# Monitoring industrial ecosystems

## EU MEMBER STATES FACT SHEETS

Croatia

Author: Kincsö Izsak, Technopolis Group

**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*

## LEGAL NOTICE

This document has been prepared for the European Commission however it reflects the views only of the authors, and the European Commission is not liable for any consequence stemming from the reuse of this publication. More information on the European Union is available on the Internet (http://www.europa.eu).

| PDF | ISBN: 978-92-9469-714-1 | doi: 10.2826/67673 | EA-05-24-002-EN-N |
|---|---|---|---|

Luxembourg: Publications Office of the European Union, 2024
© European Union, 2024

The reuse policy of European Commission documents is implemented by the Commission Decision 2011/833/EU of 12 December 2011 on the reuse of Commission documents (OJ L 330, 14.12.2011, p. 39). Except otherwise noted, the reuse of this document is authorised under a Creative Commons Attribution 4.0 International (CC-BY 4.0) licence (https://creativecommons.org/licenses/by/4.0/). This means that reuse is allowed provided appropriate credit is given and any changes are indicated.

For any use or reproduction of elements that are not owned by the European Union, permission may need to be sought directly from the respective rightholders.

# TABLE OF CONTENTS



# TABLE OF FIGURES

# Key Highlights

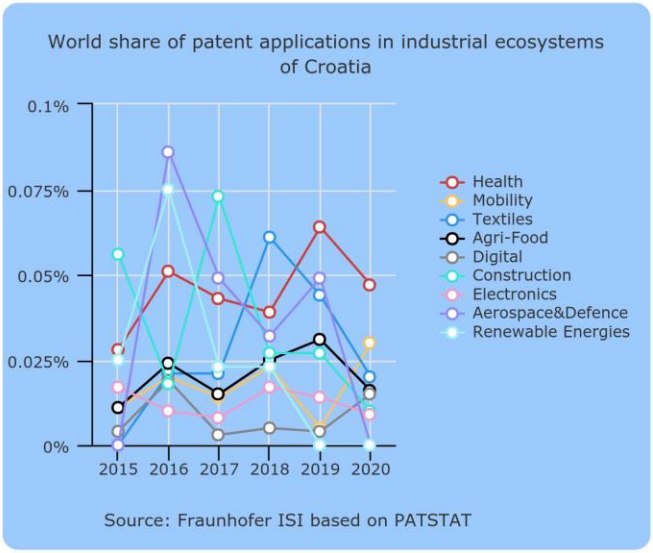
This country report has been developed as part of the '**European Monitor of Industrial Ecosystems'** project of the European Commission, Directorate General for Internal Market, Industry, Entrepreneurship and SMEs and the European Innovation Council and SMEs Executive Agency. It provides data insights 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:

- Croatia had by far the highest share of its patent applications in the **Health** industrial ecosystem, where it also shows some strengths relative to its size within the EU27. It also shows dynamics in the field of **Mobility** globally.

## Digital and green transition technologies:

- Among the digital technologies monitored in this project, Croatia had the highest country share of patent applications in **Advanced Manufacturing and Robotics.** In the field of green transition technologies, Croatia has generated most technologies related to **Advanced Materials**.
- Trends over time in Croatia's share in the world patent applications shows an overall decrease in green transition technologies and fluctuations, especially in Biotechnology, Wind Power and Geothermal, Hydropower and Biomass.
- In the field of digital technologies, an oscillating trend can be observed with a recent surge in the world share of Croatia in the **Internet of Things** from 2019 to 2020.




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

- Croatia' share of production in digital technologies over global production indicates that it created the highest value by the deployment of **Micro- and Nanoelectronics and Advanced Manufacturing and Robotics** technologies across all manufactured goods in the economy in 2021.
- Over the period from 2010 to 2021 Croatia's share decreased in Big Data or the Internet of Things but it has increased in Digital Security and since 2019 it has started to increase again in Advanced Manufacturing and Robotics.
- In the field of green transition technologies, the Croatia 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 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 Kincsö Izsak, from 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 procedure[1] or at the European Patent Office[2] 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[3] 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**[4] 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.

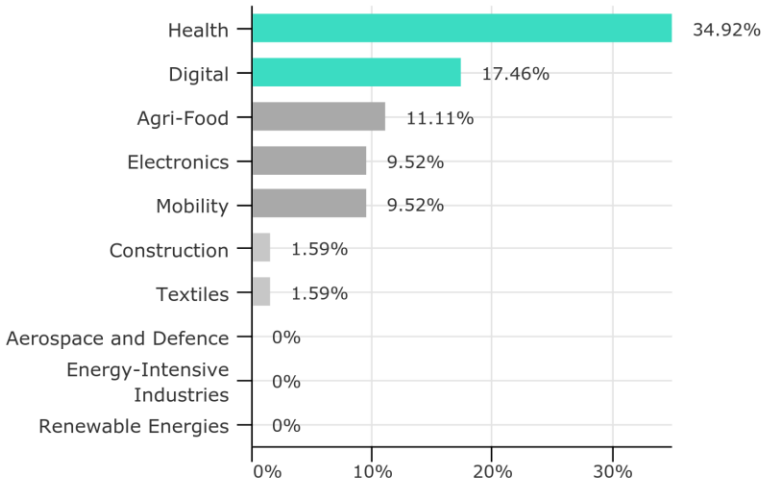
**Crunchbase data**[5] were used to analyse entrepreneurial dynamics and private equity and venture capital investment. Crunchbase is a widely trusted source of information on venture capital backed innovative companies. Technology startups represent key building blocks in the transition towards a more 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, Croatia had the highest share of its country patent applications related to the Health industrial ecosystem in 2020 as shown by the patent analysis. Health is followed by the Digital ecosystem that reflects the growth of the Croatian IT sector. According to Eurostat, the percentage of value added by the ICT sector at current prices was 11.58 in 2020 in Croatia[6].

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




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

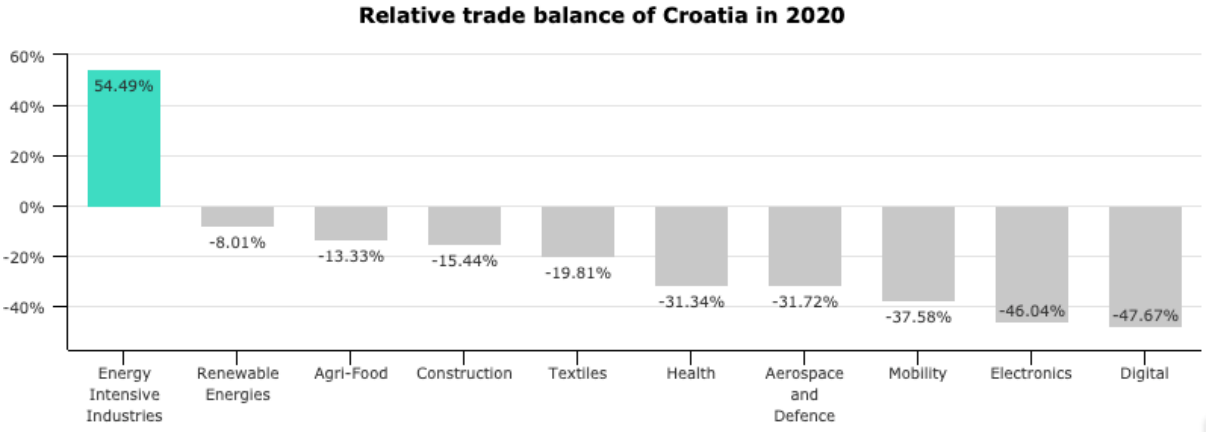
| | |
|---|---|
| **Health** | **19** |
| Mobility | 22 |
| Textiles | 24 |
| Digital | 24 |
| Electronics | 25 |
| Agri-Food | 26 |
| Construction | 26 |
| Aerospace and Defence | 27 |

* ranking in Renewable Energy and Energy Intensive Industries is not available for Croatia in 2020

*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. Croatia registered a trade surplus in products related to technologies relevant for Energy Intensive Industries.

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



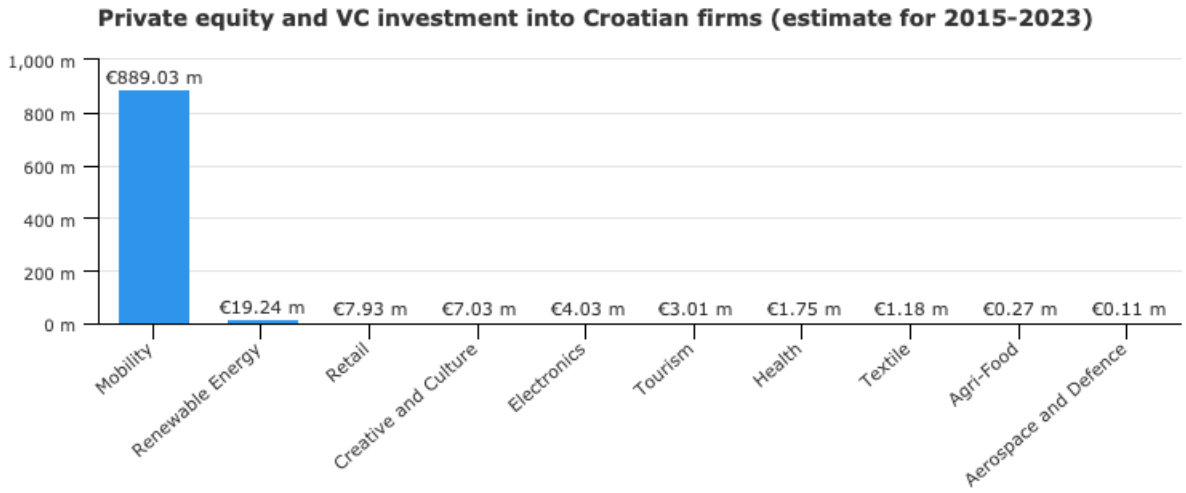

*Source: Fraunhofer ISI based on UNCOMTRADE*

Most private equity and venture capital investment in Croatia went into innovative companies operating in the field of Mobility, followed by Renewable Energy over the period from 2015 to

[6] https://ec.europa.eu/eurostat/databrowser/view/tin00086/default/table?lang=en&category=t_isoc.t_isoc_se

2020. The high share in mobility is thanks to a particular Croatian producer of electric cars which is regarded as a major innovator in the country's automotive sector.

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

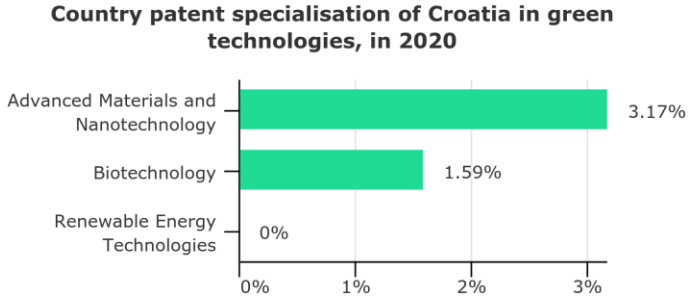



*Source: Technopolis Group based on Crunchbase*

## 2.3. Green transformation

Within the country, Croatia has been the most specialised in generating technologies related to Advanced Materials and Biotechnology, which have the potential to drive the green transformation of its industries. In a global comparison, Croatia has ranked 22nd place among the EU27 Member States in generating technologies related to Biotechnology.

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



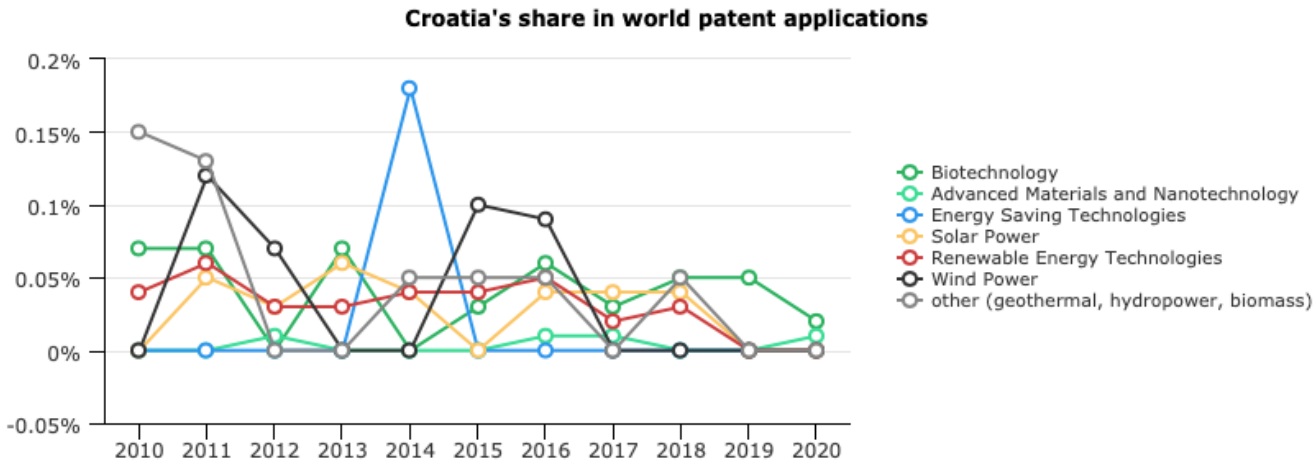

**Ranking of Croatia within EU27 in terms of its share of global patent applications in 2020** (1 - best performer, 27 worst performer)

| | |
|---|---|
| **Biotechnology** | **22** |
| Advanced Materials and Nanotechnology | 23 |
| Energy Saving Technologies | 24 |

*Source: Fraunhofer ISI based on Patstat*

Evolution of the world's patent applications between 2010 and 2020 shows that that Croatia's global share in most fields followed an oscillating trend, especially for what concerns its share in Biotechnology, Wind Power and Geothermal, Hydropower and Biomass. Overall, the share of world patent applications has decreased from 2010 to 2020 for the majority of green technologies.

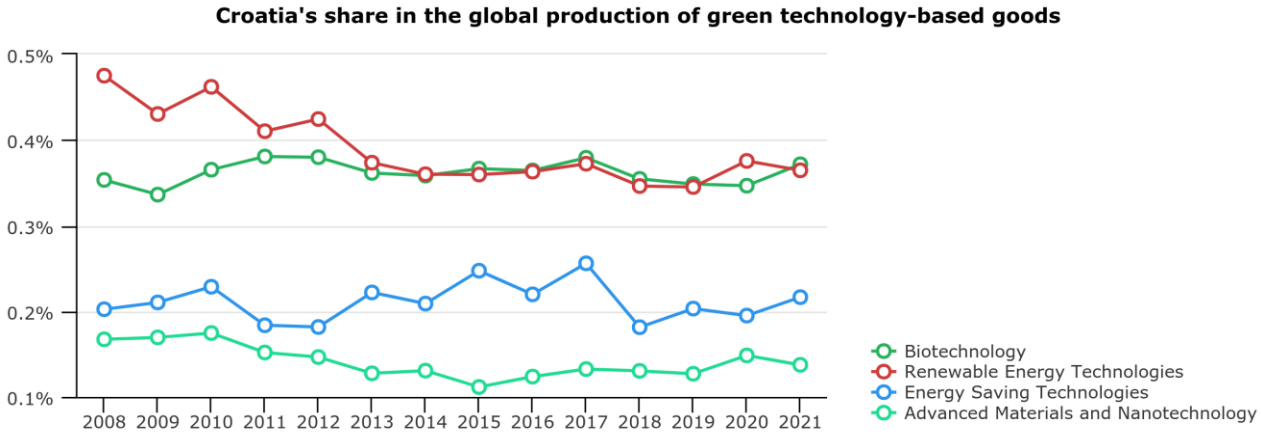
*Figure 5: Trends over time in Croatia's share in world patent applications*




*Source: Fraunhofer ISI based on Patstat*

The Prodcom-based indicators measure the share of advanced technology-related production in Croatia for a given year and it also captures the country share in global production of manufacturing goods. Croatia's share of production in a certain technology over global production indicates a decrease in Renewable Energy Technologies from 2010 to 2020. Croatia managed to keep its share of Biotechnology-based goods stable over time, where it ranked the highest among the various green technologies in 2020.

*Figure 6: Production of advanced technology-based products in Croatia*

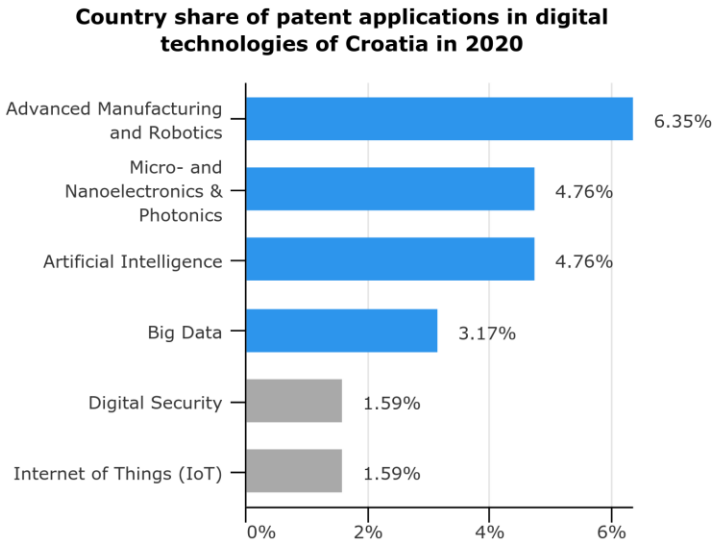



*Source: IDEA Consult based on Prodcom data*

## 2.4. Digital transformation

Among the digital technologies monitored in this project, Croatia had the highest country share of patent applications in Advanced Manufacturing and Robotics. Regarding its global share in patent applications, it ranked 16$^{th}$ place in the Internet of Things and 20$^{th}$ place in Artificial Intelligence, and in Micro and Nanoelectronics and Photonics.

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



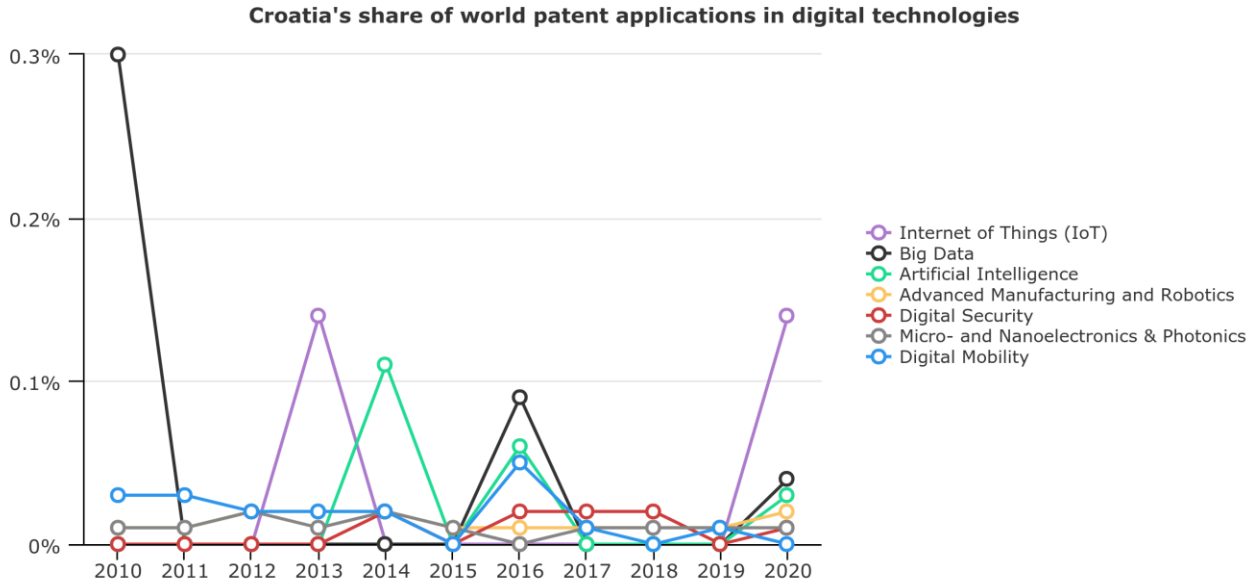

**Ranking of Croatia within EU27 in terms of its share of global patent applications in 2020** (1 - best performer, 27 worst performer)

| | |
|---|---|
| **Internet of Things (IoT)** | **16** |
| Artificial Intelligence | 20 |
| Micro- and Nanoelectronics & Photonics | 20 |
| Big Data | 21 |
| Advanced Manufacturing and Robotics | 23 |
| Digital Security | 23 |
| Digital Mobility | 26 |

*Source: Fraunhofer ISI based on Patstat*

Over time, trends show that there is an overall oscillating trend. Croatia's global share in the Internet of Things has increased from 2019 to 2020, reaching the same level as it was in 2013. Digital Mobility shows a slight decrease over time. The biggest decrease can be seen in the field of Big Data, where Croatia's share has dropped significantly since 2010.

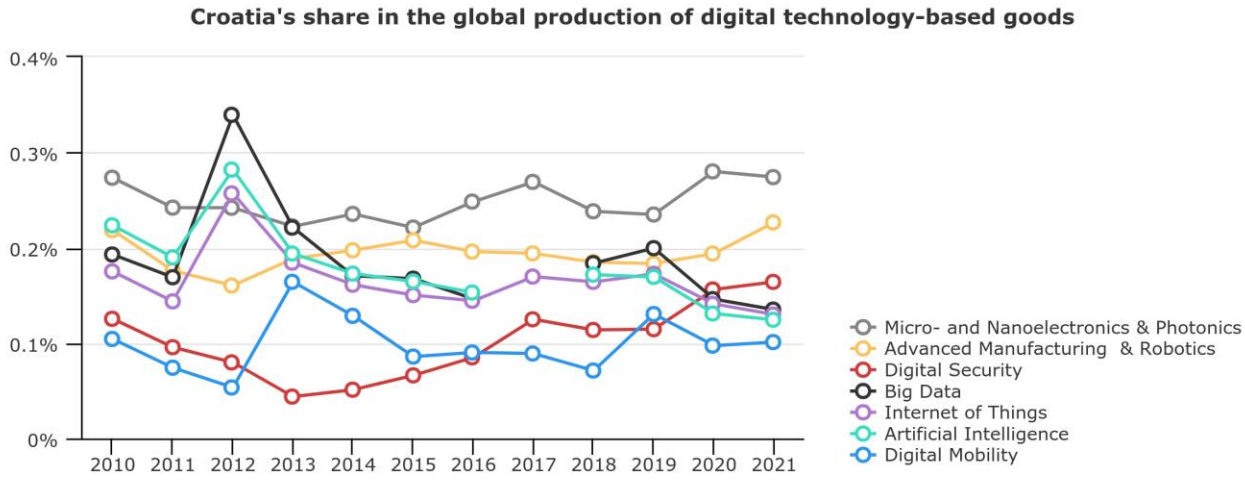
*Figure 8: Trends over time in Croatia's share of world patent applications*




*Source: Fraunhofer ISI based on Patstat*

Croatia's share of production in a particular technology over global production indicates that it created the highest value by the deployment of Micro- and Nanoelectronics & Photonics, and Advanced Manufacturing and Robotics technologies across all manufactured goods in the economy in 2021. Over the period from 2010 to 2021 Croatia's share decreased in Big Data and the Internet of Things, but it increased in Digital Security. Since 2019 positive trends are apparent in the field of Advanced Manufacturing and Robotics.

*Figure 9: Production of advanced technology-based products in Croatia*




*Source: IDEA Consult based on Prodcom data*

EA-05-24-002-EN-N

Publications Office
of the European Union

ISBN 978-92-9469-714-1