



# Monitoring industrial ecosystems

EU MEMBER STATES FACT SHEETS

Slovakia

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## EUROPEAN COMMISSION

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# TABLE OF CONTENTS

<b>Key Highlights .....</b>	<b>4</b>
<b>1. Introduction .....</b>	<b>5</b>
<b>2. Advanced technologies fostering the green and digital transition of industrial ecosystems.....</b>	<b>6</b>
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 share 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 $((\text{exp} - \text{imp})/(\text{exp} + \text{imp}))$ (2020) .....	7
Figure 3: Private equity and venture capital investment into tech companies related to industrial ecosystems in Slovakia .....	8
Figure 4: Country share and world share (expressed in terms of ranking) in patent applications of Slovakia .....	8
Figure 5: Trends over time in Slovakia's share in world patent applications.....	9
Figure 6: Production of advanced technology-based products in Slovakia .....	9
Figure 7: Country share and world share (expressed in terms of ranking) in digital technology related patent applications of Slovakia .....	10
Figure 8: Trends over time in Slovakia's share of world patent applications.....	10
Figure 9: Production of advanced technology-based products in Slovakia .....	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:

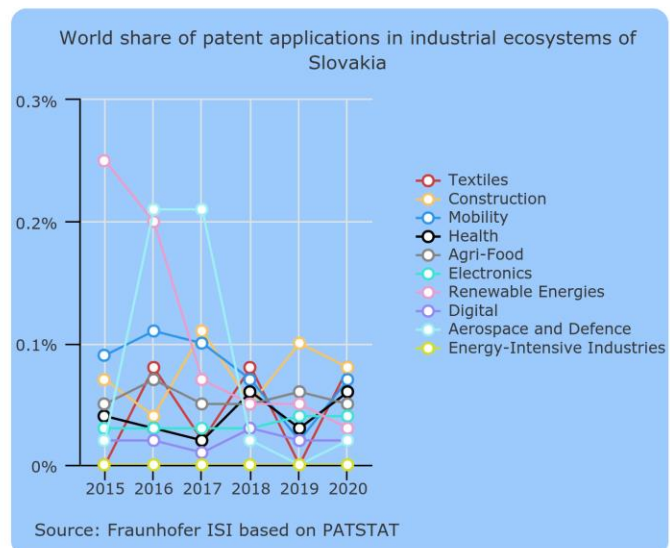


## Technological performance in industrial ecosystems:

- Regarding technology development, Slovakia had the highest share of patent applications within its country in the **Health and Electronics** industrial ecosystems. In a global comparison, it had some relative strengths in the **Textiles** ecosystem.

## Digital and green transition technologies:

- Among the digital technologies monitored in this project, Slovakia had the highest country share of patent applications in **Advanced Manufacturing and Robotics**.
- Trends over time indicate that the world share of Slovakia in all digital technologies remained mostly unchanged from 2010 to 2020, with the exception of the world share in Internet of Things, which decreased sharply over the recent years.
- In the field of green technologies, Slovakia has been the most specialised in **Advanced Materials and Nanotechnology, and Biotechnology** within its economy.



## Capacity to produce goods based on digital and green technologies:

- Slovakia's share of production in digital technologies over global production indicates that it created the highest value by the deployment of **Big Data and Digital Security**. Trends over time show a dynamic increase in its global share only in Big Data and a decrease or stagnation in other digital technology related goods.
- In the field of green transition technologies, the share of production in a certain technology over Slovakia's total production indicates an increase in **Energy Saving Technologies**, followed by 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 2021<sup>1</sup> 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<sup>2</sup>.

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 Carmen Moreno, Technopolis Group for the European Commission. However, it does not necessarily reflect the views of the European Commission.

<sup>1</sup> 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](https://commission.europa.eu/system/files/2021-05/communication-industrial-strategy-update-2020_en.pdf)

<sup>2</sup> 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<sup>3</sup> or at the European Patent Office<sup>4</sup> 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<sup>5</sup> 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**<sup>6</sup> 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**<sup>7</sup> 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.

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<sup>3</sup> World Intellectual Property Organization, WIPO Patent Cooperation Treaty (PCT) <https://www.wipo.int/pct/en/>

<sup>4</sup> European Patent Office, Supporting Innovation and Patents in Europe <https://www.epo.org/en>

<sup>5</sup> United Nations Comtrade, UN Comtrade Plus-International Trade Data Platform <https://comtradeplus.un.org/>

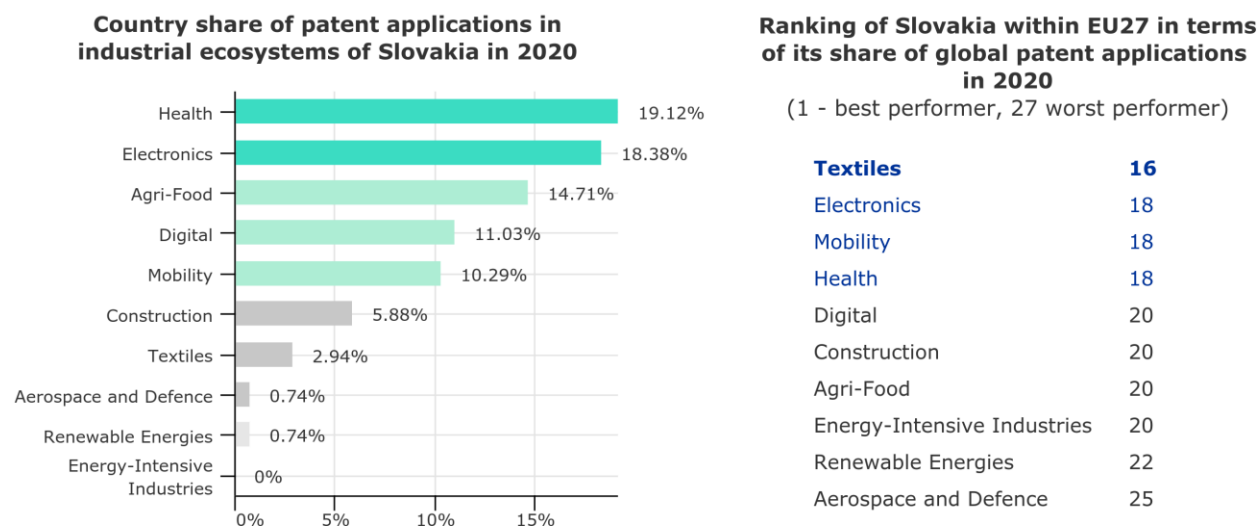
<sup>6</sup> Eurostat, Eurostat PRODCOM-European Union Production and Trade Statistics <https://ec.europa.eu/eurostat/web/prodcom>

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

## 2.2. Technology development in industrial ecosystems

Regarding technology development, Slovakia had the highest share of patent applications within its country in the Health and Electronics industrial ecosystems in 2020 as captured by patent data. In a global comparison, it ranked highest in the Textiles ecosystem in terms of share of global patent applications, raking at 16<sup>th</sup> place. It also ranks 18<sup>th</sup> in Electronics, Mobility and Automotive, 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. Slovakia registered a trade surplus in Automotive, Mobility and Transport.

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 Slovakia went into Renewable Energy, followed by Automotive, and Aerospace and Defence.

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

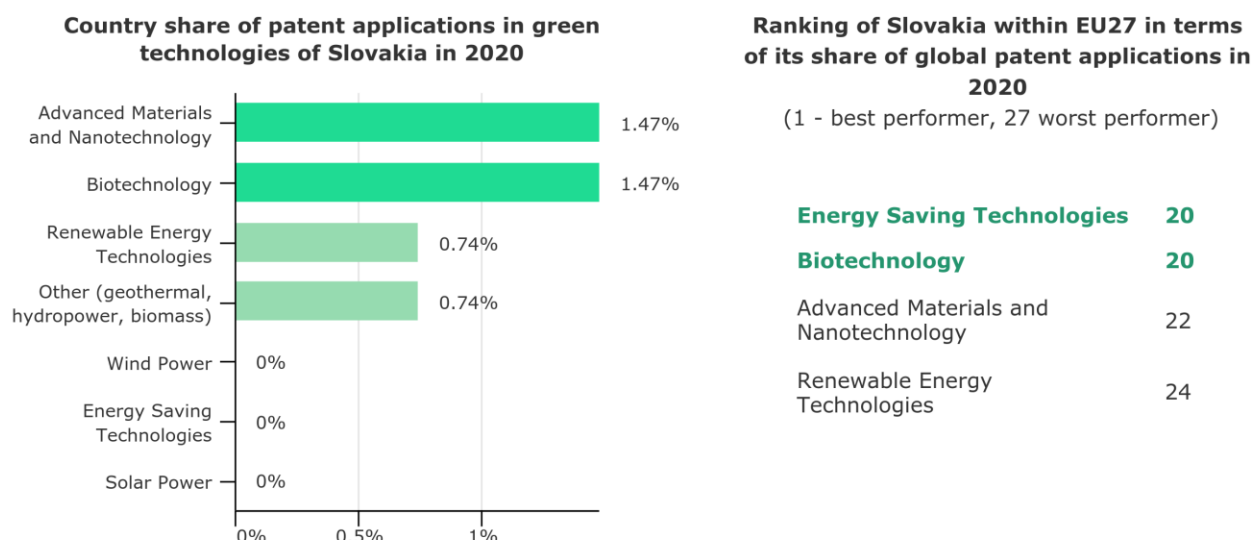


Source: Technopolis Group based on Crunchbase

## 2.3. Green transformation

Slovakia has been the most specialised in generating technologies related to Advanced Materials and Nanotechnology, and to Biotechnology within its economy. Similarly, Slovakia ranked at 20<sup>th</sup> place among the EU27 Member States in Energy Saving Technologies and in Biotechnology in terms of its world share of patent applications.

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

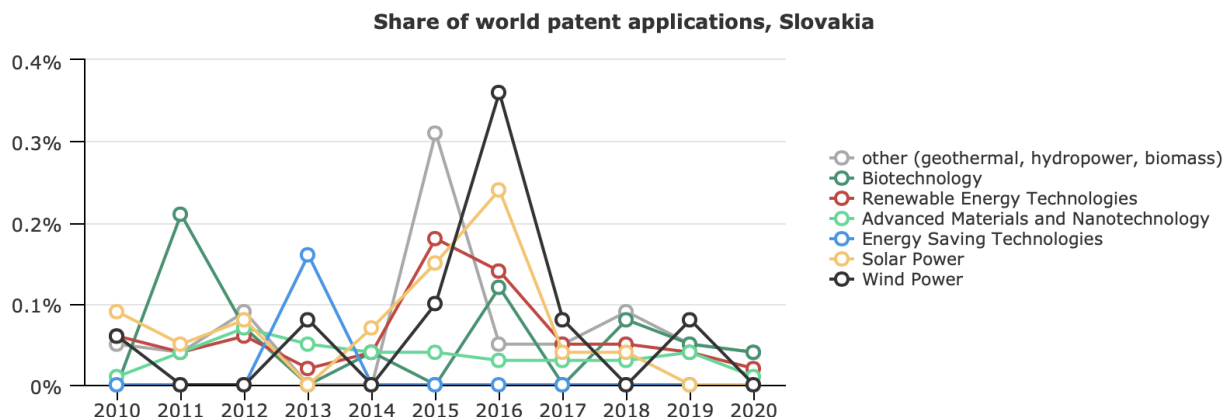


Source: Fraunhofer ISI based on Patstat

Trends in the world's patent applications show that Slovakia's share decreased particularly since 2016 in several green technologies and since then it remained overall constant during the last decade. The share in Geothermal, Hydropower and Biomass, and of Wind Power peaked in 2015 and 2016 respectively, to then decrease at initial level in the following years.



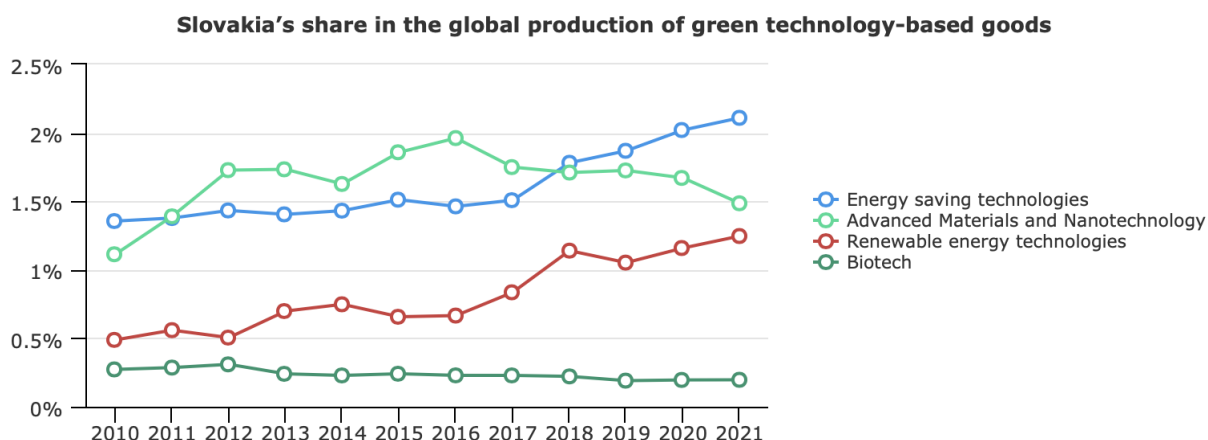
Figure 5: Trends over time in Slovakia's share in world patent applications



Source: Fraunhofer ISI based on Patstat

The Prodcom-based indicator measures the share of advanced technology-related production in Slovakia for a given year. The share of production in a certain technology over Slovakia's total production indicates an increase in Energy Saving Technologies, ranking the highest, and in Renewable Energy Technologies. The share of production in Advanced Materials has decreased from 2016 to 2021.

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

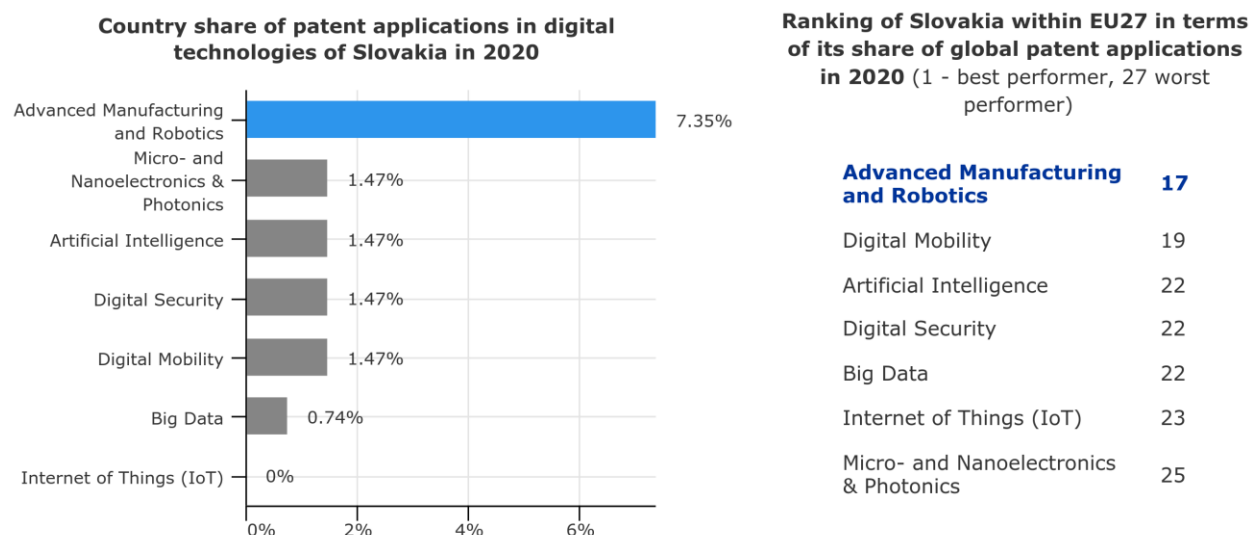


Source: IDEA Consult based on Prodcom data

## 2.4. Digital transformation

Among the digital technologies monitored in this project, Slovakia had the highest country share of patent applications in Advanced Manufacturing and Robotics, where it ranked at 17<sup>th</sup> place within EU27 countries in terms of its share of patent applications in 2020.

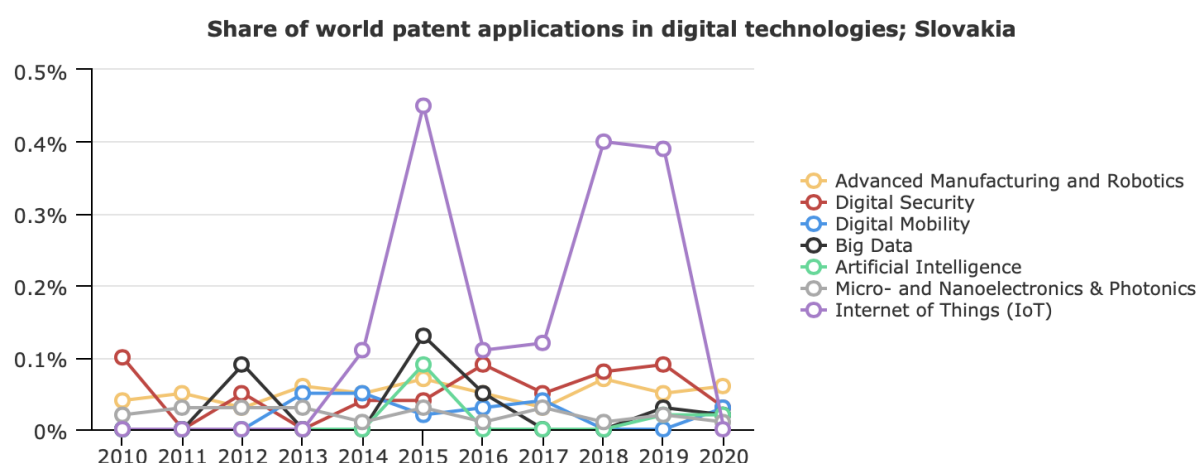
Figure 7: Country share and world share (expressed in terms of ranking) in digital technology related patent applications of Slovakia



Source: Fraunhofer ISI based on Patstat

Trends over time indicate that the world share of Slovakia in all digital technologies remained mostly unchanged from 2010 to 2020, with the exception of the world share in Internet of Things, which peaked in 2015, 2018 and 2019, then decreased to its original level.

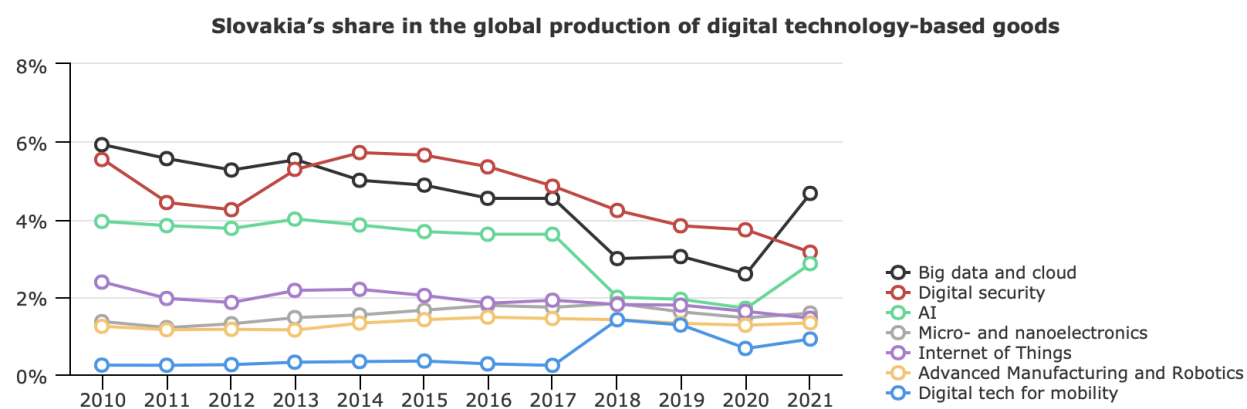
Figure 8: Trends over time in Slovakia's share of world patent applications



Source: Fraunhofer ISI based on Patstat

The Prodcom-based indicator measures the share of Slovakia in advanced technology-related production for a given year. The share of production in a particular technology over Slovakia's total production indicates that Slovakia has the largest share in the field of Big Data and Cloud, followed by Digital Security. The latter has regularly decreased from 2014 to 2021.

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



Source: IDEA Consult based on Prodcorn data

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