Monitoring industrial ecosystems

EU MEMBER STATES FACT SHEETS

Belgium

Author: Els Van de Velde, IDEA Consult

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

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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:

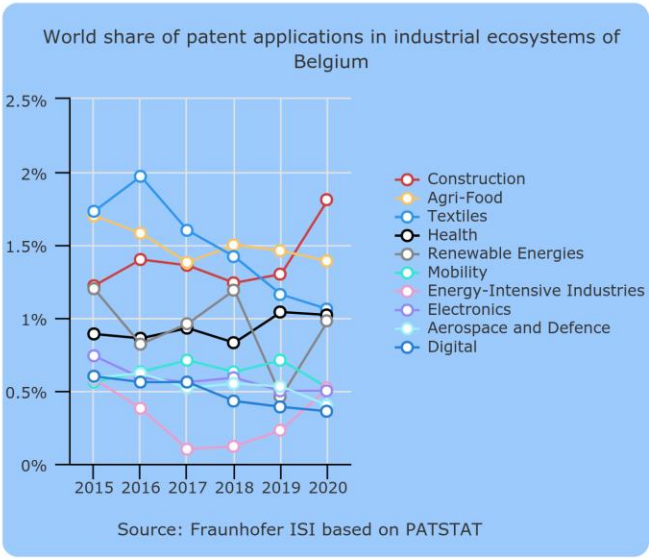
Belgium

Technological performance in industrial ecosystems:

- Among EU27 countries, Belgium is responsible for a relatively large share of worldwide patent applications in **Agri-Food and Construction**. Its share of **Textiles** has been historically high, but declined in recent years.

Digital and green transition technologies:

- Belgium is a frontrunner within the EU27 in generating digital technologies in the areas of **Advanced Materials, Nanotechnology and Biotechnology.**
- Its global position in **Advanced Manufacturing and Robotics, Advanced Manufacturing Technology and Digital Mobility** has strengthened over time. In other digital technologies, notably Internet of Things, Big Data and Artificial Intelligence, its global position has weakened.
- Belgium's relative position in patent applications for green technologies has remained broadly stable over the 2015-2020 period. It has a strong position within the EU27 for **Solar Power**.



Capacity to produce goods based on digital and green technologies:

- The Belgian share of production of digital technologies is highest in the field of **Micro-and Nanoelectronics, Advanced Manufacturing and Robotics related products,** and lowest in Digital Security.
- Belgium expanded its share of production in green technologies in areas related to **Biotechnology and Renewable Energy.** Biotechnology represents the technology area where Belgium has the highest share in global production.

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 Els Van de Velde, from 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 procedure[3] or at the European Patent Office[4] 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[5] 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[6] 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.

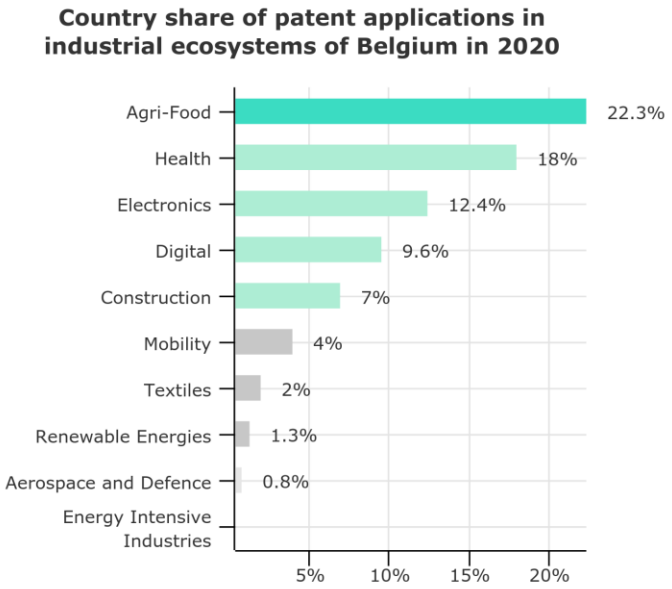
Crunchbase data[7] were used to analyse entrepreneurial dynamics and private equity and venture capital investment. Crunchbase is a widely trusted source of information on venture capital backed innovative companies. Technology startups represent key building blocks in the transition towards a more digital, 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, Belgium had the highest country share of its patent applications in the Agri-Food, Health and Electronics industrial ecosystems in 2020 as captured by patent data. In a global comparison, it ranked at the sixth place in Agri-Food within the EU27 countries, and seventh place in Construction, Health and Textiles.

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



Ranking of Belgium within EU27 in terms of its share of global patent applications in 2020

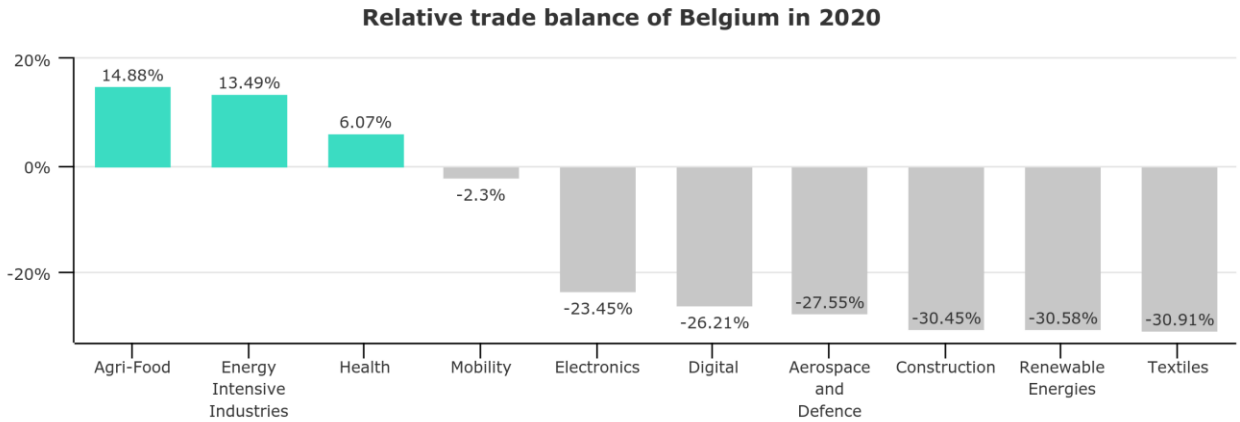
(1 - best performer, 27 worst performer)

Agri-Food	**6**
Health	7
Construction	7
Textiles	7
Mobility	9
Aerospace and Defence	9
Renewable Energies	9
Electronics	10
Digital	10
Energy-Intensive Industries	11

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. Belgium registered a trade surplus in technology-based products related to Agri-Food, Energy Intensive Industries, and the Health ecosystem in 2020.

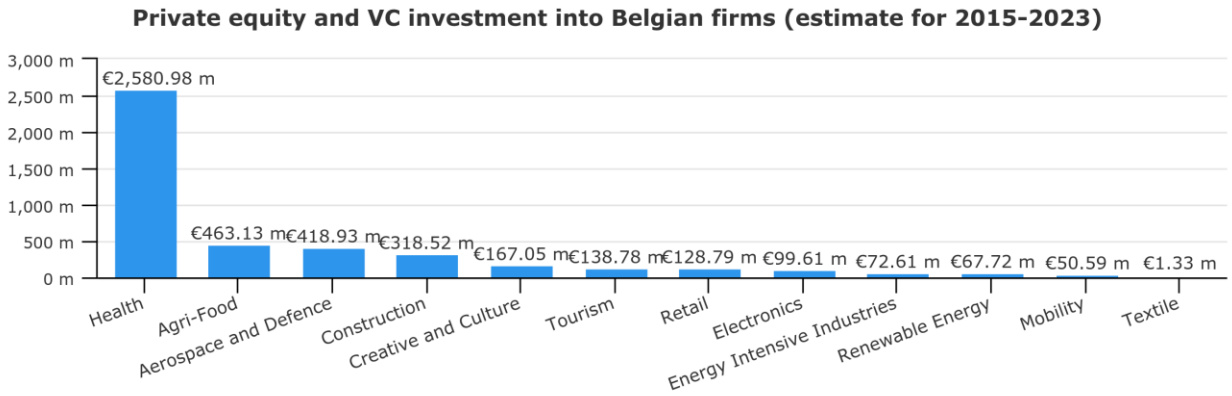
*Figure 2: Trade balance in relation to overall trade volume ((exp. - imp.-1)*100) (2020)*



Source: Fraunhofer ISI based on UNCOMTRADE

Most private equity and venture capital investment went into innovative Belgian tech companies operating in the field of Health with a high value compared to other industrial ecosystems and showing the importance of startup and scaleup activity in health and medtech in Belgium. Health was followed by Agri-Food and Aerospace and Defence over the period from 2015 to 2023.

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

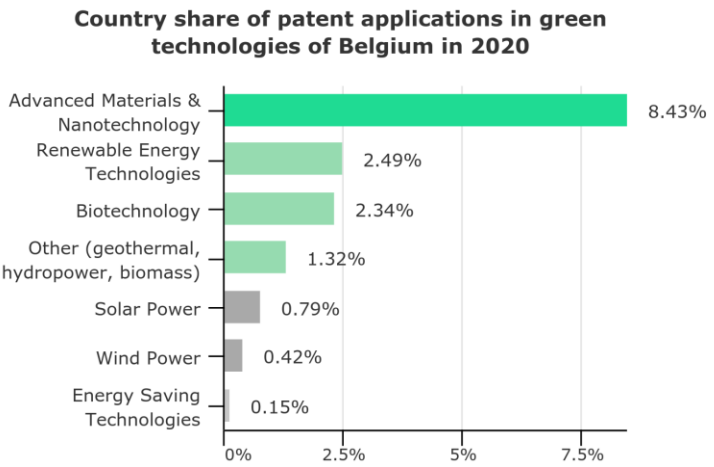


Source: Technopolis Group based on Crunchbase

2.3 Green transformation

Within the country, Belgium had the highest share of patent applications in generating technologies related to Advanced Materials and Nanotechnology within its economy with the potential to drive the green transformation of its industries. Belgium ranked at the fourth place among the EU27 Member States in Biotechnology and at the fifth place in Advanced Materials and Nanotechnology regarding its world share of patent applications.

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



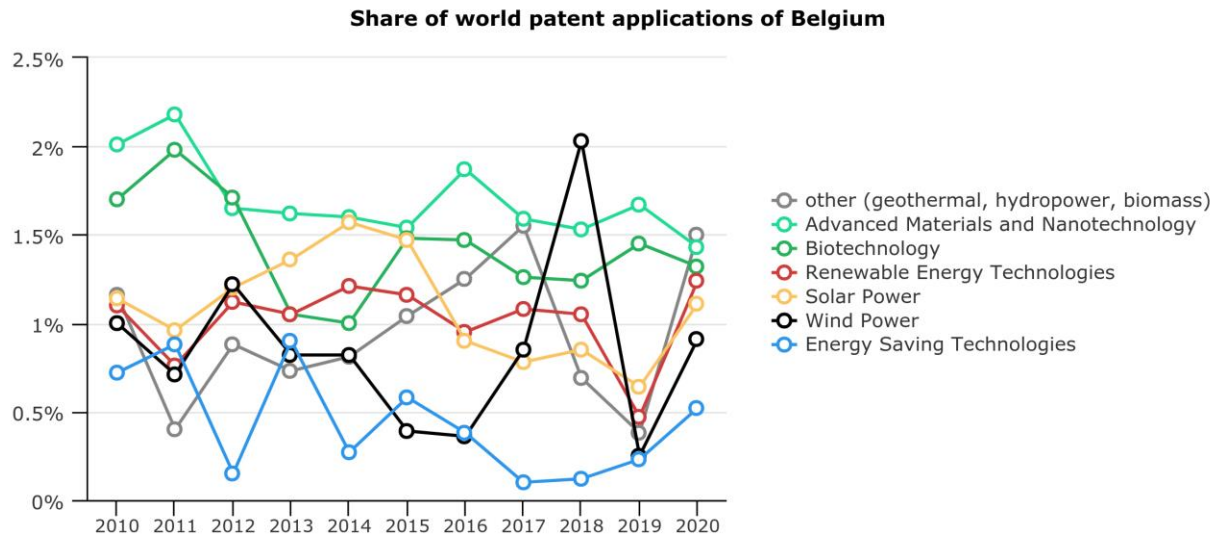
Ranking of Belgium within EU27 in terms of its share of global patent applications in 2020 (1 - best performer, 27 worst performer)

Biotechnology	**4**
Advanced Materials and Nanotechnology	5
Renewable Energy Technologies	9
Energy Saving Technologies	11

Source: Fraunhofer ISI based on Patstat

Trends in the world's patent applications show that Belgium has overall decreased its global share in most green technology fields. However, there has been an increase again from 2019 to 2020 in the field of Other Renewable Energies such as Geothermal, Hydropower and Biomass, Solar Power, and in Energy Saving Technologies. With regard to Wind Power, Belgium's global position has been spectacularly increasing until 2018 and it had a drop in 2019, nonetheless it bounced back again in 2020.

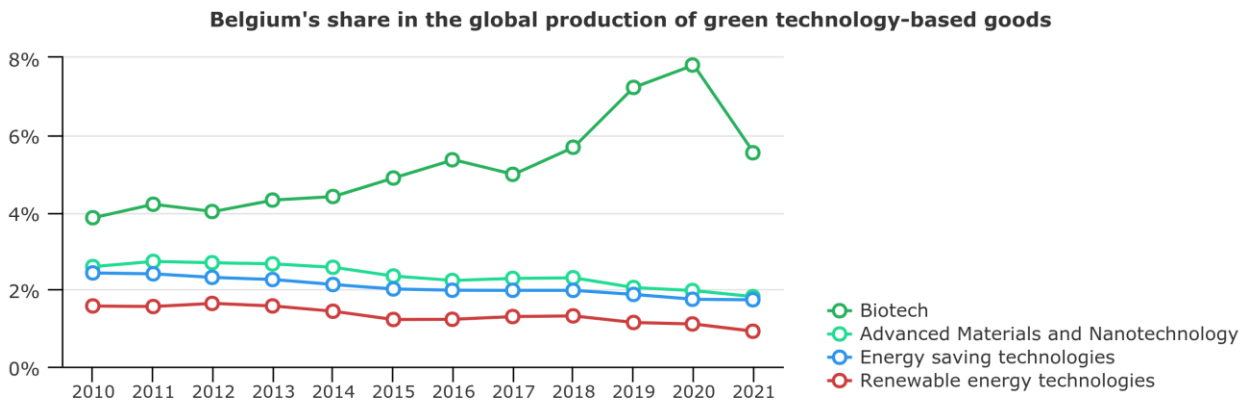
Figure 5: Trends over time in Belgium's share in world patent applications



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 Belgium for a given year. The share of production in a certain technology over Belgium's total production indicates a slight downward trend over the period from 2010 to 2021 such as in Advanced Materials, in Energy Saving Technologies and Renewable Energy Technology related products. In the field of Biotechnology, Belgium's share in global production has been increasing steadily until 2020 but it has decreased from 2020 to 2021.

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

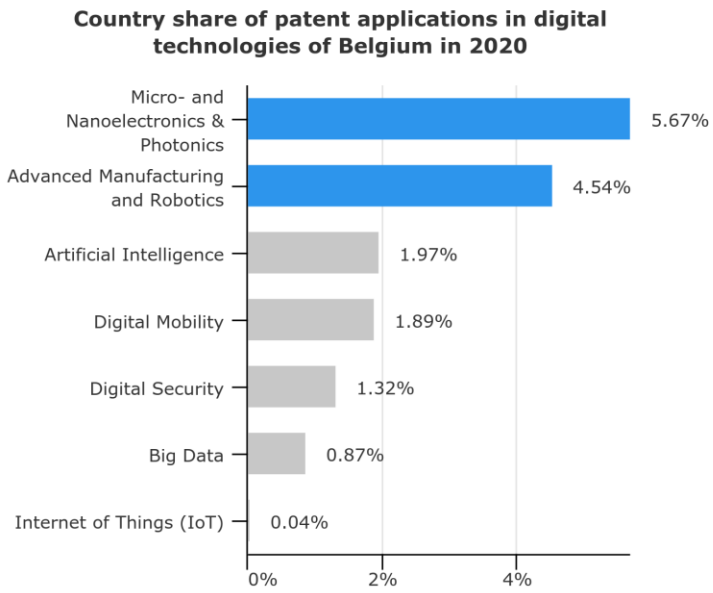


Source: IDEA Consult based on Prodcom data

2.4 Digital transformation

Among the digital technologies monitored in this project, Belgium had the highest country share in patent applications related to Micro-and Nanoelectronics and Advanced Manufacturing and Robotics. It ranked at the sixth place in Micro- and Nanoelectronics, and at the seventh place in Artificial Intelligence and Digital Mobility 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 Belgium



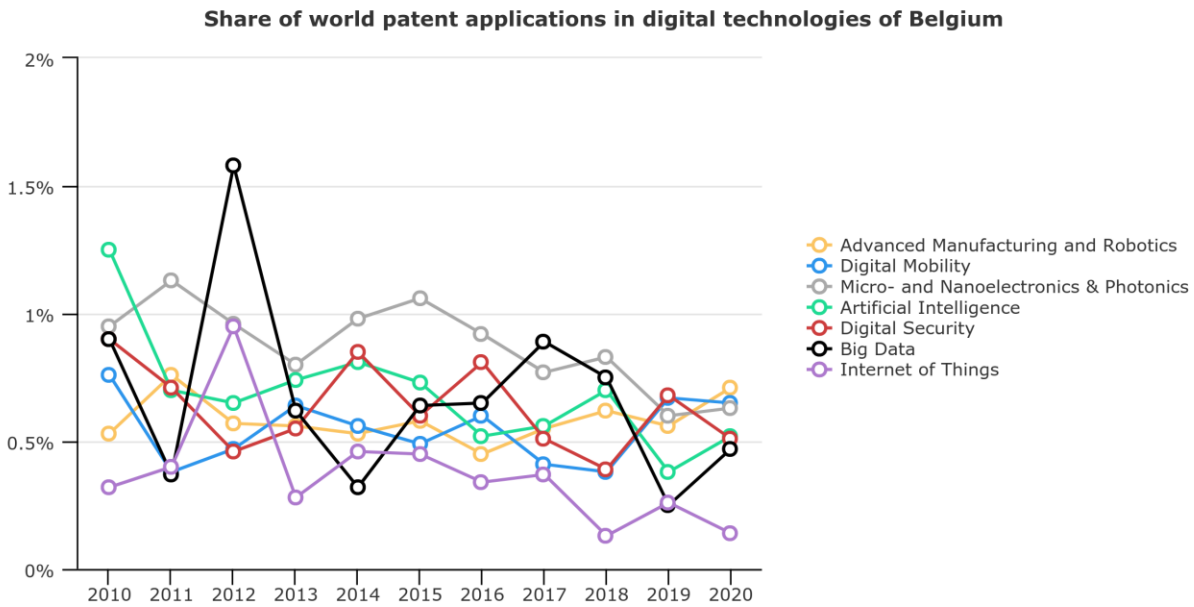
Ranking of Belgium within EU27 in terms of its share of global patent applications in 2020 (1 - best performer, 27 worst performer)

Micro- and Nanoelectronics & Photonics	**6**
Artificial Intelligence	7
Digital Mobility	7
Big Data	8
Advanced Manufacturing and Robotics	9
Digital Security	9
Internet of Things (IoT)	11

Source: Fraunhofer ISI based on Patstat

The trends over time show that Belgium's share of world patent applications in most digital technologies decreased from 2010 to 2020. However, it has managed to maintain stability and even increase its share in Advanced Manufacturing and Robotics since 2016. It has also remained stable in Digital Mobility. Although its share in Big Data has dropped significantly, it started to increase again from 2019 to 2020.

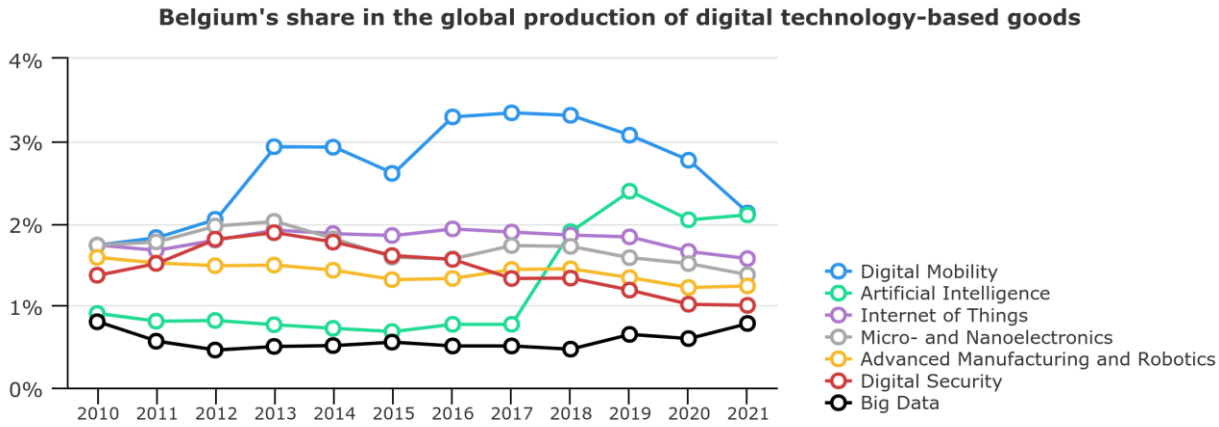
Figure 8: Trends over time in Belgium's share of world patent applications



Source: Fraunhofer ISI based on Patstat

The Prodcom-based indicator measures the share of Belgium in advanced technology-related production for a given year and it also captures the country share in global production of manufacturing goods that assesses the value created by the deployment of technologies in all manufactured goods. The share of production in a particular technology over Belgium's total production indicates that it has the largest share in the field of Digital Mobility (albeit with a decreasing trend) and Artificial Intelligence technology related products. In these technologies, Belgium has been also a technology developer, which suggests that it has managed to turn these into commercialised products.

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



Source: IDEA Consult based on Prodcom data

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