



Monitoring industrial ecosystems

EU MEMBER STATES FACT SHEETS

Poland

Author: Cecilia Rolla, Technopolis Group

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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*

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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: Country specialisation and world share (expressed in terms of ranking) in patent applications in industrial ecosystems related technologies.....	7
Figure 2: Trade balance in relation to overall trade volume ((exp. - imp.-1)*100) (2020)...	7
Figure 3: Private equity and venture capital investment into tech companies related to industrial ecosystems in Poland	8
Figure 4: Country specialisation and world share (expressed in terms of ranking) in patent applications of Poland	8
Figure 5: Trends over time in Poland's share in world patent applications	9
Figure 6: Production of advanced technology-based products in Poland	9
Figure 7: Country specialisation and world share (expressed in terms of ranking) in digital technology related patent applications of Poland.....	10
Figure 8: Trends over time in Poland's share of world patent applications	10
Figure 9: Production of advanced technology-based products in Poland	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:

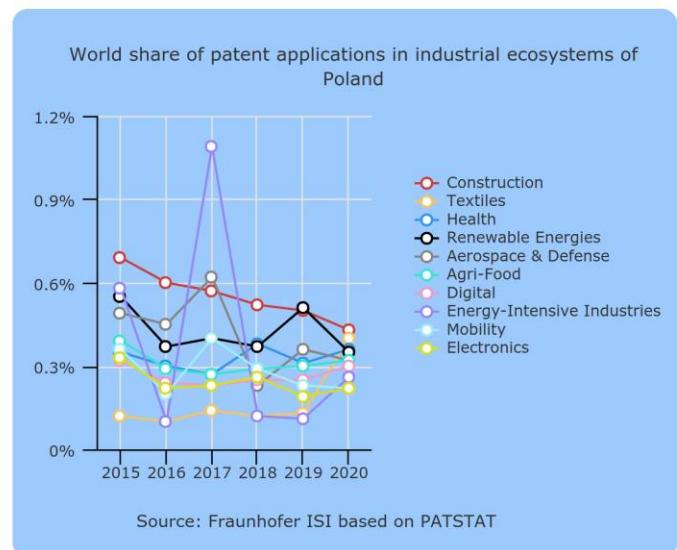


Technological performance in industrial ecosystems:

- Poland had the highest world share of its patent applications related to the **Construction** industrial ecosystem in 2020. Within its national borders, it was the most specialised in the Digital, Health, Electronics, and Agri-Food industrial ecosystems as indicated by patent data.

Digital and green transition technologies:

- Among the digital technologies monitored in this project, Poland had the highest country share of patent applications in **Advanced Manufacturing and Robotics**. In the field of green transition technologies, Poland has generated most technologies related to **Advanced Materials and Nanotechnologies**.
- The trends in global patent applications indicate that Poland slightly increased its share in various green technologies, such as **Renewable Energy Technologies** from 2010 to 2020.
- In the field of digital technologies, an oscillating trend can be observed. Its world share has been the highest in **Internet of Things**. It increased its share in Digital Security, Advanced Manufacturing and Robotics and in Artificial Intelligence since 2017.



Capacity to produce goods based on digital and green technologies:

- Poland's share of production in digital technologies over global production indicates that it created the highest value by the deployment of **Big Data and Artificial Intelligence** technologies across all manufactured goods in the economy in 2021.
- Since 2017, Poland's share has increased across most digital technologies, with a particular surge of the share in Big Data.
- In the field of green transition technologies, Poland created the highest value by the deployment of **Renewable Energy 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 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.

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 the 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/>

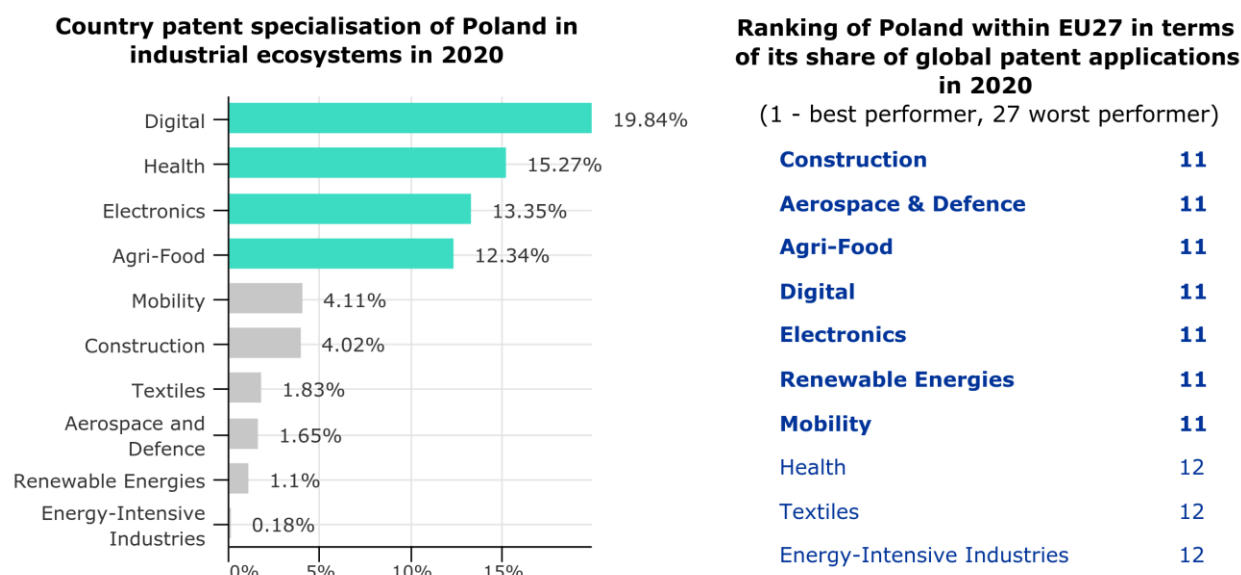
⁶ Eurostat, Eurostat PRODCOM-European Union Production and Trade Statistics <https://ec.europa.eu/eurostat/web/prodcom>

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

2.2. Technology development in industrial ecosystems

Regarding technology development, Poland was the most specialised in the Digital, Health, Electronics, and Agri-Food industrial ecosystems within its national boundaries in 2020, as indicated by patent data. In a global comparison, it ranked highest in Construction within the EU27 countries regarding its world share (0.43% in 2020), but it occupied the 11th position in technology development related to several other ecosystems such as Aerospace & Defence, Agri-Food, Digital, Electronics, Renewable Energies and Mobility.

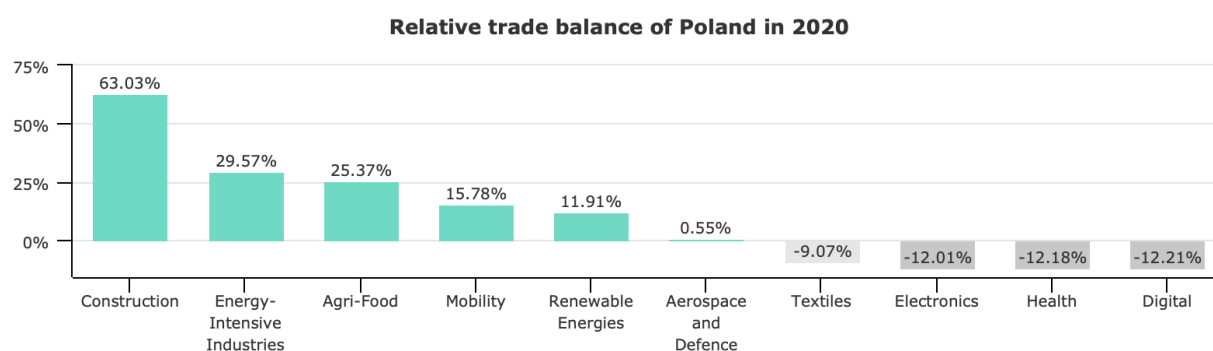
Figure 1: Country specialisation and world share (expressed in terms of ranking) in patent applications in industrial ecosystems related technologies



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. Poland registered a trade surplus in technology-based products related to the Construction, Energy-Intensive Industries, Agri-Food, Mobility, Renewable Energies industrial ecosystems (and close to zero in Aerospace & Defence),.

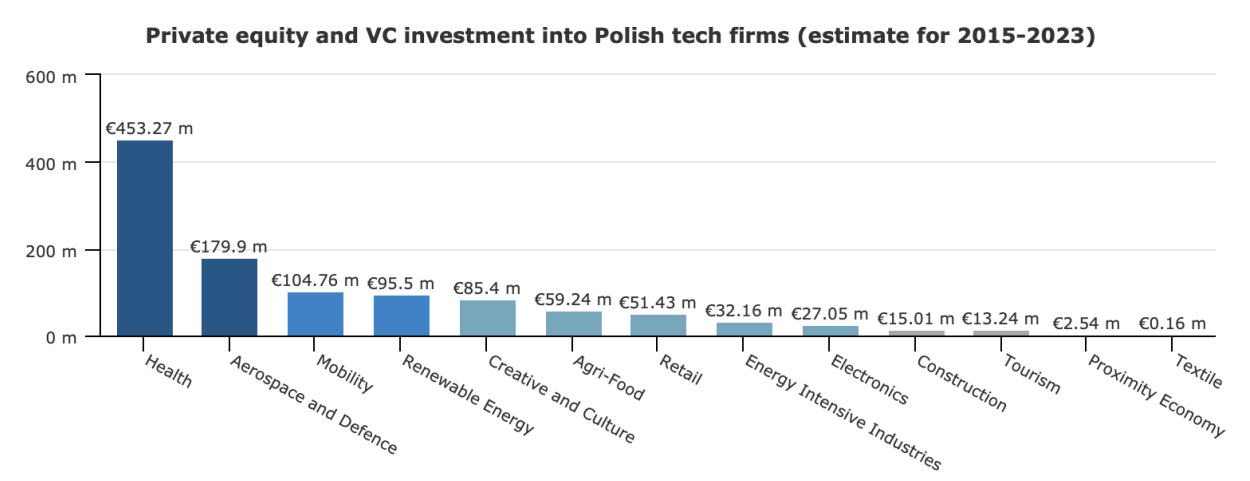
Figure 2: Trade balance in relation to overall trade volume ((exp. - imp.) * 100) (2020)



Source: Fraunhofer ISI based on UNCOMTRADE

Most private equity and venture capital investment in Poland went into innovative companies operating in Health, followed by Aerospace and Defence over the period from 2015 to 2023 as captured by Crunchbase data.

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

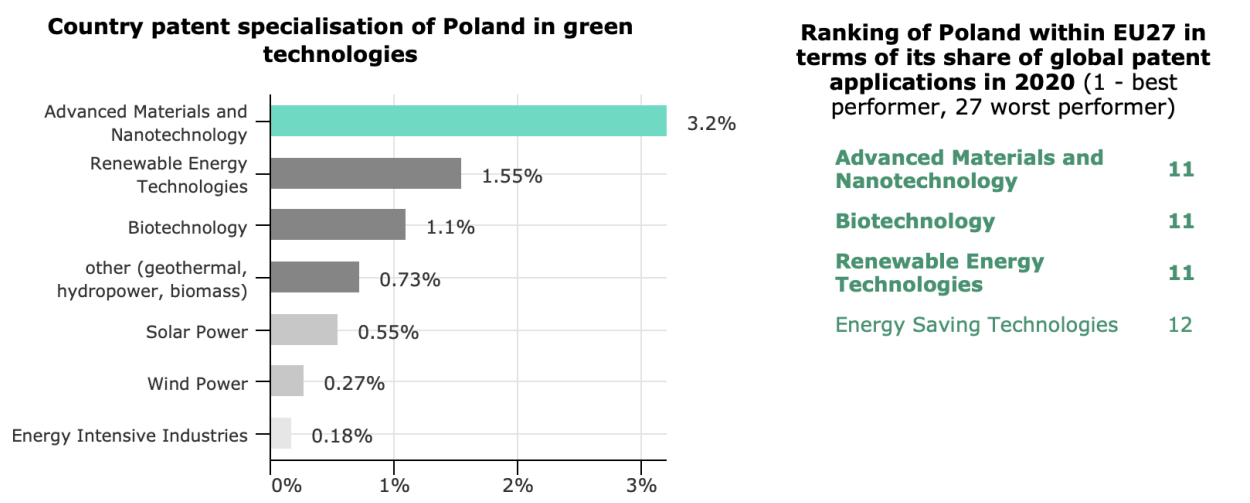


Source: Technopolis Group based on Crunchbase

2.3. Green transformation

Within the country, Poland has been the most specialised 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, Poland has ranked at the 11th place among the EU27 Member States in generating technologies related to Advanced Materials and Nanotechnology, in Biotechnology and Renewable Energy Technologies.

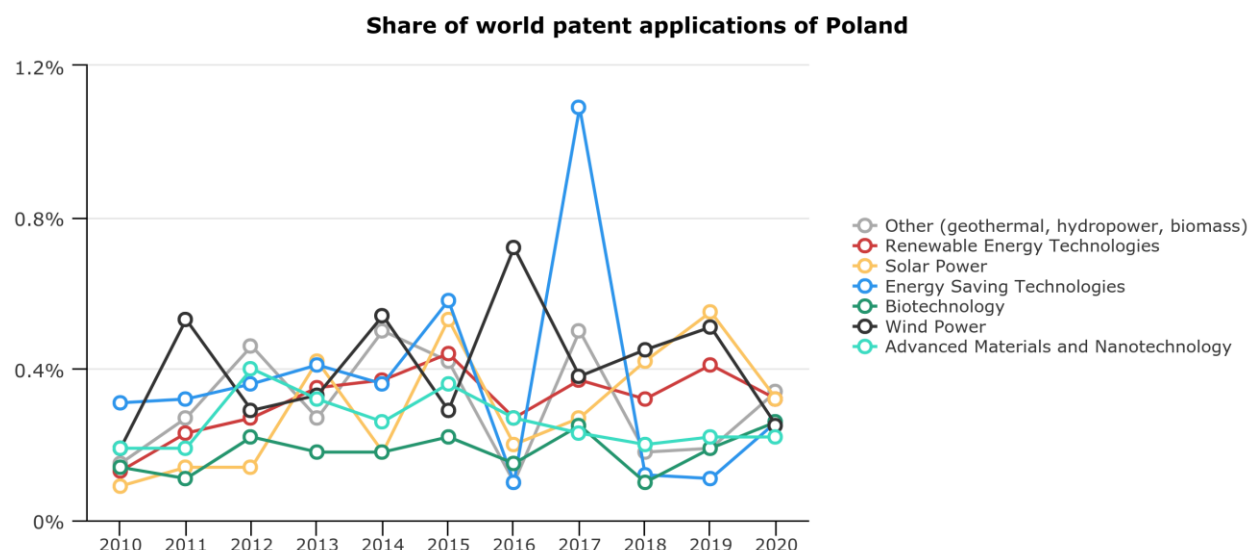
Figure 4: Country specialisation and world share (expressed in terms of ranking) in patent applications of Poland



Source: Fraunhofer ISI based on Patstat

The trends in global patent applications indicate that Poland slightly increased its share in various green technologies, such as in Renewable Energy Technologies over the period from 2010 to 2020. It remained stable in Advanced Materials. Nonetheless, its share in Energy Saving Technologies dropped since 2017.

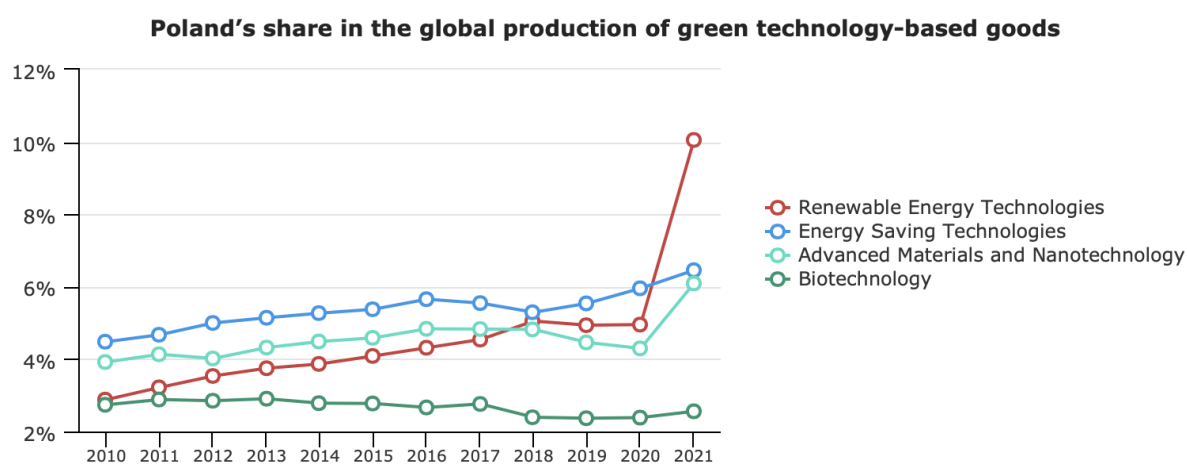
Figure 5: Trends over time in Poland's share in world patent applications



Source: Fraunhofer ISI based on Patstat

The Prodcom-based indicator measures the share of advanced technology-related production in Poland for a given year. The share of production in a certain technology over Poland's total production indicates an increase in Renewable Energy Technologies, Energy Saving Technologies and Advanced Materials, with Renewable Energy technologies ranking the highest.

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

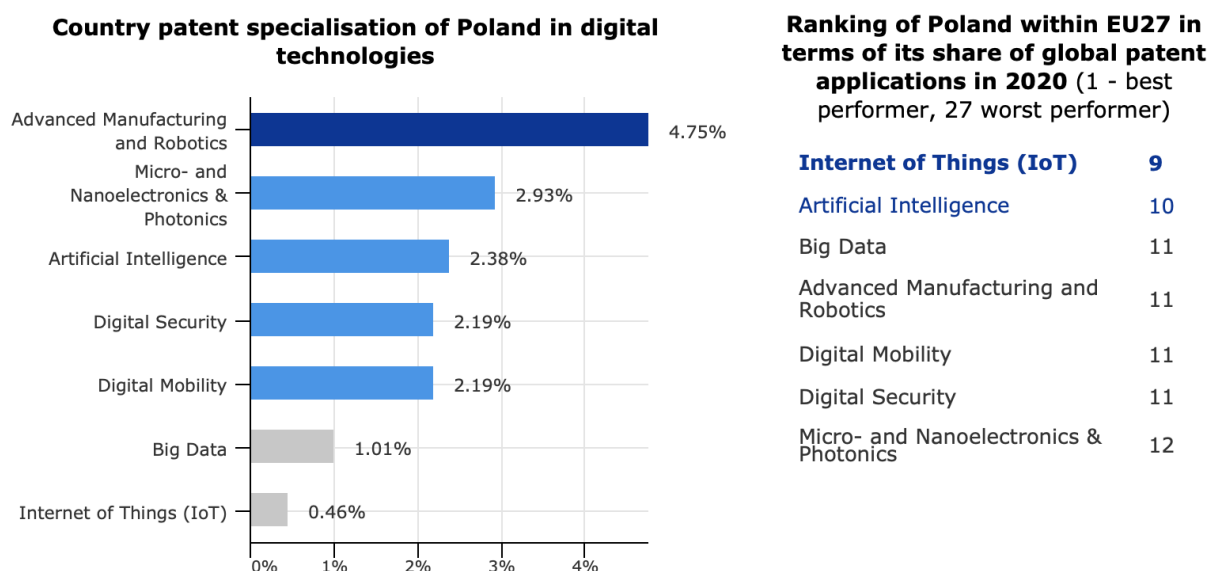


Source: IDEA Consult based on Prodcom data

2.4. Digital transformation

Among the digital technologies monitored in this project, Poland has been the most specialised in Advanced Manufacturing and Robotics. Regarding its global share in patent applications among EU27, it ranked at the 9th place in the Internet of Things and 10th place in Artificial Intelligence.

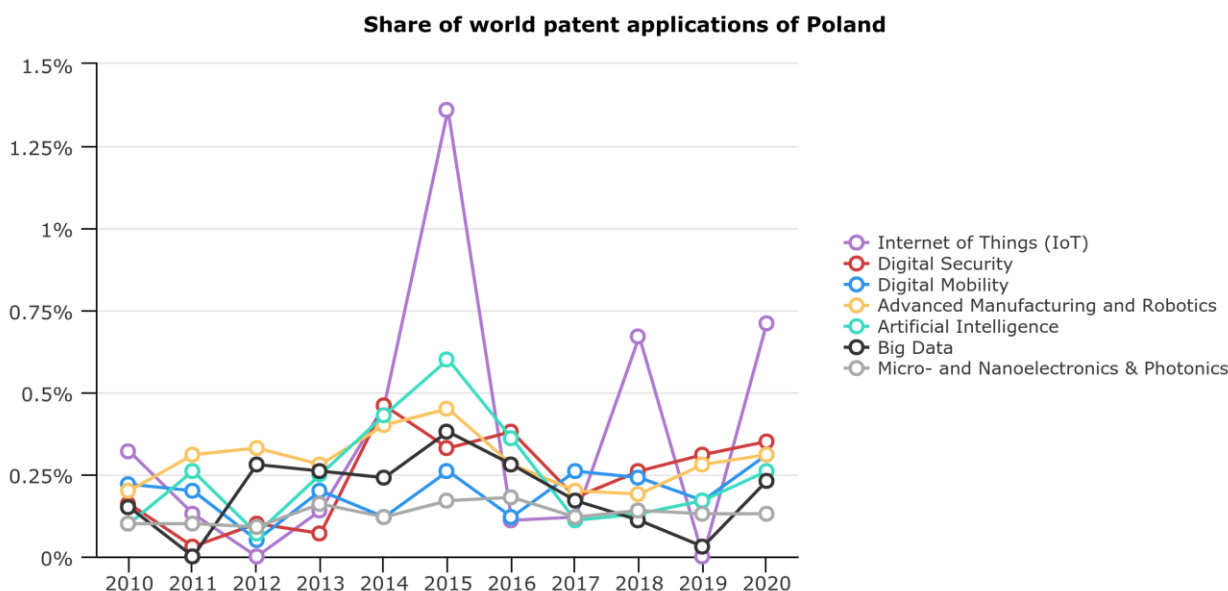
Figure 7: Country specialisation and world share (expressed in terms of ranking) in digital technology related patent applications of Poland



Source: Fraunhofer ISI based on Patstat

Trends over time indicate a substantial decrease in the world share of Poland in the Internet of Things over the period from 2015 to 2020. Poland has been increasing its world share of patent applications in various digital technologies since 2017 such as in Digital Security, Advanced Manufacturing and Robotics and in Artificial Intelligence (although the latter follows a drop between 2015-2017).

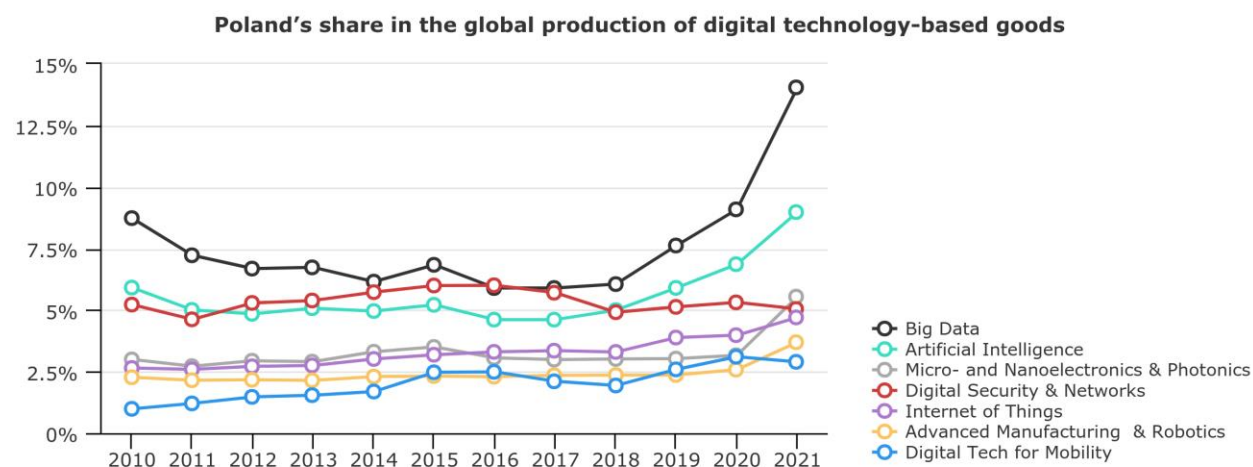
Figure 8: Trends over time in Poland's share of world patent applications



Source: Fraunhofer ISI based on Patstat

The Prodcom-based indicator measures the share of Poland in advanced technology-related production for a given year. The share of production in a particular technology over Poland's total production indicates that Poland has the largest share in the field of Big Data and Artificial Intelligence technology-based products. The share of production remained stable regarding goods based on Digital Security technologies but has increased over time in all other digital technology related products.

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



Source: IDEA Consult based on Prodcorn data

