Monitoring industrial ecosystems

EU MEMBER STATES FACT SHEETS

Romania

Author: Emma Coroler, 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

PDF ISBN: 978-92-9469-738-7 doi: 10.2826/22135 EA-06-24-012-EN-N

Luxembourg: Publications Office of the European Union, 2024

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 and world share (expressed in terms of ranking) of patent applications of Romania in 2020 in technologies related to industrial ecosystems 7

Figure 2: Trade balance in relation to overall trade volume ((exp - imp)/(exp+imp)) (2020) 7

Figure 3: Private equity and venture capital investment into tech companies related to industrial ecosystems in Romania 8

Figure 4: Country share and world share (expressed in terms of ranking) in green transition related technologies 8

Figure 5: Trends over time in Romania's share in world patent applications 9

Figure 6: Production of advanced technology-based products in Romania 9

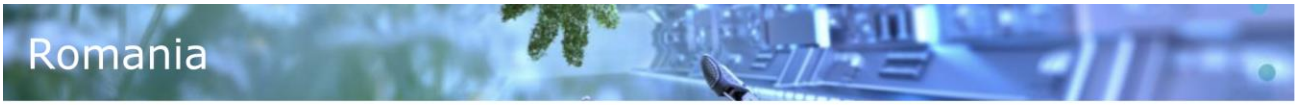
Figure 7: Country share and world share (expressed in terms of ranking) in digital technology related patent applications of Romania 10

Figure 8: Trends over time in Romania's share of world patent applications 10

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

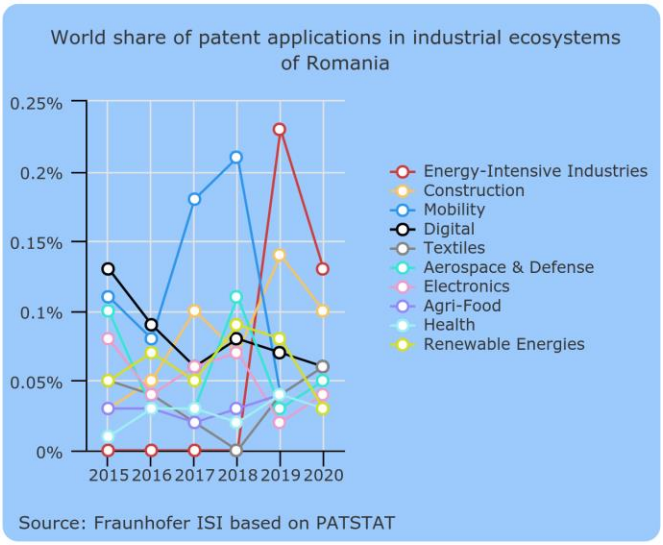


Technological performance in industrial ecosystems:

- Romania had by far the highest share of its patent applications in the **Energy Intensive Industries and Construction** industrial ecosystems, where it also shows some strengths relative to its size within the EU27.

Digital and green transition technologies:

- Among the digital technologies monitored in this project, Romania had the highest country share of patent applications in **Artificial Intelligence,** and in **Digital Security.** In the field of the green transition, Romania had been relatively the strongest in **Energy Saving Technologies and Renewable Energy Technologies**.
- Over time, Romania's share in the world patent applications shows fluctuations in Energy Saving technologies, Wind Power and Other Renewable Energies such as Geothermal, Hydropower and Biomass.
- In the field of digital technologies, an oscillating trend can be observed with a preeminent role of **Internet of Things** from 2017 to 2019, but then a subsequent decline.



Capacity to produce goods based on digital and green technologies:

- Romania's share of production in digital technologies over global production indicates that it created the highest value by the deployment of **Digital Security and Big Data** technologies across all manufactured goods in the economy in 2021.
- Over the period from 2014 to 2021 Romania's share has substantially decreased in **Big Data and Digital Mobility**.
- In the field of green transition technologies, Romania created the highest value by the deployment of **Renewable Energy and Energy Saving 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[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 Emma Coroler, 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 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 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.

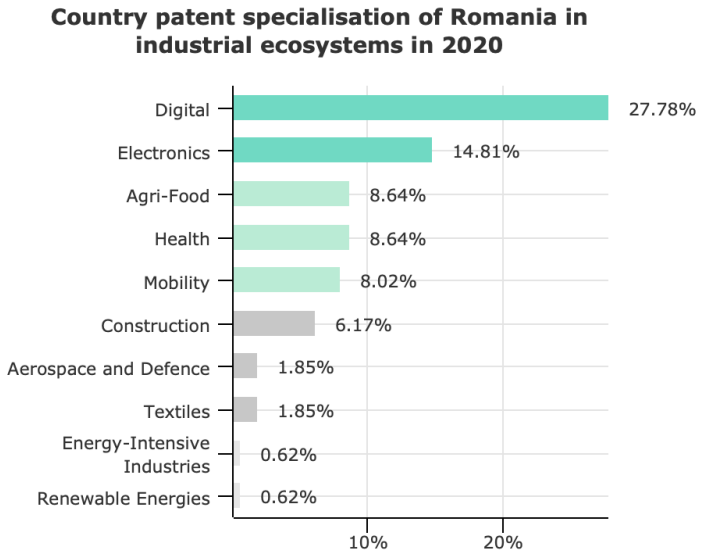
Crunchbase data[7] were used to analyse entrepreneurial dynamics and private equity and venture capital investment. Crunchbase is a widely trusted source of information on venture capital backed innovative companies. Technology startups represent key building blocks in the transition towards a more digital, 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, Romania has been the most specialised in the Digital and Electronics industrial ecosystems in 2020 as captured by patent data. This is in line with the well-known focus of Romania on the ICT sector. In a global comparison, it ranked at the 15th place within the EU27 countries in Energy Intensive Industries, and at the 16th place in the Digital ecosystem.

Figure 1: Country and world share (expressed in terms of ranking) of patent applications of Romania in 2020 in technologies related to industrial ecosystems



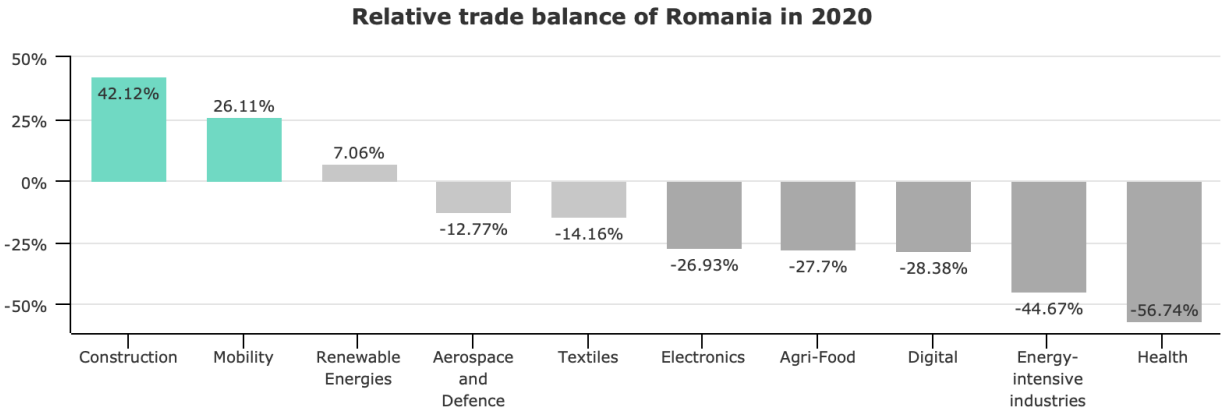
Ranking of Romania within EU27 in terms of its share of global patent applications in 2020
(1 - best performer, 27 worst performer)

Energy Intensive Industries	**15**
Digital	16
Construction	17
Aerospace and Defence	18
Electronics	19
Mobility	19
Renewable Energies	21
Textiles	21
Health	23
Agri-Food	23

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. Romania registered a trade surplus in technology-based products related to Construction and to Mobility, Automotive and Transport.

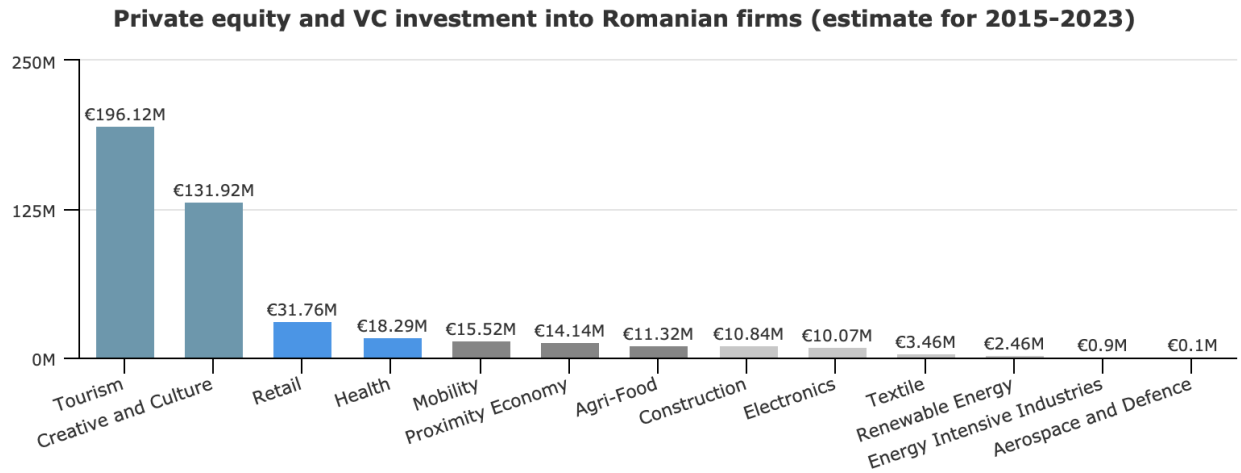
Figure 2: Trade balance in relation to overall trade volume ((exp - imp)/(exp+imp)) (2020)



Source: Fraunhofer ISI based on UNCOMTRADE

Most private equity and venture capital investment went into innovative Romanian tech companies operating in the field of Tourism and Creative and Culture over the period from 2015 to 2023.

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

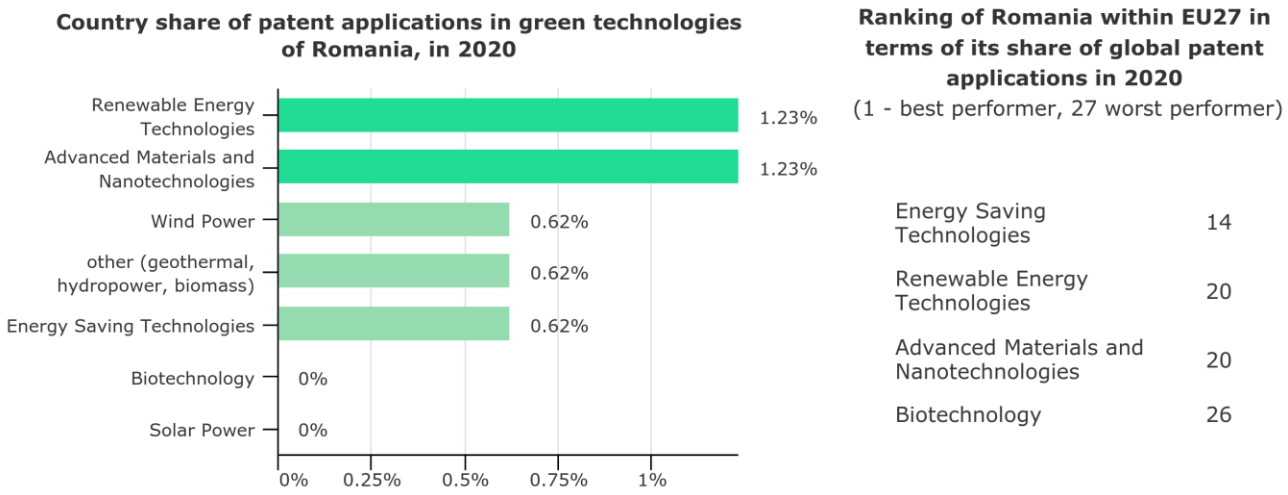


Source: Technopolis Group based on Crunchbase

2.3 Green transformation

Within the country, Romania has been the most specialised in generating technologies related to Renewable Energy Technologies and Advanced Materials and Nanotechnologies, which have the potential to drive the green transformation of its industries. In a global comparison, Romania ranked at the 14th place among the EU27 Member States in generating technologies related to Energy Saving Technologies.

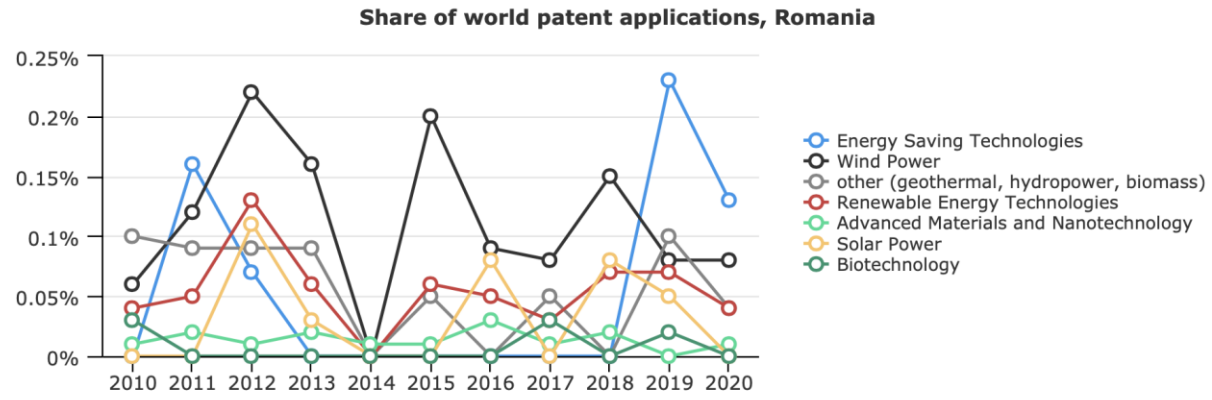
Figure 4: Country share and world share (expressed in terms of ranking) in green transition related technologies



Source: Fraunhofer ISI based on Patstat

Evolution in the world's patent applications show that Romania had an oscillating trend in various fields, including Energy-saving technologies, Wind Power and Other Renewable Energies such as geothermal, hydropower and biomass.

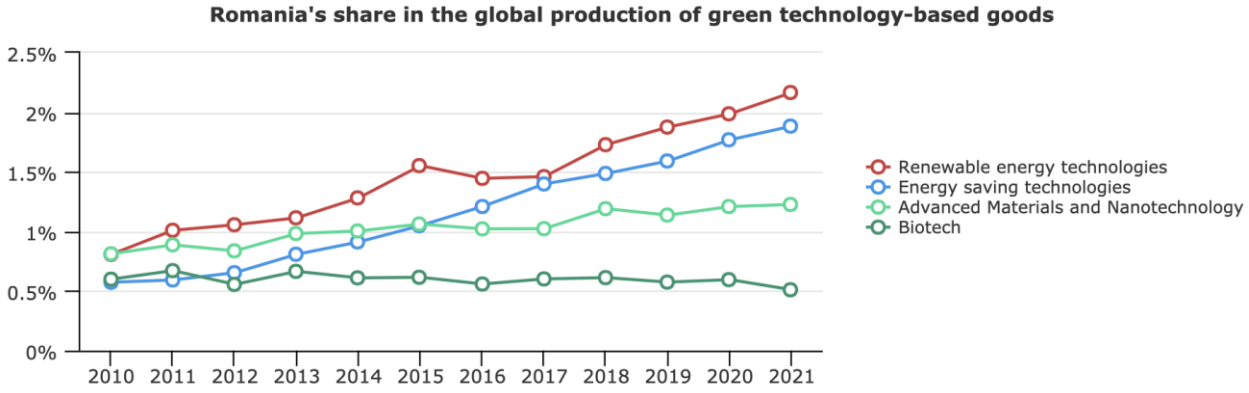
Figure 5: Trends over time in Romania's share in world patent applications



Source: Fraunhofer ISI based on Patstat

The Prodcom-based indicator measures the share of advanced technology-related production in Romania for a given year. The share of production in a certain technology over Romania's total production indicates an increasing trend for all green technologies and particularly for Renewable Energy and Energy Saving Technologies related products. This suggests that Romania has managed to turn its relative technological advantage into production.

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

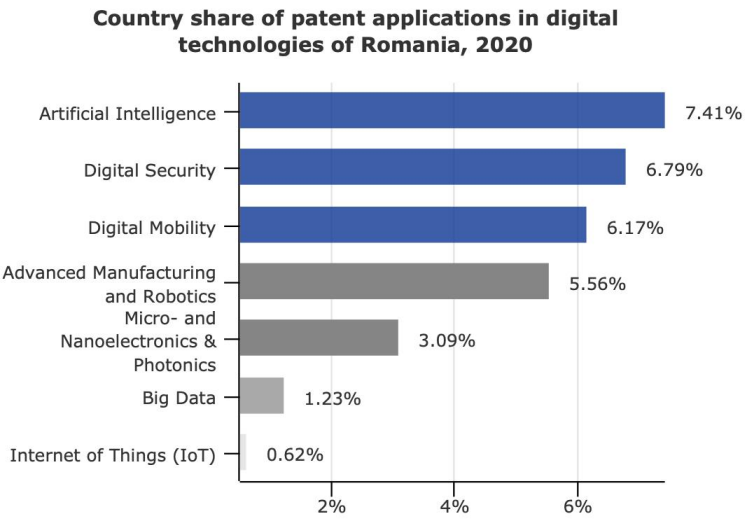


Source: IDEA Consult based on Prodcom data

2.4 Digital transformation

Among the digital technologies monitored in this project, Romania has been the most specialised in Artificial Intelligence and Digital Security, while it ranked at the 13th place among the EU27 Member States in the field of Internet of Things in 2020.

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



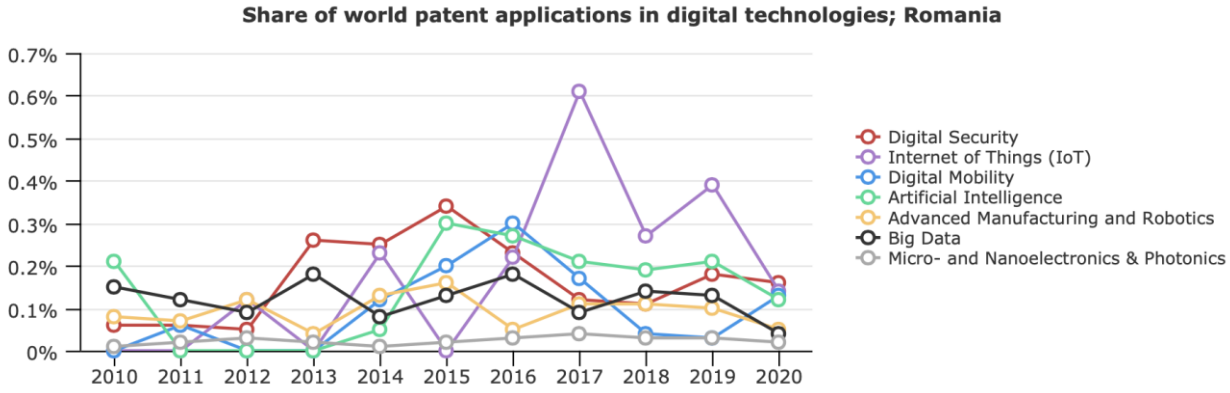
Ranking of Romania within EU27 in terms of its share of global patent applications in 2020 (1 - best performer, 27 worst performer)

Internet of Things (IoT)	**13**
Digital Mobility	14
Artificial Intelligence	15
Digital Security	15
Advanced Manufacturing and Robotics	18
Micro- and Nanoelectronics & Photonics	18
Big Data	19

Source: Fraunhofer ISI based on Patstat

Trends over time indicate an increase or at least stability of Romania global position in the fields of all digital technologies. Romania's share of world patent applications in Internet of Things had two peaks in 2016 and in 2019, and then a decrease in 2020.

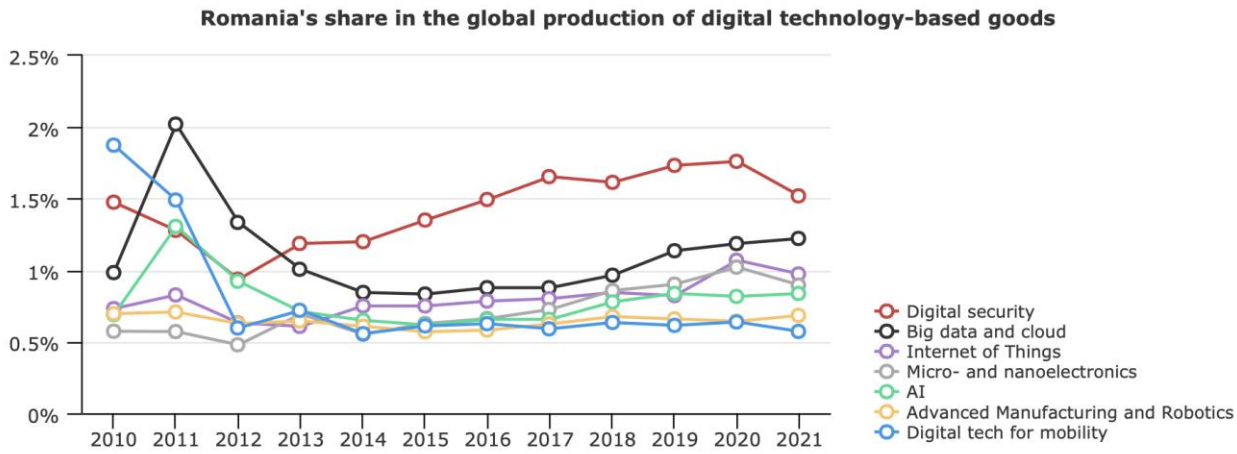
Figure 8: Trends over time in Romania's share of world patent applications



Source: Fraunhofer ISI based on Patstat

The Prodcom-based indicator measures the share of Romania in advanced technology-related production for a given year. The share of production in a particular technology over Romania's total production indicates that it has the largest share in the field of Digital Security, where it has constantly increased its production of the related technology-based products.

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



Source: IDEA Consult based on Prodcom data

EA-06-24-012-EN-N

Publications Office
of the European Union

ISBN 978-92-9469-738-7