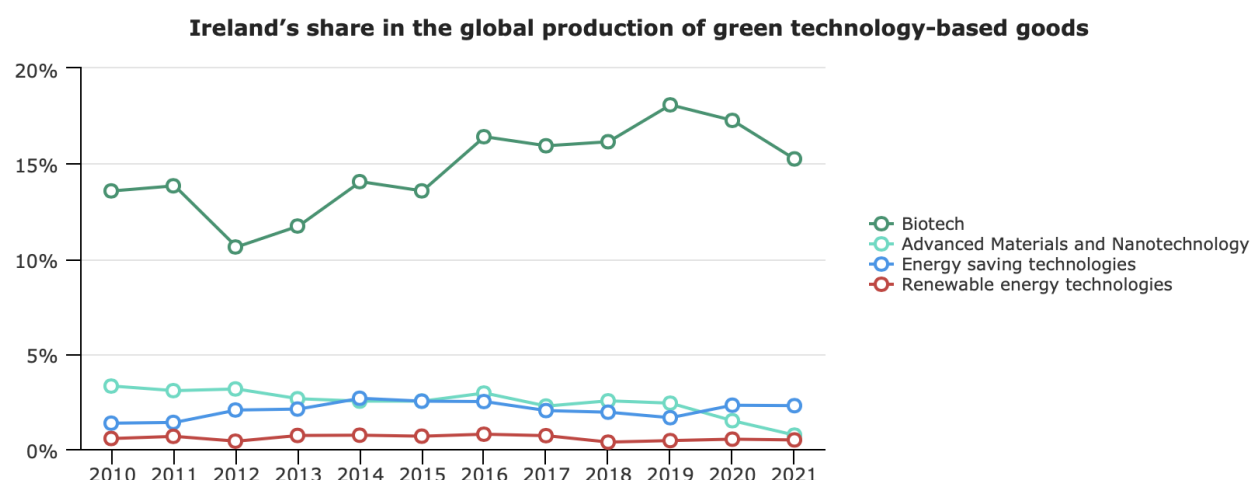
Figure 5: Trends over time in Ireland's share in world patent applications



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 Ireland for a given year. The share of production in a certain technology over Ireland's total production indicates a positive trend in Biotechnology, with the highest share among all green technologies.

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

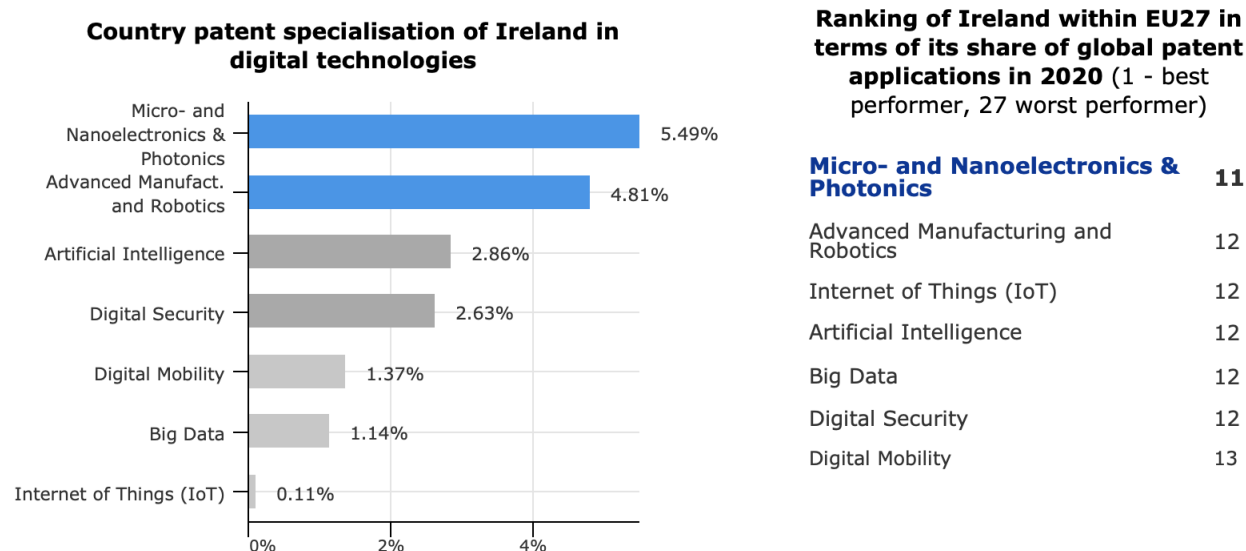


Source: IDEA Consult based on Prodcom data

2.4 Digital transformation

Among the digital technologies monitored in this project, Ireland has been the most specialised in Micro- and Nanoelectronics and Advanced Manufacturing and Robotics. It ranked 11th place in Micro- and Nanoelectronics in terms of its world share of patent applications among the EU27 Member States.

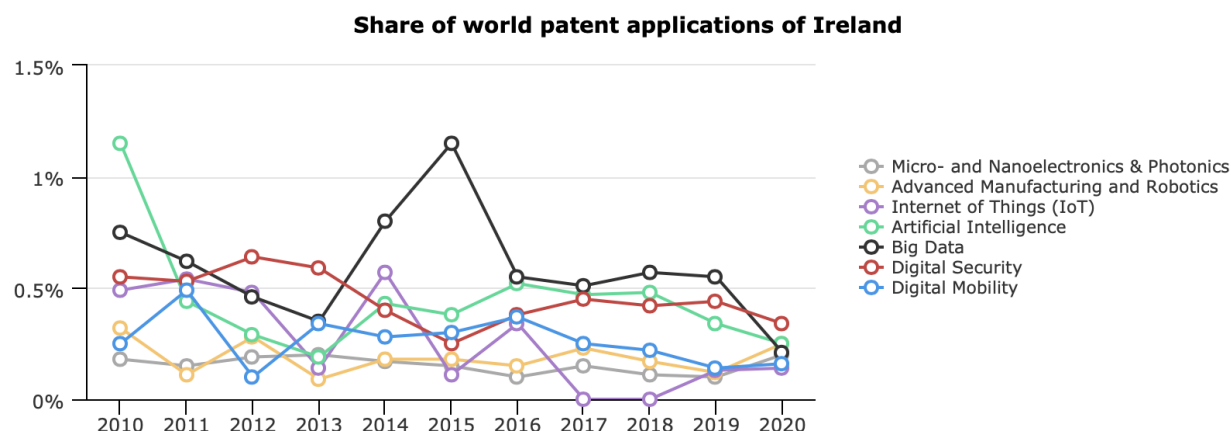
Figure 7: Country specialisation and world share (expressed in terms of ranking) in digital technology related patent applications of Ireland



Source: Fraunhofer ISI based on Patstat

Trends over time indicate that Ireland decreased its global position in several fields in particular in Big Data but also in Artificial Intelligence and Digital Security over the period from 2010 to 2020. It has maintained its share in Advanced Manufacturing and Robotics and has been increasing its share in the Internet of Things again since 2018.

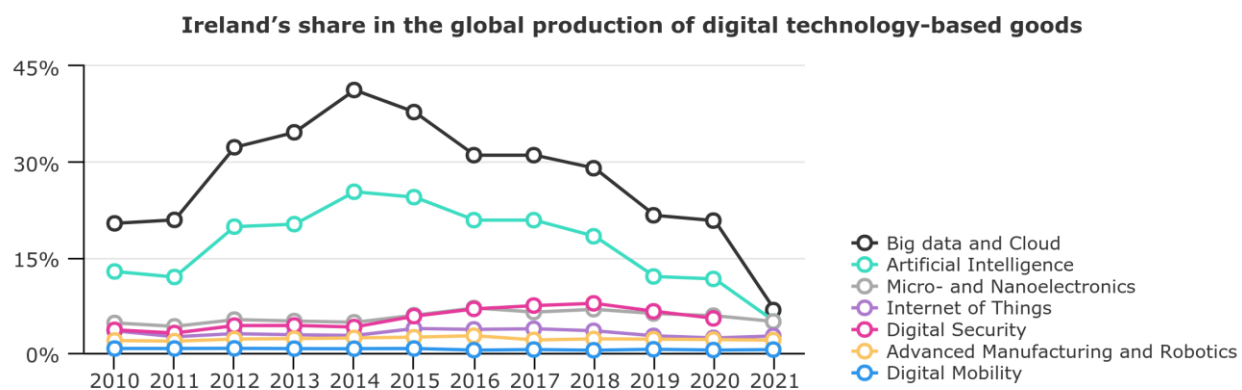
Figure 8: Trends over time in Ireland's share of world patent applications



Source: Fraunhofer ISI based on Patstat

The Prodcom-based indicator measures the share of Ireland in advanced technology-related production for a given year. The share of production in a particular technology over Ireland's total production indicates that it has the largest share in the field of Big Data and Cloud and Artificial Intelligence related products. Nonetheless, trends shows a decrease in the share in the global production over time. Ireland has the lowest share of production In Digital technologies for Mobility related products.

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



Source: IDEA Consult based on Prodcorn data

