



Monitoring industrial ecosystems

EU MEMBER STATES FACT SHEETS

Netherlands

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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:

Netherlands

Technological performance in industrial ecosystems:

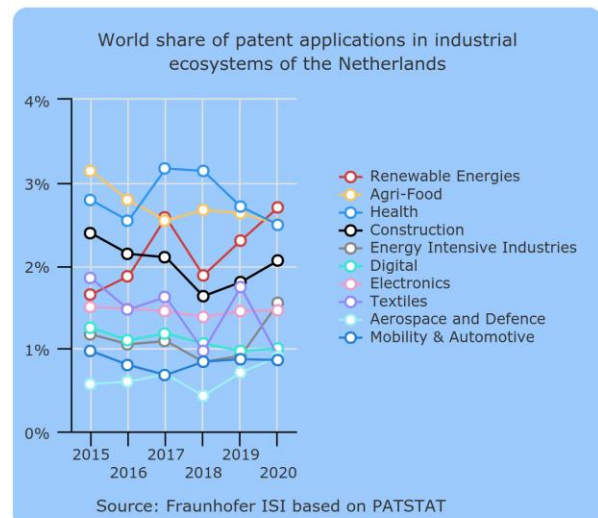
- In a global comparison, the Netherlands ranked within the top countries in **Electronics and Health** in terms of its share of world patent applications among the EU27 countries. It has been also increasing its share in **Renewable Energy Technologies** as suggested by patent data.

Digital and green transition technologies:

- Within the EU27, the Netherlands ranked among the top countries in generating digital and green technologies in the Internet of Things, Micro- and Nanoelectronics & Photonics, and Artificial Intelligence, in Advanced Materials and Nanotechnologies and in Biotechnology.
- It has dynamically increased its relative strengths in **Geothermal, Hydropower and Biomass energies** and it defended its position in other green transition technologies such as Renewable Energy, Energy Saving Technologies and Advanced Materials as well over time.
- In the field of the digital transition, the Netherlands has dynamically increased its global share of patent applications in the **Internet of Things** and has remained strong in digital technologies overall.

Capacity to produce goods based on digital and green technologies:

- Netherlands' production share in digital technologies globally indicates that it created the highest value by the deployment of **Advanced Manufacturing and Robotics** technologies across all manufactured goods in the economy in 2021. Trends over time show a dynamic increase in its global share in Advanced Manufacturing and Robotics, however, a decrease or stagnation in all other digital technology related goods.
- In the field of green transition technologies, the Netherlands created the highest value by the deployment of **Biotechnology**, 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 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 Jules Van de Meulengraaf, 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/>

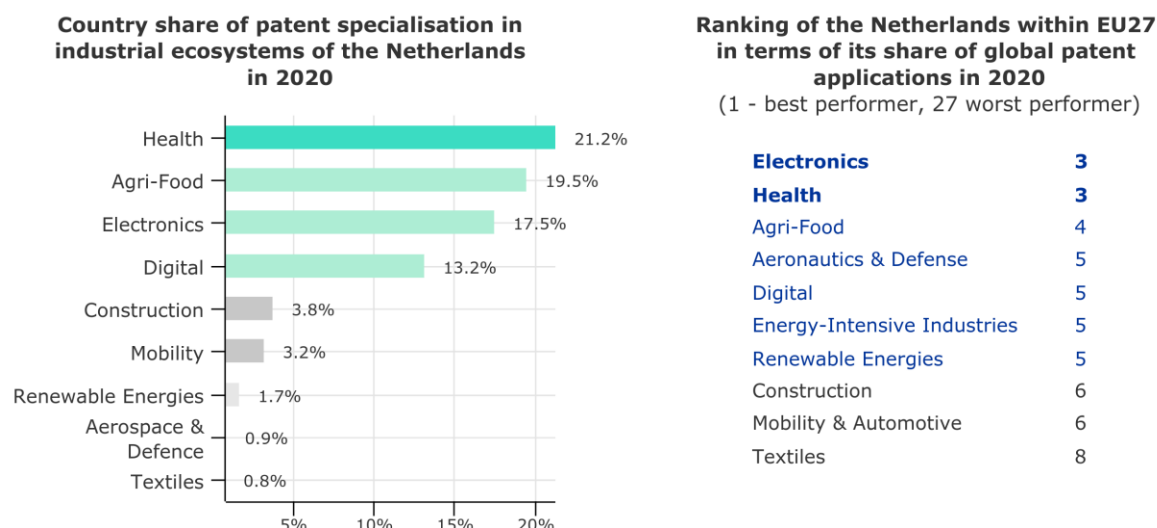
⁶ Eurostat, Eurostat PRODCOM-European Union Production and Trade Statistics <https://ec.europa.eu/eurostat/web/prodcom>

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

2.2. Technology development in industrial ecosystems

Regarding technology development, the Netherlands has been most specialised within the country in the Health industrial ecosystem, followed by Agri-Food and Electronics as expressed by the indicator on patent applications in 2020. In a global comparison, the Netherlands ranked 3rd among the EU27 countries in terms of its share of the world patent applications in Electronics and Health.

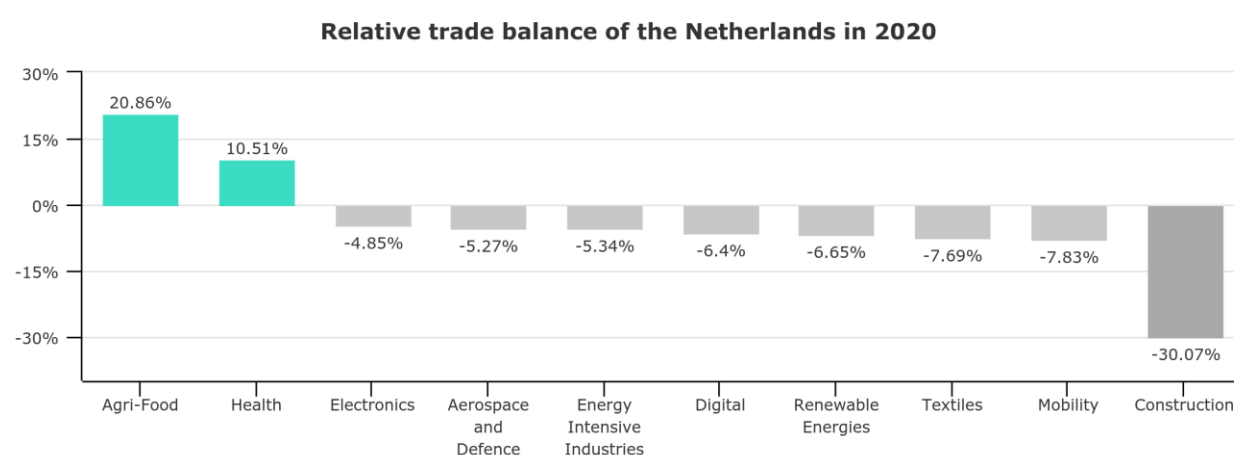
Figure 1: Country share and world share (expressed in terms of ranking) in patent applications in industrial ecosystems related technologies



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

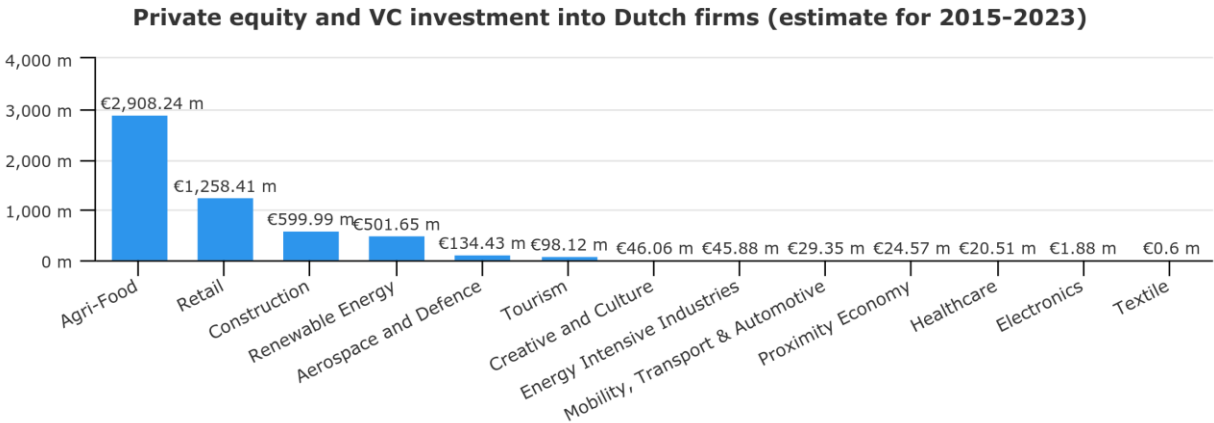
Figure 2: Trade balance in relation to overall trade volume $((exp - imp)/(exp + imp))$ (2020)



Source: Fraunhofer ISI based on UNCOMTRADE

Most private equity and venture capital investment in the Netherlands went into innovative companies operating in Agri-Food, followed by Retail and Construction, from 2015 to 2023.

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

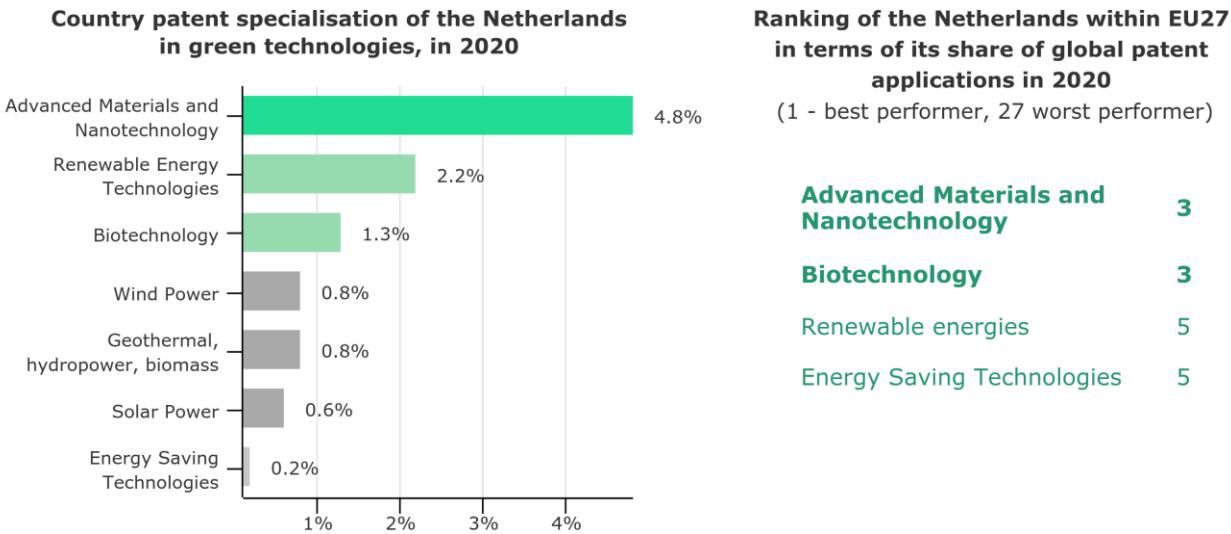


Source: Technopolis Group based on Crunchbase

2.3. Green transformation

Within the country, the Netherlands has been the most specialised in generating technologies related to Advanced Materials and Nanotechnology, followed by Renewable Energy in 2020 as captured by patent statistics. Within the EU27, the Netherlands ranks at the 3rd place in terms of its world share of patent applications in Advanced Materials and Nanotechnologies and in Biotechnology.

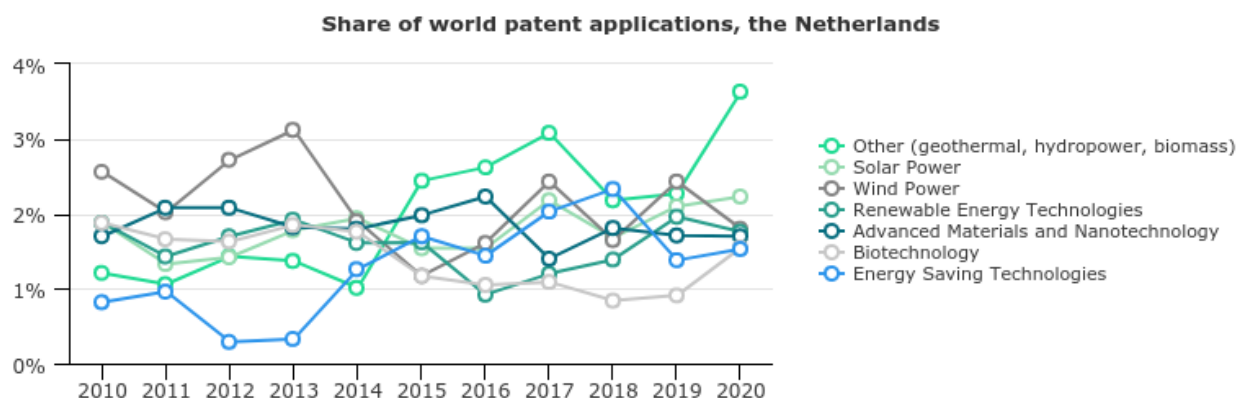
Figure 4: Country share and world share (expressed in terms of ranking) in patent applications of the Netherlands



Source: Fraunhofer ISI based on Patstat

Trend over time indicates that the Netherlands increased its relative strength in Geothermal, Hydropower and Biomass energies the most as expressed by its share of world patent applications over the period from 2010 to 2020. It shows positive trend in Energy Saving Technologies as well. In other green technology fields, it defended its position over time.

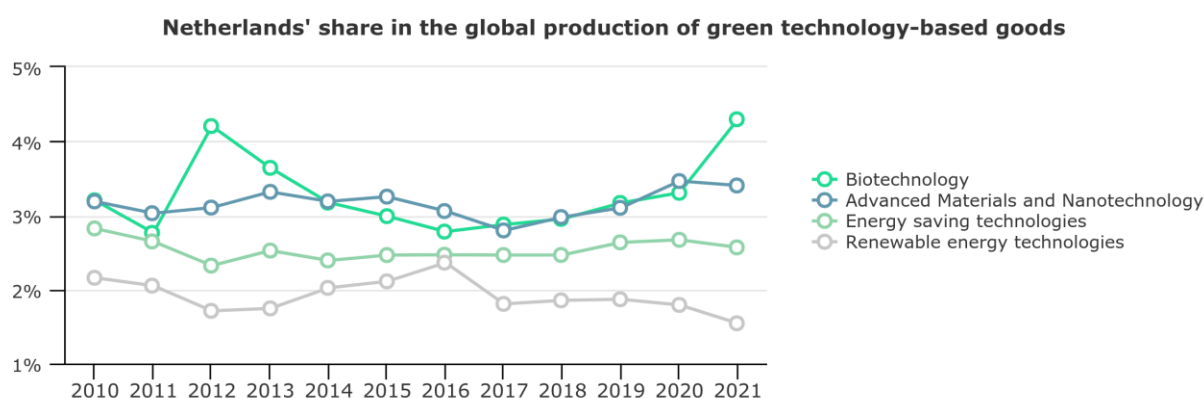
Figure 5: Trends over time in the Netherlands' share in world patent applications



Source: Fraunhofer ISI based on Patstat

The Prodcom-based indicator measures the Netherlands' share of advanced technology-related production for a given year. The share of production in a certain technology over total production in the Netherlands indicates strengths in Biotechnology.

Figure 6: Production of advanced technology-based products in the Netherlands



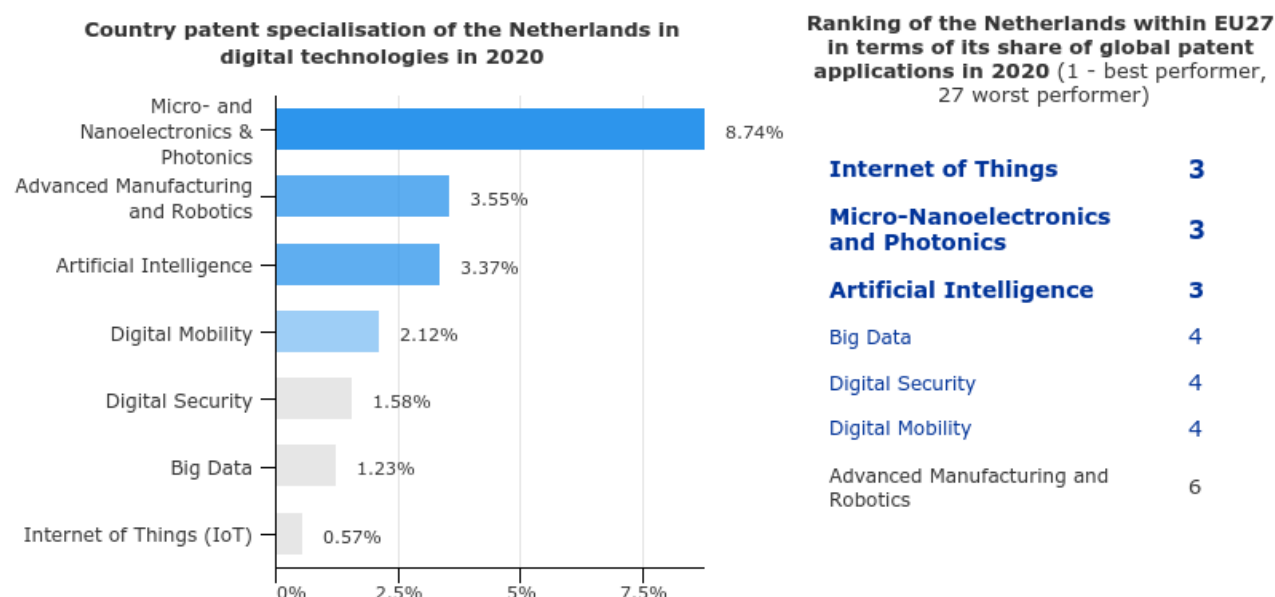
Source: IDEA Consult based on Prodcom data

2.4. Digital transformation

Among the digital technologies monitored in this project, the Netherlands had the highest share of patent applications in Micro- and Nanoelectronics & Photonics, followed by Advanced Manufacturing and Robotics.

In a comparison with EU countries, the Netherlands ranked at the 3rd place in the fields of the Internet of Things, Micro- and Nanoelectronics & Photonics, and Artificial Intelligence in 2020.

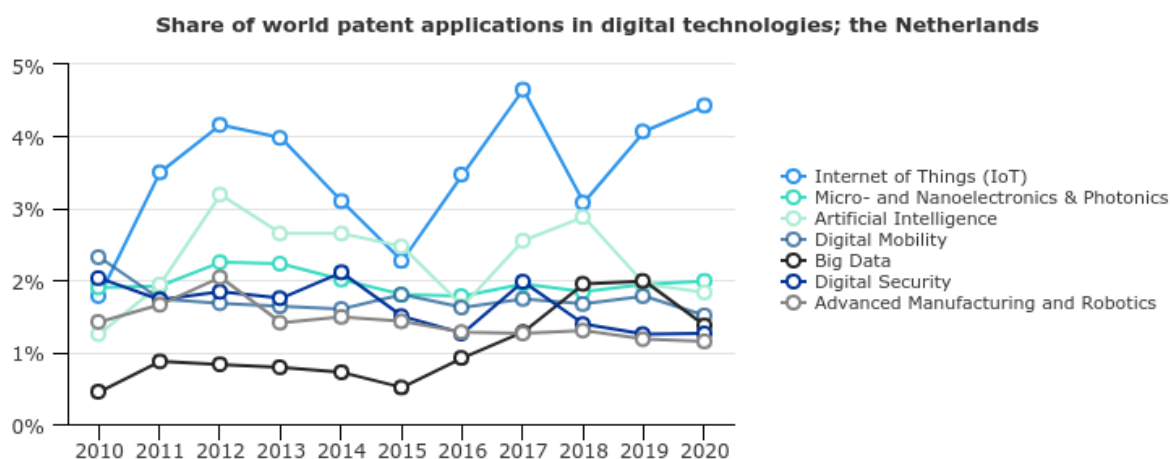
Figure 7: Country share and world share (expressed in terms of ranking) in digital technology related patent applications of the Netherlands



Source: Fraunhofer ISI based on Patstat

Trends over time indicates that the Netherlands increased its relative strength in the Internet of Things expressed by its share of world patent applications over the period from 2010 to 2020. It has defended its position in Micro-and Nanoelectronics and Photonics. It has also increased its share in the world patent applications in Big Data, but it decreased its position in Artificial Intelligence.

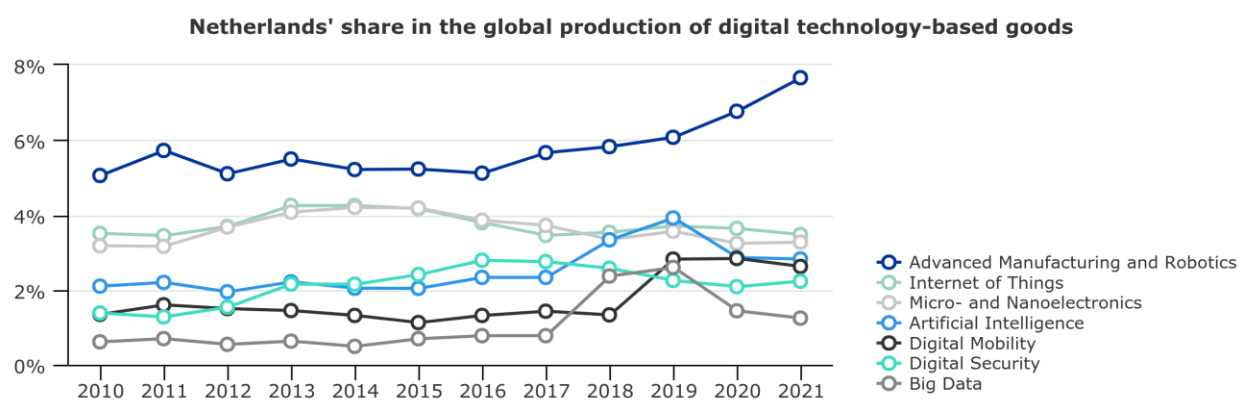
Figure 8: Trends over time in the Netherlands' share in world patent applications



Source: Fraunhofer ISI based on Patstat

Netherlands' share of production in digital technologies over global production indicates that it created the highest value by the deployment of Advanced Manufacturing and Robotics technologies across all manufactured goods in the economy in 2021. Trends over time show an increase in its global share in Advanced Manufacturing and Robotics, however, a decrease or stagnation in all other digital technology related goods.

Figure 9: Production of advanced technology-based products in the Netherlands



Source: IDEA Consult based on Prodcorn data

