April 2024. Technological snapshot

# Artificial intelligence in Catalonia



ACCIÓ Catalonia Trade & Investment

Generalitat de Catalunya
Government of Catalonia

CataloniaConnects

# Artificial intelligence in Catalonia. Technological snapshot.

ACCIÓ
Government of Catalonia




The contents of this document are subject to a Creative Commons license. Unless otherwise indicated, reproduction, distribution and public communication is permitted as long as the author is cited, no commercial use is made and derivative works are not distributed. A summary of the license terms can be found at:
https://creativecommons.org/licenses/by-nc-nd/4.0/

The use of brands and logos in this report is merely informative. The brands and logos mentioned belong to their respective owners and are in no way owned by ACCIÓ. This is a partial illustrative representation of the companies, organizations and entities that are part of the artificial intelligence ecosystem. There may be companies, organizations, and entities that have not been included in the study.

Carried out by
Strategy and Competitive Intelligence Unit of ACCIÓ
CIDAI - Centre of Innovation for Data Tech and Artificial Intelligence
Karina Gibert Oliveras

Collaboration
Secretariat of Digital Policies. Directorate General of Innovation and Digital Economy

Barcelona, April 2024

ACCIÓ Catalonia Trade & Investment
Generalitat de Catalunya Government of Catalonia
CataloniaConnects

# Contents

Executive Summary

1. Definition of artificial intelligence

2. World artificial intelligence market

3. Generative artificial intelligence

4. Artificial intelligence ethics and regulatory framework

5. Opportunities and challenges stemming from artificial intelligence

6. Artificial intelligence in Catalonia

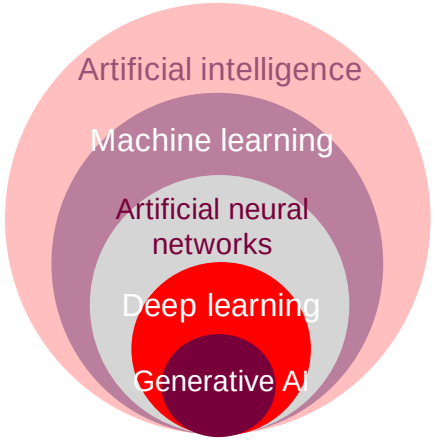
7. Success Cases in Catalonia

# Executive summary of artificial intelligence in Catalonia (I)



Artificial intelligence is a machine's ability to exhibit abilities similar to human intelligence, such as reasoning, learning, planning, and creativity.

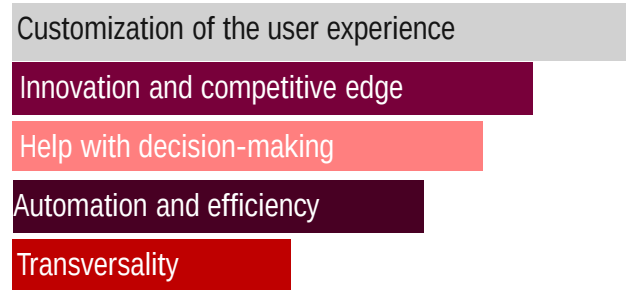
## AI disciplines




## Main applications

- Health
- Industry
- Marketing
- Mobility & logistics
- Agriculture
- Cultural ind.
- Energy
- Society
- Security
- E-commerce
- Finance & banking
- Environment
- Education
- Cybersecurity
- Art and creativity

## Importance of AI




Boom of generative AI: models that take raw data and learn to generate high-quality contents

## World Market

- With annual growth amounting to 35.5%, AI is expected to achieve a 1.85 trillion-dollar market value by 2030.
- The main AI countries are the United States, China and Japan, while the EU is a reference for the implementation of the first specific law on artificial intelligence.

## Opportunities stemming from AI

- Improved productivity, new capabilities and enhanced calculations
- Disruptive, cross-cutting, democratizing and accessible technology
- Key to the 4.0 and 5.0 revolutions
- Commitment to AI by public institutions and the private sector
- Technological cooperation with developing regions

## Challenges stemming from AI

- Increased consumption of resources such as energy and water
- Changes in the labor structure and increasing inequalities and digital divide
- Increased cybersecurity risks
- A new geopolitical weapon in a fragmented world
- Generation of fake news putting political regimes at risk

ACCIÓ Catalonia Trade & Investment
Generalitat de Catalunya Government of Catalonia
CataloniaConnects

# Executive summary of artificial intelligence in Catalonia (II)



## 488 companies along the value chain

173% more companies than in 2019.

**€2,155 M** turnover (0.8% of the Catalan GDP).

14,525 jobs.

43.9% of the companies are startups.

Highlights:

For developed technology:

- Machine learning (57.8%)
- AI platforms (31.8%)

By sector of application:

- Services (45.1%)
- Industry (40.8%)

## Leading AI startups

Barcelona, the leading city in terms of funding rounds for AI startups in southern Europe

The AI startups in Barcelona complete, on average, 1 round valued at **€2.1 M** every 18 days

## Attractive for AI-intensive international companies

1st region in southern Europe for foreign investment in the last five years (2019-2023).

Foreign investment in AI in Catalonia in 2023 (€289 M) accounted for 54.7% of the total invested in AI in the whole of Spain.

87% of the 140 technological hubs of foreign companies based in Catalonia focus on AI.

## Benchmarking Initiatives

CATALONIA.AI · CIDAI · EIAC · AIRA · XARXA RDI·IA · Aina · Salut/IA · DCA · DIH4CAT

## R&D excellence

3rd largest region in terms of AI Horizon funding

29 major technological and research centers

A unit of the Ellis network is based in Barcelona

# 1. Definition of artificial intelligence

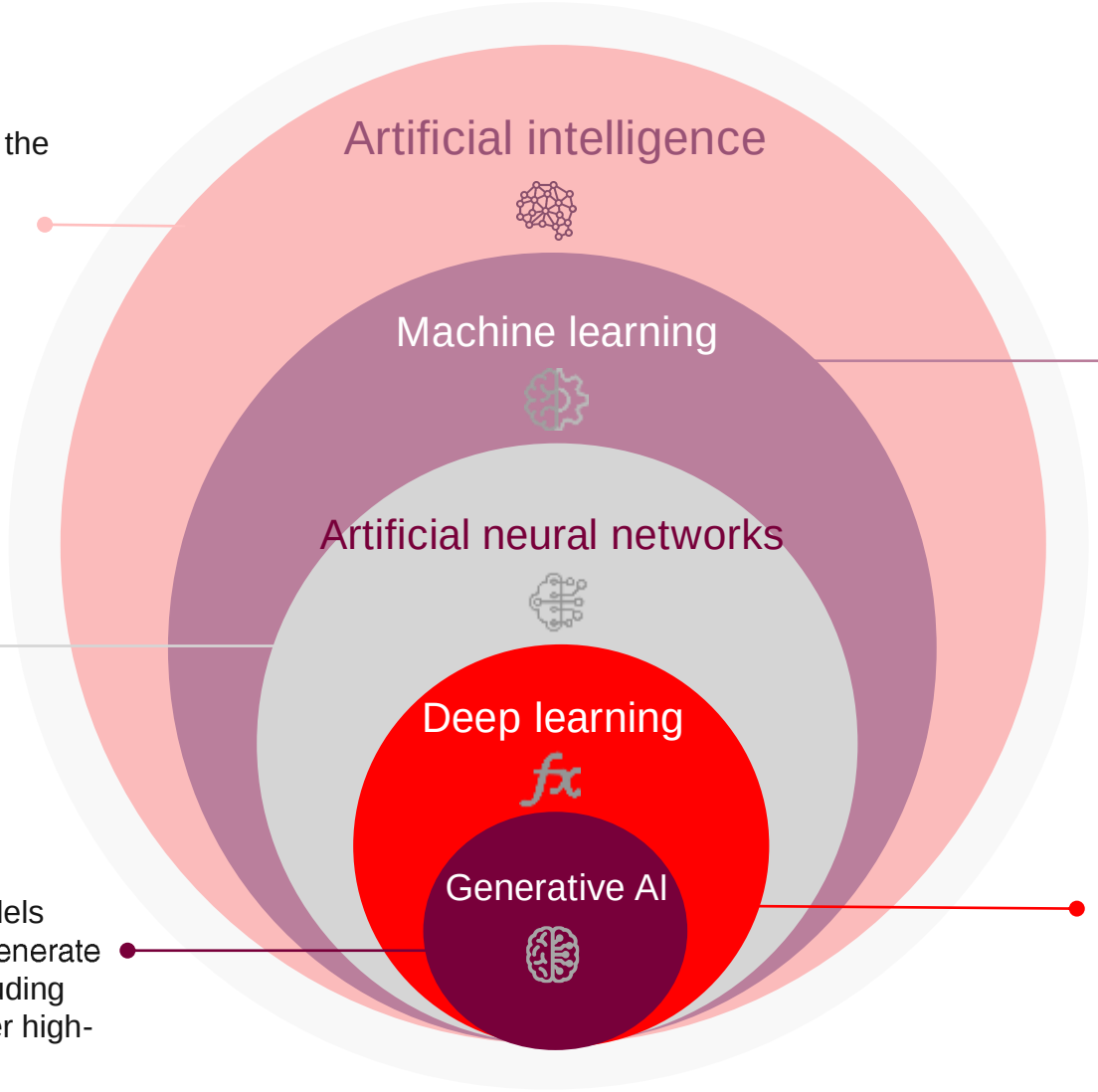
# Artificial intelligence



Artificial intelligence is a discipline that combines computing, data processing and the automatic management of knowledge to resolve complex problems.

Artificial neural networks form a subset of machine learning and they lie at the heart of deep learning algorithms. Both the name and the structure are inspired by the human brain, mimicking the way in which biological neurons communicate with each other. Artificial neural networks must be trained with datasets to learn and they can improve their accuracy as they process more data.

Generative AI refers to deep learning models which, based on raw data, can “learn” to generate more plausible results for each query, including texts, images, video, code, music and other high-quality contents.




Machine learning is a branch of artificial intelligence that focuses on algorithms for intensive data processing in order to learn complex patterns of reality so that it can be shaped.
Some may gradually improve their accuracy as they process more data.

Deep learning is a kind of artificial neural network that uses more complex operators, and it is able to resolve more complex problems with higher quality and less computing time.



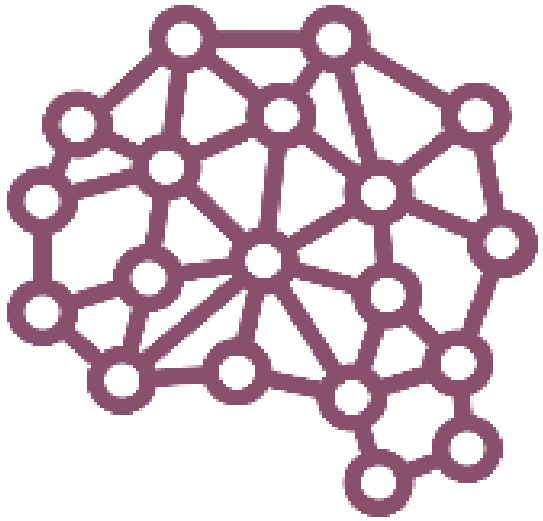
Sources: ACCIÓ, based on IBM, MIT, Dealroom and Databrick

# Convergence of AI and other technologies



The boom of artificial intelligence is linked to the synchronized maturing of several technologies, including:

- Semiconductors and microelectronics
- Data architecture
- Wearable devices and smart sensors
- Cloud and edge



- Connectivity and networks (5G)
- Supercomputing
- Quantum
- Blockchain

- New space

Source: the authors

# Applications of artificial intelligence



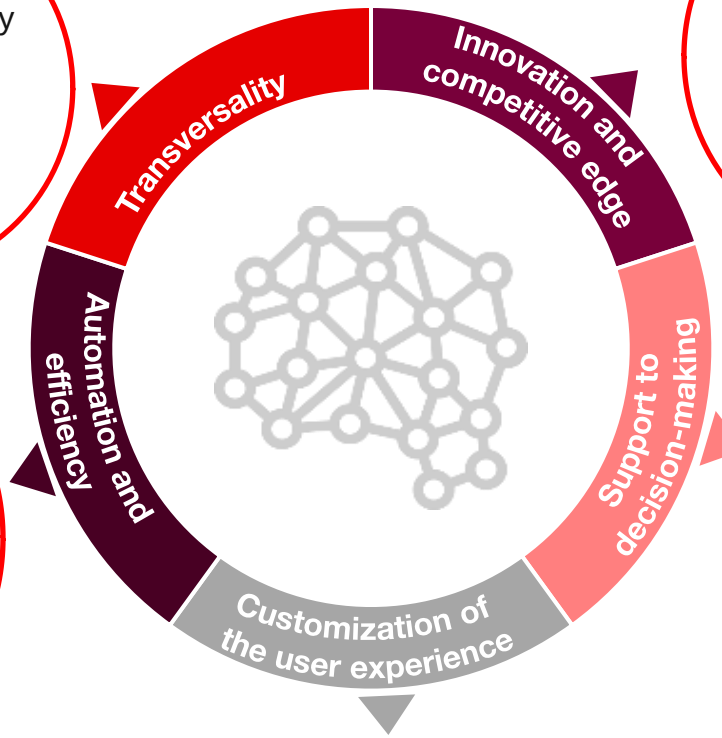
- HEALTH
- MOBILITY AND LOGISTICS
- ENERGY
- E-COMMERCE
- EDUCATION
- INDUSTRY
- AGRICULTURE
- SOCIETY
- FINANCE AND BANKING
- CYBERSECURITY
- MARKETING
- CULTURAL INDUSTRIES
- SECURITY
- ENVIRONMENTAL SYSTEMS
- ART AND CREATIVITY

# Importance of artificial intelligence



The impact that AI will have on the markets and business models will be far-reaching. AI will be key to the Industry 4.0 revolution and the creation of added value in all market segments. It's a technology from which many industries will benefit, including sectors such as cybersecurity, telecommunications, banking and e-commerce.

AI has strategic value that can reduce costs and improve productivity. Industries that adopt AI technologies can acquire a competitive edge by being more streamlined, innovative and better able to adapt to rapidly evolving environments. AI permits faster and more accurate product development by simulating and modeling various scenarios. It helps identify design flaws, predict outcomes and rationalize the innovation process.




AI permits process and production automation, predictive maintenance and smart inventory and energy consumption management, as well as demand planning and the optimization of the entire supply chain. RPA (robotic process automation) or software robotics uses automation techniques in transactional tasks and it can accelerate the digital transformation.

Smart decision-making support systems are complex systems that combine different predictive, descriptive or reasoning-based models that can process knowledge and data in an integrated manner and help organizations make decisions ranging from those on a more operational level, such as predictive maintenance, to more strategic ones, such as designing new products and anticipating potential unwanted scenarios.

In areas such as retail sales, marketing and e-commerce, AI-based systems can help understand users' preferences and behavior. This facilitates personalized recommendations and tailored customer service bots to improve the user experience and seek customer loyalty. In public administration, AI can use these customized recommendations to build proactive systems that improve citizen satisfaction by better meeting their needs.

Source: ACCIÓ

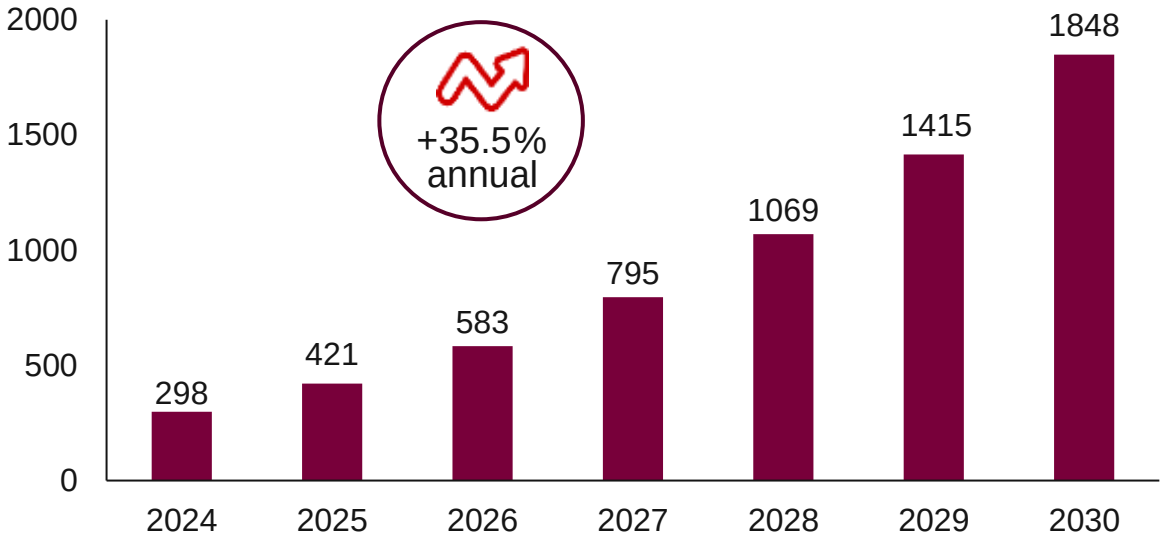
# 2. World artificial intelligence market

# Global data and prospects for AI



On a global scale, a significant increase in the contribution of AI to the GDP is predicted until 2030, related to the sustained growth of investment and the development of AI by companies, which are placing increasing importance on it in order to enter new markets with new business models.

## Evolution of the volume of the world AI market (thousands of millions of dollars)




With annual growth amounting to 35.5%, AI is expected to achieve a 1.85 trillion-dollar market value by 2030.



An increase in the GDP is expected in Europe, resulting in a total of 84 thousand million dollars, which will be reflected in annual growth amounting to 15.9% between 2024 and 2030.

Sources: Statista and BCG

# Main regions of importance in the world



All the regions will experience the benefits of AI by 2030, especially Asia and North America.



## Asia

Has established itself as the leading region in the AI market

China, South Korea, Singapore and Japan have made major investments in AI R&D and implementation, placing Asia second in the global ranking.





## The Americas

At the forefront of AI adoption and innovation

North America will hold the highest market share in the world until 2030 in terms of AI adoption, thanks to the development of generative AI.





## Europe

Sustained growth until 2030 and great potential for innovation in AI

Europe is establishing itself as one of the most powerful regions in terms of AI innovation, with the United Kingdom, France and Germany as the leading countries.

The EU has a pioneering regulatory framework which is expected to bring advantages to local companies.



Sources: Statista, PwC, AGP Frost and ITA

# Leading global AI companies (by turnover)






With presence in Catalonia

Source: Statista

# 3. Generative artificial intelligence

# Definition of generative artificial intelligence



Generative AI is the branch of AI refers to deep learning models which, based on raw data, can “learn” to generate more plausible results for each query, including texts, images, video, code, music and other high-quality contents.

- Automatic generation programs are programmed for use in a variety of fields, including the design of drugs, new material compositions and synthetic data generation.
- This technology uses non-supervised and semi-supervised learning to identify the abstract or underlying pattern of the input request to generate unique content, such as text, software codes, images, audio and video.
- An auto-generation program uses algorithms powered by machine learning/deep learning to create systematized and optimized human-like output.



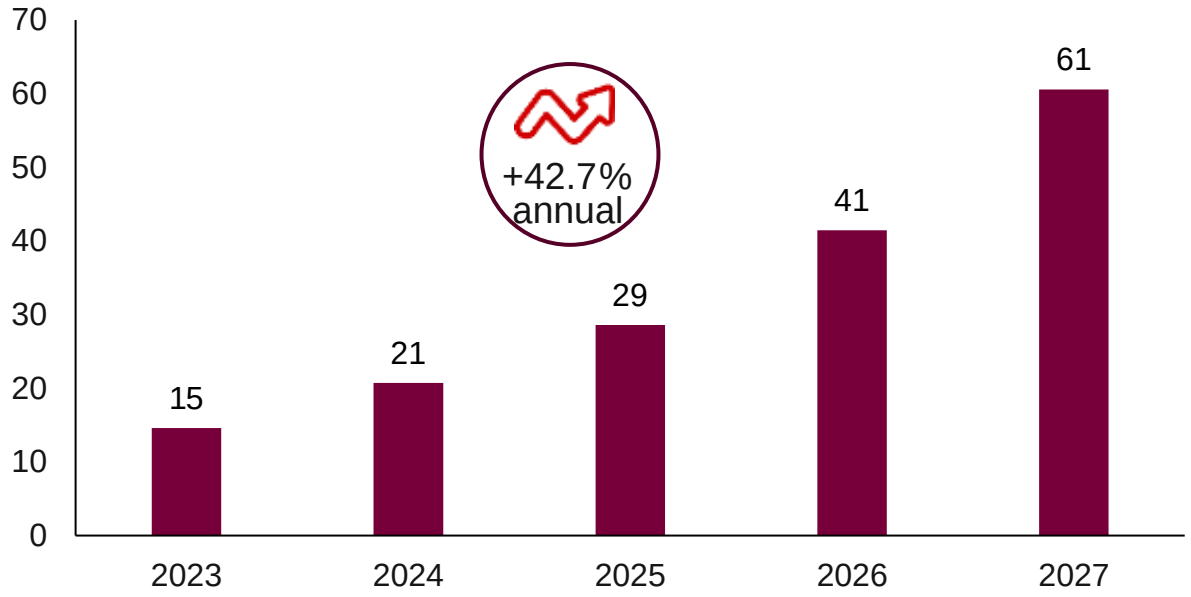
Sources: CIDAI, IBM, MIT, CBI, Dealroom and Databrick

# Potential market for generative AI



A significant increase in the potential market for generative AI is expected, thanks to the evolution of learning models that have led to major improvements in the creation of content, mainly in the form of text, images, audio and video.

## Evolution of the global generative AI market (thousands of millions of dollars)




Growth of the market due to the rapid adoption of generative programs in various areas of application and industries such as the media, entertainment and information technology.

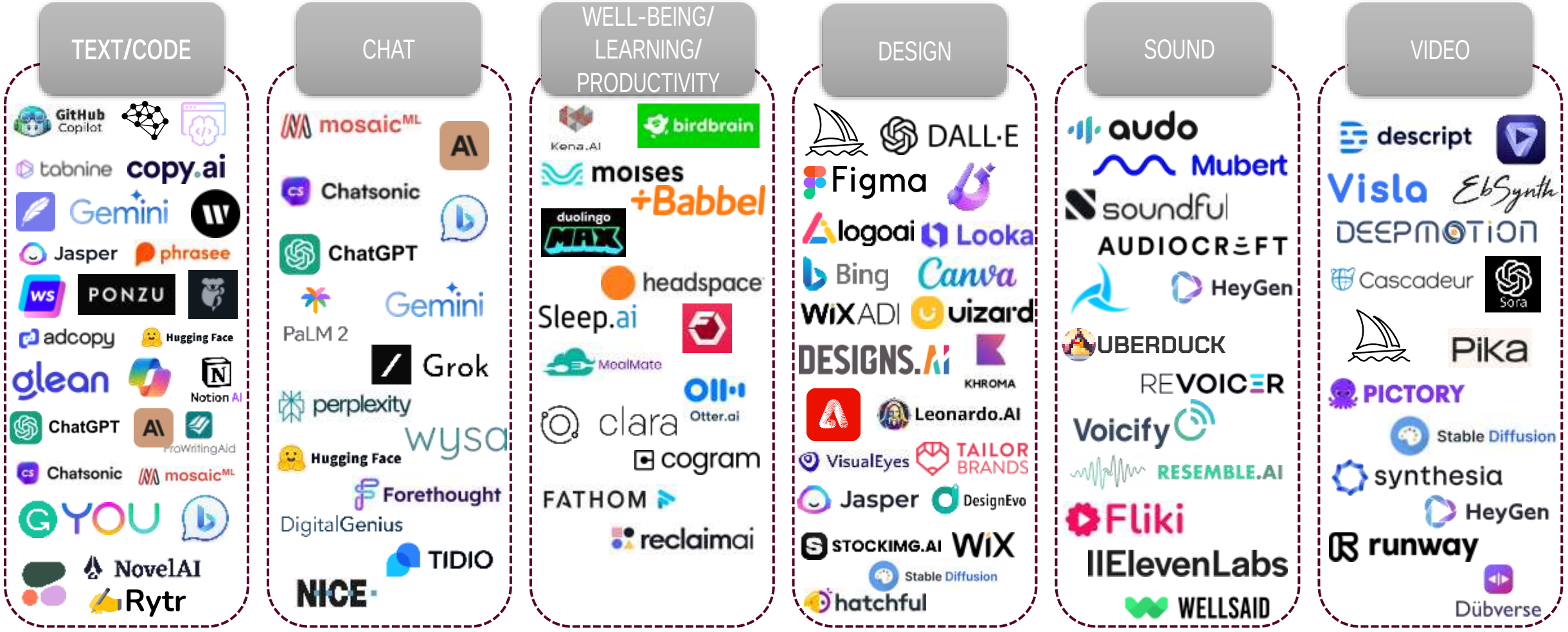
The improved self-generating models will increase usage and the applications in several new fields.



Source: Frost & Sullivan

# Main generative AI apps






Partial illustrative image.

Source: the authors

# Impact of generative AI in the main regions



North America is the world leader in the adoption of generative AI programs.



## Asia-Pacific

The regional market, which includes the technologically experienced and rapidly-growing economies of China and India, is expected to grow at the highest rate worldwide.

With platforms like ChatGPT blocked in China, local companies are producing native generative AI tools which are compliant with the strict local regulations and based on local reference data.

Homegrown Baidu has launched its generative AI chatbot called ERNIE Bot.



## North America

North America has the highest number of patents submitted in the world, positioning itself as the leader in the global market.

The synthetic generation of text-based messages and images covers approximately one third of all the marketing communication of large companies in the region.



## Europe

Europe is poised for rapid and high adoption, but new regulations for generative technologies have been proposed and they may have an impact on their development and implementation.

The debate on compliance with the directive on data protection and intellectual property is still going on.

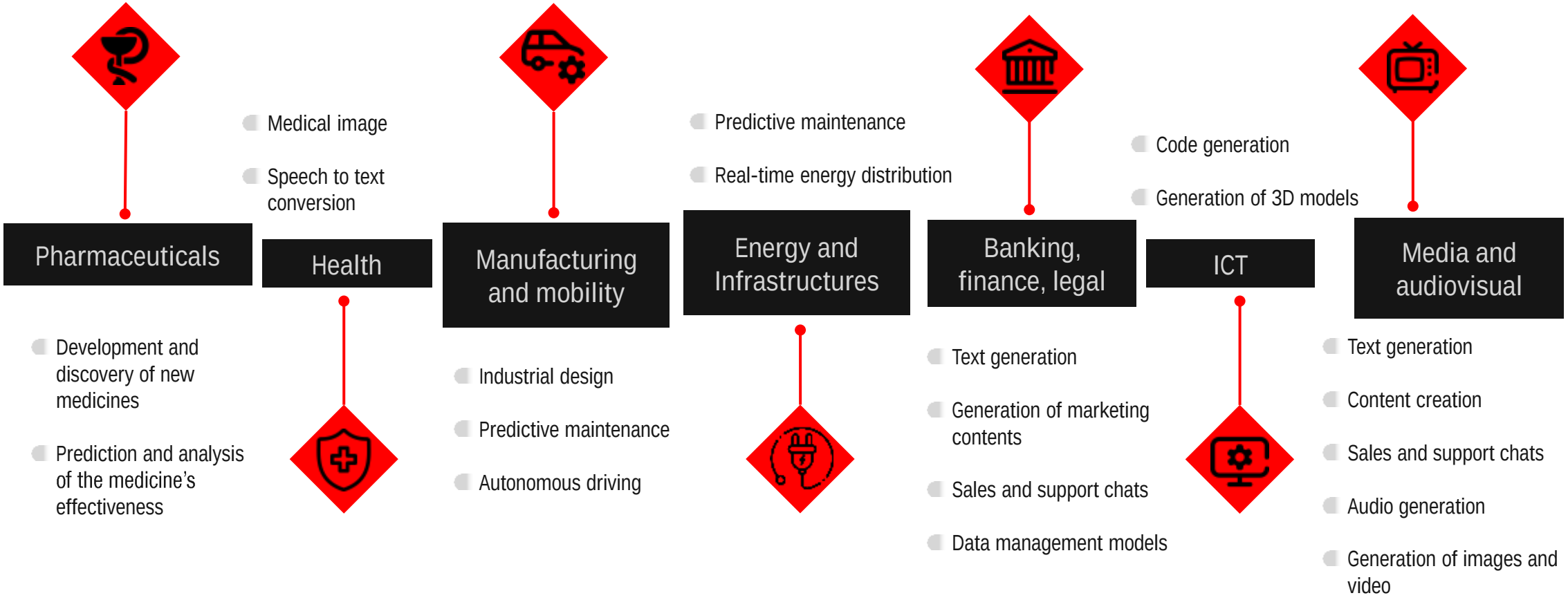
The Stability AI startup based in London has developed Stable Diffusion, a generative AI image generator.

Source: Frost & Sullivan

# Applications of generative AI



The main applications are expected in the field of written contents, support for content creation, video and audio generation. Code generation is another area in which it can prove highly useful.

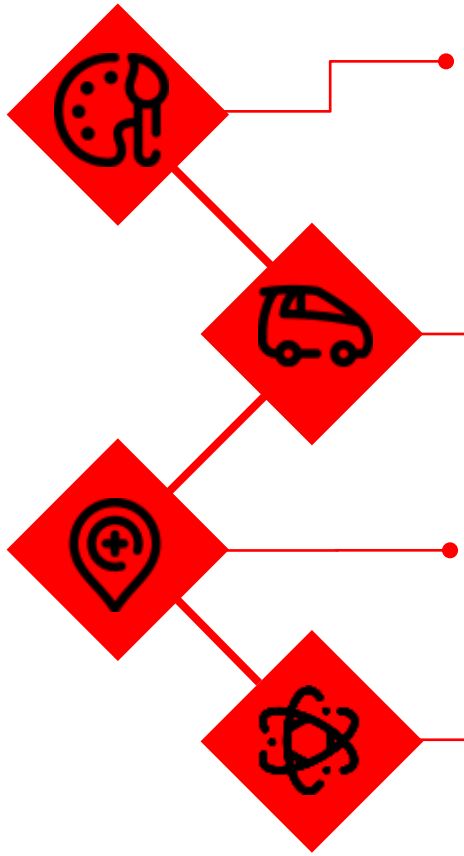



Sources: Frost & Sullivan, CB Insights, McKinsey and Dealroom

# Trends and challenges stemming from generative AI



## Trends



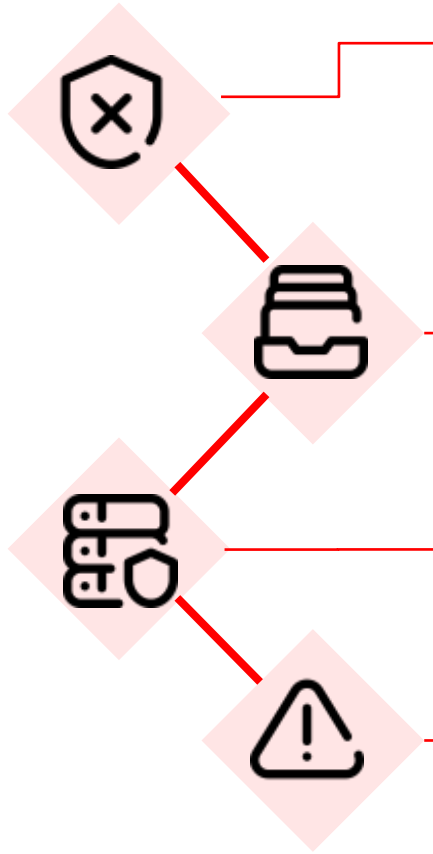
### New models
Language models, text-to-image models, dialog and conversational models, music composition, content creation.
SLM, small language models that are more manageable, allowing better adaptation.

### Autonomous driving
Autonomous driving is largely based on AI, machine learning and artificial neural networks.

### Bio/Health
Medicine is one of the fields with the greatest potential for growth. Customized medicine, medical imaging, design of new drugs, etc.

### Synthetic data
Synthetic data aren't based on the observation of any real phenomena and they can be used to train models, constituting an interesting and rapidly expanding trend.

## Challenges



### Cybersecurity
Cybersecurity risk protection tools display certain weaknesses (flaws, shortcomings, etc.) when it comes to protecting generative AI applications.

### Data
The need to create more synthetic data and change the way in which models are trained.

### Privacy and intellectual property
How to restrict access to sensitive data and respect authorships.

### Ethics
How far can AI go? Limitations, regulations and restrictions.

Sources: Frost & Sullivan, CB Insights, McKinsey and Dealroom

# 4. Artificial intelligence ethics and regulatory framework

# Ethics in AI. What risks does AI entail?

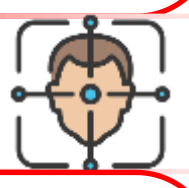


AI offers great opportunities and endless applications in multiple fields. However, it's a technology that entails risks and doubts in the ethical field when it comes to applying it. The risks that AI may entail include:



Algorithmic biases: gender, ethnicity, origin, age, etc.

Inappropriate uses that threaten fundamental rights: facial biometric recognition, access to and use of private data, violations of copyright in the use of data for training, creation of fake images, news and videos, hacking, a lack of transparency in apps or devices using AI, etc.





Unpredictability and legal liability: AI displays great complexity, autonomy and self-learning capacity, thus posing a challenge in the legislative field (predictability of the standard); compensation for wrongful injuries or damage to a person or property; there is no clear regulation regarding copyright for AI creations.

Lack of human control over autonomous intelligent systems that use AI (e.g. autonomous vehicles).






Underuse and overuse of AI: lost investment opportunities regarding AI, lack of use (distrust) and excessive use (uselessness of applications) can entail budgetary and competitive risks.

Rethinking and automation of jobs: the use of AI will substantially impact and transform workplaces based on automatable tasks and precipitate the reshaping of others. Jobs regarded as automatable will undergo a loss of prestige.



Source: European Parliament, based on *AI: threats and opportunities and AI ante portas: legal & ethical reflections*

# AI Act: the European Union leading the world



- On 13 March 2024, the European Parliament approved a proposal for harmonized rules with regard to artificial intelligence (the so-called **"AI Act"**). The Regulation seeks to ensure that AI systems deployed and used in the EU are secure and that they respect fundamental rights and the EU's values. This historic legislation also aims to stimulate investment and innovation in AI in Europe. Its application is expected to begin in 2026, with the exception of the most restrictive cases, which will apply as early as 2025.
- A layer of horizontal legal protection is established in the use and commercialisation of AI, with different prohibitions and obligations, depending on the level of risk of the AI systems: limited risk (with transparency and consumer information obligations), high risk (which must meet strict security and technical requirements for access to the market), and prohibited or unacceptable risk (which are not allowed, e.g.: cognitive-behavioral manipulation).





**Categorization and examples of supplier obligations in accordance with the level of risk of AI systems**

| Limited | High Risk | Unacceptable |
|---|---|---|
| Obligation Transparency | AI security accreditation | Cognitive-behavioral manipulation |
| Recognition AI authorship | Technical guarantee and fundamental rights | Social score and predictive policing |
| Information for users | Reinforced Responsibilities suppliers | Recognition of emotions and biometrics |

Source: Council of the European Union

# Artificial intelligence initiatives in Spain



## Digital Spain Agenda 2026

The National Strategy for Artificial Intelligence (ENIA) assigned **€600 M** of initial investment in the 2021-2023 period to over **250 projects**

## Territorial Technological Specialization Networks (RETECH)

The AI RETECH initiative is intended for 13 digital transformation projects throughout the territory.

**€259 M** in mobilized investments of the

**€500 M** of total investment allocated to the program

## EECTI 2021-2027

The 23 strategic lines of the 2021-2027 Spanish Science, Technology and Innovation Strategy (EECTI) include the specific AI line.

## Fund - ICO Next Tech

Initiative that acts primarily in the digital and AI sectors

Fund endowed with **€4,000 M**

## PRTR - Next Generation EU

Component 16: National AI Strategy with a **€540 M** budget is exclusively assigned to artificial intelligence.

## KIT Digital

An instrument that subsidizes the implementation in companies of digital solutions such as AI to achieve significant progress in the level of digital maturity.

Sources: Ministry of Economy and Business, Ministry of Economic Affairs and Digital Transformation

# Initiatives in Catalonia related to ethics in artificial intelligence



## The OEIAC's PIO self-assessment model



In coherence with the European Regulation of the AI Act and within the framework of the Catalan Catalan.AI Strategy, the Catalan Observatory for Ethics in Artificial Intelligence (OEIAC) has implemented a PIO self-assessment model (Principles, Indicators and Observables) designed for any public or private institution and any user considering the use of AI technologies and wishing to evaluate the risks and benefits of using this technology. Using the answers to 70 questions/indicators based on seven ethical principles, the model provides observable and quantifiable results. This self-assessment model can therefore measure the AI's degree of compliance with the principles and ethical guidelines and generate an indicator/meter.

## Catalan charter for digital rights and responsibilities

The Catalan charter for digital rights and responsibilities includes human rights accepted until now that require an updated implementation with their digital version (digital rights). Likewise, a perspective of expanding fundamental freedoms is taken into account in order to contribute to the construction of emerging rights. The digital rights and responsibilities proposed in the charter are addressed to society as a whole and all natural and legal persons, including companies, non-profit organizations and public institutions. It is a declaration of rights undergoing constant construction which is open to the public. The areas covered by the charter include universal Internet access; an open governance model; freedom of expression; digital innovation; data protection; guaranteed skills and digital inclusion; mechanisms for safeguarding digital rights; and ethics in the field of AI and algorithmic governance in the public and private sector.

Sources: OEIAC and Ministry of Digital Policies and Public Administration

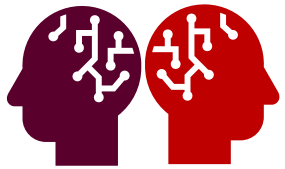
# 5. Opportunities and challenges stemming from artificial intelligence

# Opportunities and challenges stemming from AI



## Opportunities

- Improved productivity, new capabilities and enhanced calculations
- Disruptive, cross-cutting, democratizing and accessible technology
- Key to the 4.0 and 5.0 revolutions
- Public institutions and the private sector are committing to AI
- Technological cooperation with developing regions



## Challenges

- Increased consumption of resources such as energy and water
- Changes in the labor structure and increasing inequalities and digital divide
- Increased cybersecurity risks
- A new geopolitical weapon in a fragmented world
- Generation of fake news putting political regimes at risk

Source: the authors

# 6. Artificial intelligence in Catalonia

# Mapping of the artificial intelligence ecosystem in Catalonia



488 companies +173%*

2,155 million euros +59 %*

14,525 jobs +71%*

87.8% are SMEs.

55.3% are less than 10 years old.

43.9% are startups.

38.5% invoice more than one million euros and 16.8% invoice over 10 million euros.

27.3% are exporters.

Developed technology includes machine learning companies (57.8%) and AI platforms (31.8%), and the sectors of application include services (45.1%) and industry (40.8%)**.



*With respect to the mapping data obtained in 2019.

**Companies may be classified for more than one technology and sector of application.

Source: ACCIÓ (2023 company data; turnover and number of employees in 2022)

# Leading artificial intelligence companies in Catalonia (I)



## According to the area of technological specialization

### Generative AI

IBM, Microsoft, GFT, amazon, ORACLE, minsait

### Chatbots

Microsoft, amazon, ORACLE, Landbot, mediktor, innovamat

### Voice and image recognition

NPAW, partium, pervasive technologies, eodyne, Lobelia., bookline, GALGOMEDICAL, RICOH imagine. change., doceoademptio, DERMAVISION, tensormedical, SPACE SUR

### Machine learning

IBM, orange, vodafone, COSTAISA, stratesys, minsait, amazon, GPAINNOVA, Google, idneo, Schneider Electric, Microsoft, inetum, RED POINTS, ORACLE, LABAQUA, vlex, PICVISA, knowmad mood, AIS GROUP, GRUPO AIA, Telefónica, DAVANTIS, M1, AG Solution, sas, Landbot, UVE, neural labs, gmv, nostrum biodiscovery, CISCO, asho, pervasive technologies, AQUILES, SAMSUNG Zhilabs, connecthink, OMNIOS

### Robotics

SADAKO, FANUC, KUKA, hp, PAL ROBOTICS, ARITEX, HOMAG, THEKER, ABB, SALTO

### Text analysis

Telefónica, Microsoft, vodafone, inetum, CISCO, Google, dynatrace, IBM, stratesys

### Data security

ORACLE, IBM, inetum, NTT DATA, SEIDOR, Microsoft, Telefónica, minsait, SAP, salesforce

### Platforms

Telefónica, Microsoft, amazon, orange, hp, Schneider Electric, SNGULAR, knowmad mood, accenture, vodafone, idneo, RICOH imagine. change., IBM, Google, salesforce

### Consultancy

NTT DATA, pwc, SAP, accenture, salesforce, Deloitte., minsait, Atos, T-Systems, QUANTION, GFT, SEIDOR, Capgemini

### IoT/sensors

Microsoft, vodafone, inetum, WORLD SENSING, orange, AEInnova, hp, Schneider Electric, minsait, LABAQUA

### Computer vision

FICOSA, IRIS, CONTER, RICOH imagine. change., SADAKO, Microsoft, bcnvision, PICVISA, allread, Sentinel

### Cloud

orange, Telefónica, SAP, amazon, Microsoft, CISCO, IBM, vodafone, salesforce, Google, ORACLE

Note: partial illustrative image

# Leading artificial intelligence companies in Catalonia (II)



## According to the sector of application

### Health




### Industry




### Mobility




### Finance




### Culture, leisure and experiences




### Resources




### Services




### Consultancy




Note: partial illustrative image

# Agents of the AI ecosystem in Catalonia



**Technological centers and research institutes**

BSC · CIT UPC · Institut de Recerca CONTRA LA LEUCÈMIA Josep Carreras · CRG · CVC · easy · i2cat · IDEAI · IREC · LEITAT · CETAQA · CREAF · ICN2 · crag · D.A.S · eXiT · ICFO · IIIA-CSIC · CIMNE · CRM · ICRA · ttc · eurecat · GREia · inLab FIB · IRTA · IRI

+72 AI-intensive research groups

**Universities and training centers**

arol.dev · BIT · esade · ubiqum · Universitat de Girona · UVIC · Universitat Politècnica de Catalunya BarcelonaTech · Universitat Ramon Llull · Universitat Rovira i Virgili · akademy.AI · laSalle · UAB Universitat Autònoma de Barcelona · Universitat de Barcelona · Universitat de Lleida · ulc barcelona · UOC · upf. Universitat Pompeu Fabra Barcelona · Universitat Abat Oliba CEU · IESE

**Networks and facilities**

BIST · DIH4CAT · Digital Impulse Hub · AIRA · DCA · DFACTORY · i4KIDS · ellis · X4HPC · XTS Xarxa Salut · RDI·IA · xiscat

**Associations, clusters and ventures**

BCN.ai · CATEI · Clúster Digital · CIVICAi cat · EduTech Cluster · FINTECH · informaTICa · Tech Tourism Cluster · tecnio Associació · SINERGIA · CIOs.cat · acia · BB · BCN ANALYTICS · CLÚSTER AUDIOVISUAL DE CATALUNYA · ciac · in-move · secpho · Secartys · SMARTECH CLUSTER · Toch Barcelona · Clúster TIC Catalunya Sud · upf. Ventures

**Fairs and congresses**

4YFN · ADVANCED FACTORIES · CCIA · EdTech Congress · integrated systems europe · IOT Solutions World Congress · tRAIN · sonar 2024 +D · AI&BIG DATA CONGRESS · Barcelona Deep Tech Summit · Decoupling Barcelona Symposium · Forum TurisTIC · MWC Barcelona · SMARTCITY EXPO WORLD CONGRESS · Tech Spirit Barcelona · PATIENT CONGRESS

**Institutions and public administration**

Generalitat de Catalunya · ACCIÓ · Generalitat de Catalunya Centre de Telecomunicacions i Tecnologies de la Informació · Generalitat de Catalunya Secretaria de Polítiques Digitals · ICF Institut Català de Finances · avançsa · EIAC · fcri Fundació Catalana per a la Recerca i la Innovació · CIDAI Centre of Innovation for Data tech and Artificial Intelligence · tecnio Associació · TIC Salut Social · Barcelona Activa · AGAUR Agència de Gestió d'Ajuts Universitaris i de Recerca · CERCA Centres de Recerca de Catalunya · ViT · biocat · FIP

ACCIÓ Catalonia Trade & Investment

Generalitat de Catalunya Government of Catalonia

Source: ACCIÓ

CataloniaConnects

# AGAUR AI research groups in Catalonia



UPC: DiCODE, DCCGeom, SISCOM

IDEAI: RRIIS, VIRVIG, BIOCOM

IRI: PMR, RAIG

Universitat de Barcelona: AIBA, GIADS

UAB Universitat Autònoma de Barcelona / CVC Computer Vision Center: LAMP, CICS, Vis-AD, MACO, DocAI

upf. Universitat Pompeu Fabra Barcelona: IA&AA, COLT, TALN, CCN, NeuroADaS, IMVA

Universitat de Girona: AIA, LogIA, SITES, CIRS, LEQUIA

Universitat Rovira i Virgili: ITAKA

Universitat de Lleida: GREiA

Universitat Ramon Llull: laSalle, SRG Smart Soc

UVIC Universitat de Vic Universitat Central de Catalunya: TDS

UOC Universitat Oberta de Catalunya: GRECIL, AIWELL-CoSIN3

IIIA-CSIC Institut d'Investigació en Intel·ligència Artificial

BSC: HPAD, MPiEDist, CompBIO+NLP, SSAS, ACAP, CompGen

eurecat Centre Tecnològic de Catalunya: DINANMAT, AAI, Dit-Health, GTA

i2cat: SNS, DIA, AI-dSystems

IBEC: Smart-nano-bio-devices

ACCIÓ Catalonia Trade & Investment

Generalitat de Catalunya Government of Catalonia

Font: ACCIÓ i Karina Gibert, adaptat d'AGAUR

CataloniaConnects

# Initiatives to promote AI in Catalonia



CATALONIA.AI

Actions to turn Catalonia into a hub of innovation, leadership and talent attraction and companies in the field of AI.

AIRA

Partnership to promote excellent inter-disciplinary international research and talent management through new attraction and retention mechanisms.

DCA Digital Catalonia Alliance

Initiative that brings together the main emerging technological sectors in Catalonia in a partnership of innovative, visionary, disruptive and collaborative technological communities.

CIDAI Centre of Innovation for Data tech and Artificial Intelligence

Axis of the Catalan AI strategy to promote the development of collaborative projects and the transfer of knowledge of innovative solutions in applied AI.

EIAC

Initiative to study the ethical, social and legal consequences, the risks and the opportunities stemming from the implementation of AI from a transdisciplinary-transversal standpoint.

Aina

AI project that seeks to generate corpus and computer models of the Catalan language.

DIH4CAT Digital Innovation Hub de Catalunya

A connected network of assets, infrastructures and knowledge in Catalonia geared towards testing and experimenting with advanced digital technologies.

Salut/IA

Program for the promotion and development of AI in the health system from an ethical standpoint, respecting privacy and ensuring compliance with fundamental rights and non-discrimination.

XARXA RDI·IA

Instrument to equip the Catalan AI ecosystem with technological transfer mechanisms and knowledge valorisation.

# The Government of Catalonia promotes the first response chat based on generative AI in Catalan

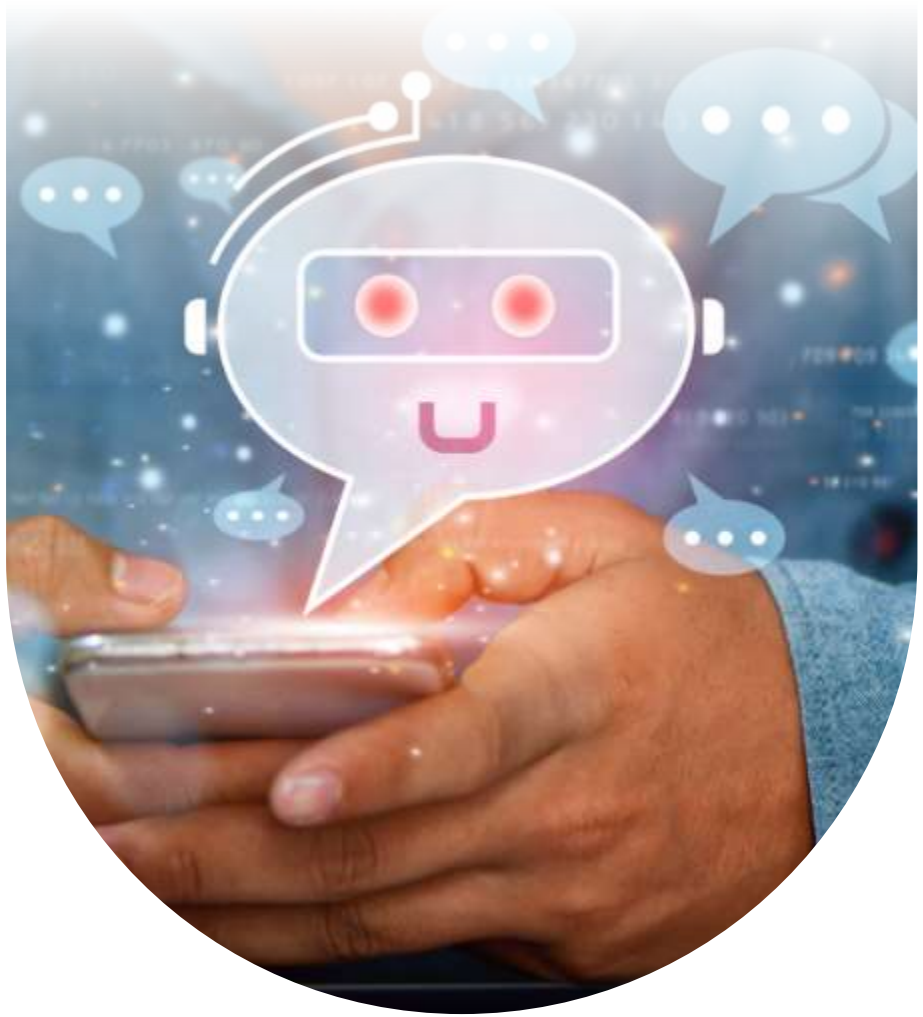


- The Government has launched the first generative artificial intelligence chatbot in Catalan, based on the artificial language of the Google Cloud's Vertex AI platform. It's an experimental project created in partnership with the Secretariat of Telecommunications and Digital Transformation, the Ministry of Business and Labor, Capgemini and Google Cloud.

- The application of this generative artificial intelligence project in Catalan will begin to generate automatic responses to the queries, complaints and suggestions that citizens send to the Business Management Office (OGE) of the Government of Catalonia. Given that it's an experimental system, in order to guarantee the quality of the information, the OGE staff will review the answers generated by the system.

- The agreement between the technology companies and the Government will enable the rest of the market to exploit the generation of intelligent automatic responses in Catalan for any area and business sector.

This system seeks to reduce the response time to citizens and improve public services, with the aim of endowing the Administration with flexibility, innovation and technological solutions focused on people's needs. The aim is also to achieve greater content creation in Catalan based on generative AI and the new digital tools.



Source: Open Administration of Catalonia (AOC)

Google Cloud Vertex AI OGE Oficina de Gestió Empresarial

ACCIÓ Catalonia Trade & Investment

Generalitat de Catalunya Government of Catalonia

CataloniaConnects

# Catalonia is a benchmark in Horizon Europe AI research projects



## AI projects in Catalonia

**95** projects

**65** million euros

**3.5%** of the European total

**31.9%** of the total for the whole of Spain

**74** institutions

*the main ones are highlighted

## Ranking by regions

1. Île-de-France
2. Upper Bavaria
3. **Catalonia**
4. Community of Madrid
5. Attica




Note 1: Includes Horizon Europe projects (2021-2023) related to artificial intelligence, machine learning, deep learning, natural language processing and computer vision.

Note 2: Catalonia is under-represented, given that the centers associated with the CSIC, such as the IIIA (located in Cerdanyola del Vallès), take into account all the projects and funding to the Community of Madrid.

Source: Horizon Europe

# Technological hubs in Catalonia focused on AI in 2023





**140 technological hubs** of foreign companies

+11% compared with the previous year

5,200 new jobs

**€500 M** turnover

## Some of the most representative hubs in Catalonia focused on AI:

AstraZeneca, Boehringer Ingelheim, Cisco, dynatrace, Fujitsu, HP, IBM, Microsoft, Nestlé, NTT DATA, Ocado Technology, Oracle, PepsiCo, Salesforce, Sanofi, Schneider Electric, SEAT:CODE, T-Systems, Volkswagen

## United States

(with 28% of all hubs) the main source country for investment in these centers, followed by Germany (17%).

## 59% of hubs

come from companies in European countries.

## AI (87%)

is one of the technological fields in which hubs are developing their most frequent services.

Source: Mobile World Capital Barcelona, ACCIÓ, Barcelona City Council: “Tech hubs overview”

# Barcelona, 1st city in southern Europe in terms of funding rounds completed by AI startups



- Barcelona is the leading city in southern Europe and the 6th most important European one by completed funding rounds in artificial intelligence startups, behind only London, Berlin, Paris, Amsterdam and Munich and ahead of Stockholm, Zurich and Madrid.
- Barcelona's startups have completed 105 rounds valued at 225 million dollars during the 2019-2023 period.

## Main startups in Barcelona

Koa Health, badi, aily, neuroelectrics, IOMED

## Top 10 European cities by completed funding rounds in artificial intelligence startups (2019-2023)




Barcelona's AI startups complete, on average

**1 round valued at 2.1 million euros every 18 days**

Note: pre-seed and seed investment rounds and the A-C series are included; the data refer to the period from 2019 to 2023.

Source: the authors, based on Crunchbase

# Catalonia, a priority European destination for AI FDI projects



Catalonia stood in 5th position as a destination for Foreign Direct Investment (FDI) in western Europe and in 1st position in southern Europe in the 2019-2023 period, with investment totaling 475 million euros and over 3,014 people employed in 31 projects.

## FDI in artificial intelligence in Catalonia (2019-2023)

| Year | Projects | CAPEX (€M) | Employment generated |
|---|---|---|---|
| 2023 | 7 | 289 | 1,648 |
| 2022 | 9 | 105 | 667 |
| 2021 | 12 | 69.7 | 571 |
| 2020 | 1 | 1.5 | 30 |
| 2019 | 2 | 9.5 | 98 |

## Main investment companies in Catalonia and capital invested (2019-2023)

1st NTT DATA €209 M

2nd T €44.1 M

3rd Apple €25.2 M

4th GFT €25.1 M

5th Schneider Electric €24.9 M

6th dynatrace €22.1 M

7th Microsoft €21 M

8th amazon €12.4 M

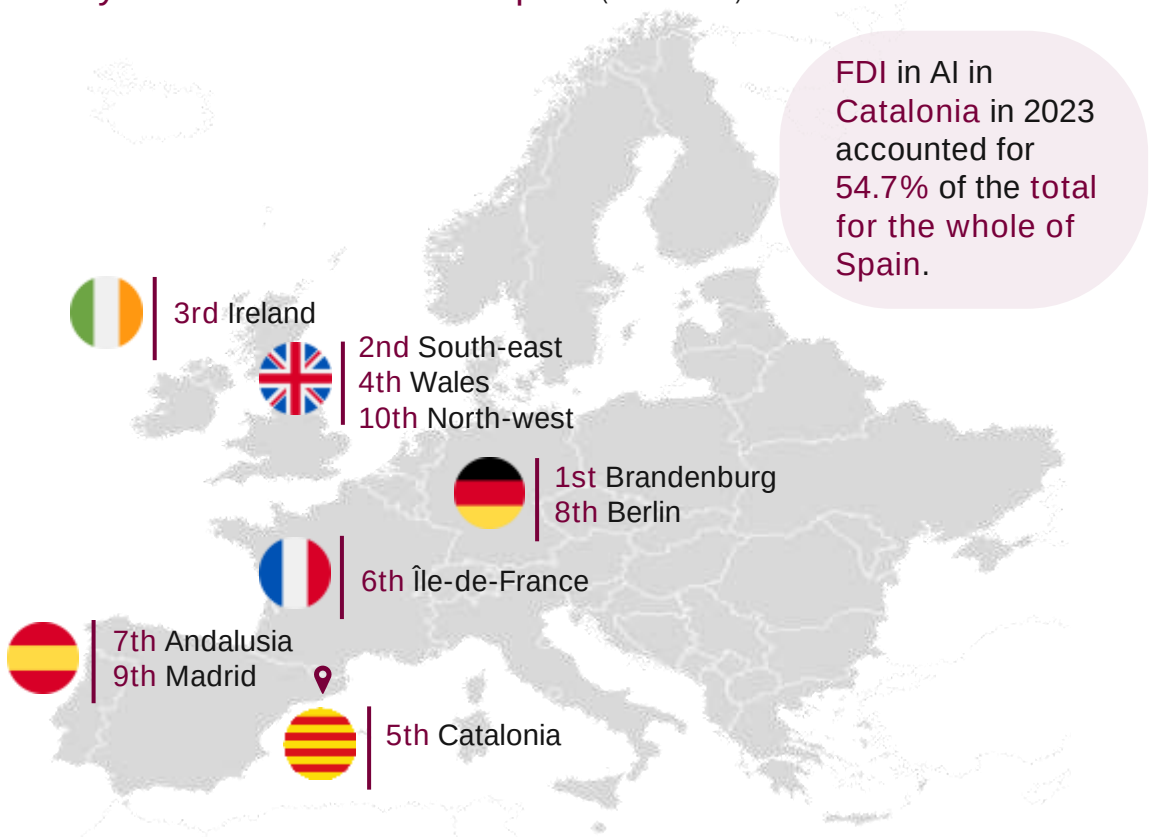
9th sanofi €12.4 M

10th KOCH €8 M

ACCIÓ Catalonia Trade & Investment

Generalitat de Catalunya Government of Catalonia

## Main destination regions of FDI in AI in Western Europe, by volume of invested capital (2019-2023)




FDI in AI in Catalonia in 2023 accounted for 54.7% of the total for the whole of Spain.

Source: the authors, based on fDi Markets

CataloniaConnects

# Catalonia, a dynamic artificial intelligence ecosystem



3rd most important European region in AI Horizon

Local business ecosystem

488 AI companies, with 173% growth

AI turnover equivalent to 0.8% of the Catalan GDP

R&D excellence

Leading AI startups

Barcelona, the leading city in terms of funding rounds for AI startups in southern Europe.

Initiatives that stimulate local AI

Attractive for leading international AI companies

Leading region in southern Europe for foreign investment

ACCIÓ Catalonia Trade & Investment

Generalitat de Catalunya Government of Catalonia

CataloniaConnects

# AI projects with the support of ACCIÓ



Since 2017 ACCIÓ has supported **253 AI projects, funded with 16 million euros**, accounting for **21.25%** of the total aid in the lines listed.

- ✓ **29 R&D Nuclei** projects
- ✓ **13 INNOTEC** projects
- ✓ **22 Techniospring** projects
- ✓ **66 Startup Capital** projects
- ✓ **132 Industry 4.0** projects

Provisional data 2017-2023

**241** beneficiary companies

**262** AI projects with the support of ACCIÓ

**€15,957,402** awarded

**21.25%** of €75.1 M of aid granted

We have 188 Industry 4.0 advisers, **120** of whom are **accredited in AI**.

# AI SWOT in Catalonia



## Strengths

- Strong business fabric
- Pioneering health system and ecosystem
- Consolidated research system
- Host for major events: MWC, ISE, Smart City, Advanced Factories, AI&Big Data Congress

## Weaknesses

- Network of small-scale AI technology providers
- Human factor: lack of training and professional profiles
- Poor availability of quality AI models in the recognition and generation of natural language in the Catalan language
- Uncertainty regarding the legal risk and civil liability

## Opportunities

- Leadership in initiatives and projects
- Development of the Catalonia.AI strategy
- Increasing availability of aid and funding in AI projects
- Creation and development of solutions for different economic sectors

## Threats

- Global market with big competitors
- Lack of data quality.
  Very long model validation cycles.
- Significant technological cost.
  Resistance to change.
- Lack of secure sandbox-type testing environments

Source: ACCIÓ

# 7. Success Cases in Catalonia

# Success Cases in Catalonia



The **Barcelona Supercomputing Center** opens access to MareNostrum5 to AI SMEs and startups

The CARLA simulator of the **CVC**, a benchmark for the development of autonomous driving

**Microsoft** drives the growth of ChatGPT from Barcelona

**Dynatrace** reinforces the development of AI from Barcelona

**Batallé** promotes a project to apply artificial vision to the meat industry

**Insectius** applies computer vision to the production of worms as the protein of the future

The **ICS** uses AI to improve breast cancer diagnoses

The **VHIO** and the **University Hospital of Bellvitge** create an AI-powered tool for brain tumor diagnoses

**Omnios** develops AI-based solutions for the optimization of companies' decision-making

**IOMED**, a benchmark in the processing of hospital data, completes a €10 M round

**MEDIAPRO** launches its artificial intelligence laboratory

**AIS Group** builds a system to predict air cargo demand with AI

**CIDAI** - High Impact Project in sustainable micromobility with Bicing

**Eurecat** applies reinforcement learning to optimize energy consumption and reduce WWTP emissions

**IAG Group** has opened an AI laboratory in Viladecans with 150 employees

# Acknowledgments of institutions



We would like to thank the following bodies for the availability and provision of data and information for the drawing up of this technological report:

CATALONIA. AI
(Catalonia Artificial Intelligence Strategy - CATALONIA.AI)

CIDAI
(Centre of Innovation for Data Tech and Artificial Intelligence)

CVC
(Computer Vision Center)

Eurecat

Google

IDEAI-UPC
(Intelligent Data Science and Artificial Intelligence)

RDI·IA Network

# Thank you!

Passeig de Gràcia, 129
08008 Barcelona

accio.gencat.cat
catalonia.com

@accio_cat
@Catalonia_TI

linkedin.com/company/acciocat/
linkedin.com/company/invest-in-catalonia/

More information about the sector, news and opportunities:
https://catalonia.com/key-industries-technologies/technologies/artificial-intelligence-in-catalonia

ACCIÓ Catalonia Trade & Investment

Generalitat de Catalunya
Government of Catalonia

CataloniaConnects