The Internet Research Center

ANNUAL REPORT 2022

CERCA
Research Centres

ANNUAL REPORT 2022

LETTER FROM THE PRESIDENT

Innovation and digital transformation have an enormous challenge: to leave no one behind

Laura Vilagrà Pons,
President, Minister
of Presidency of
the Government of Catalonia

2022 was a year of changes, challenges and discoveries. In January 2023, I was named the president of the i2CAT Foundation. Becoming the first-ever female president of the centre's Board of Trustees is an honour and a reminder that technology is here to help our society become more inclusive. It needs to cover and work for everyone, whichever their gender, origin, income or residence.

i2CAT has been at the forefront of innovation in Catalonia for almost 20 years. Led by a team that continually strives to reach new heights, the centre has underpinned a reference position in the European research and innovation arena in recent years. This leadership was reinforced by the latest Horizon Europe results: 17 projects and nearly €7M in less than two years. The organisation remains the third institution in Catalonia that has obtained more European funds within the Information and Communication Technologies branch.

Generating knowledge, advancing new technologies, and exploring what is still inconceivable to most is what i2CAT does. Its internationally recognised position in 5G/6G was given another boost in 2022 through the UNICO R&D programme, by which i2CAT has started to develop 19 research projects in advanced 5G and 6G for an aggregate value of nearly €17M. These projects, lasting until the end of 2024, will facilitate access to ultra-fast broadband in Spain and accelerate the deployment of 5G. The centre's research capacity was also recognised in Artificial Intelligence and Space Communications, which, together with 5G/6G, have obtained SGR grants from AGAUR.

The i2CAT Foundation not only holds a leading position in international research but also contributes inestimably to the digital strategies and policies of the Catalan administration. In recent years, it has played a crucial role in promoting initiatives aligned with the 5G, Artificial Intelligence and NewSpace strategies of the Government of Catalonia. The centre's participation in digital and innovation activities is paramount to empower the administration's digital transformation and solve social challenges in the territory. In the European 2030 Digital Compass strategy framework, i2CAT must play a key role in fostering new initiatives with the Government of Catalonia aligned with the vision of a successful digital transformation based on the empowerment of citizens and technological leadership, resulting in a more resilient and prosperous society.

Collaborating with the private sector is also a priority in establishing a genuinely digital society that leverages the power of advanced digital technologies to sustain economic growth. To this end, i2CAT establishes agreements with private companies to co-create and co-develop innovative digital solutions that generate economic and social impact. Last year, 20 private organisations partnered with i2CAT and started their road to innovation.

All these milestones were only possible thanks to the commitment of the talented professionals that make i2CAT. The team has been growing exponentially since 2015, reaching 200 staff in 2022 and almost tripling the number of people who were part of the team in 2019.

The digital society of the future is already here, but we still need to work towards making innovation work for everyone and leaving no one behind. For this reason, the value offered by i2CAT and its contribution to advancing the digital transformation of Catalonia is invaluable.

I would like to congratulate the i2CAT team on the excellent results of 2022 and invite them to continue fortifying our research and innovation ecosystem.
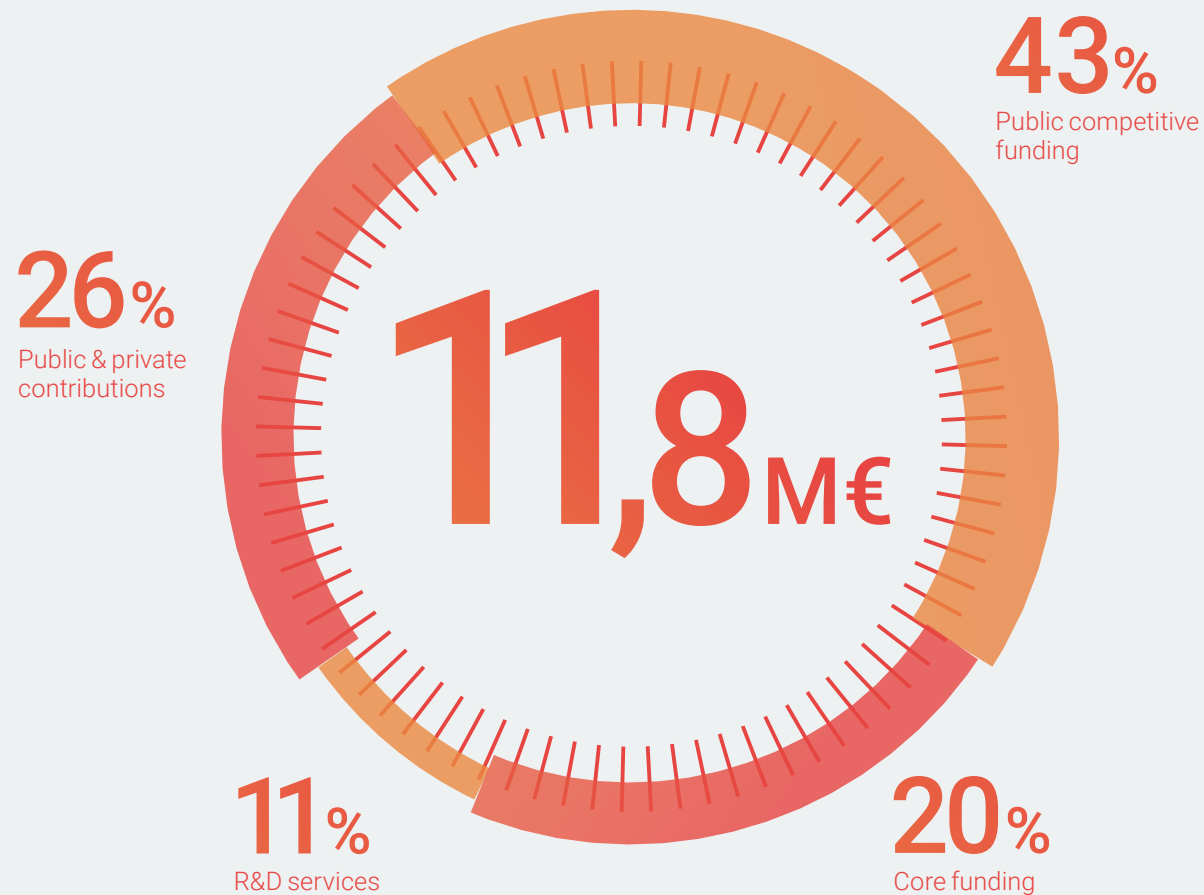
FACTS
& FIGURES

FACTS & FIGURES

Funding

43% Public competitive funding

26% Public & private contributions

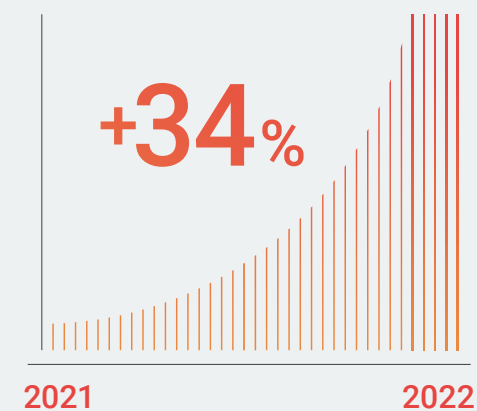**11,8**M€

11% R&D services

20% Core funding

Growth rate

+34%

2021   2022

New projects and contracts

158 Project proposals submitted

38 New competitive projects

20 New contracts with companies / organisations

Horizon Europe results

Total success rate:

24,66%

2022 funding:

6,8M€

17 new projects
granted under the Horizon Europe funding programme

COORDINATOR:

INTEGER
INTERCONNECTING 4 HELIX INNOVATION
ECOSYSTEMS IN EUROPEAN REGIONS

TECHNICAL LEADER:

XGain   XReco
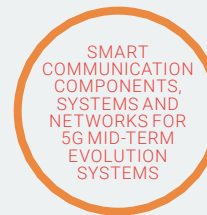
10 projects:
Pillar II - Global challenges & European Industrial Competitiveness.

1 project:
Pilar III - Innovative Europe

6 projects:
6GSNS (Smart Networks and Services Joint Undertaking)

SMART COMMUNICATION COMPONENTS, SYSTEMS AND NETWORKS FOR 5G MID-TERM EVOLUTION SYSTEMS

RESEARCH FOR REVOLUTIONARY TECHNOLOGY ADVANCEMENT TOWARDS 6G

SNS EXPERIMENTAL INFRASTRUCTURES

LARGE-SCALE SNS TRIALS AND PILOTS

Stream A
(2 PROJECTS)

Stream B
(1 PROJECT)

Stream C
(2 PROJECTS)

Stream D
(1 PROJECT)

R&D projects in execution

Total **148**

45
R&D on-demand services

83
Competitive projects

20
Strategic projects and initiatives with public administrations
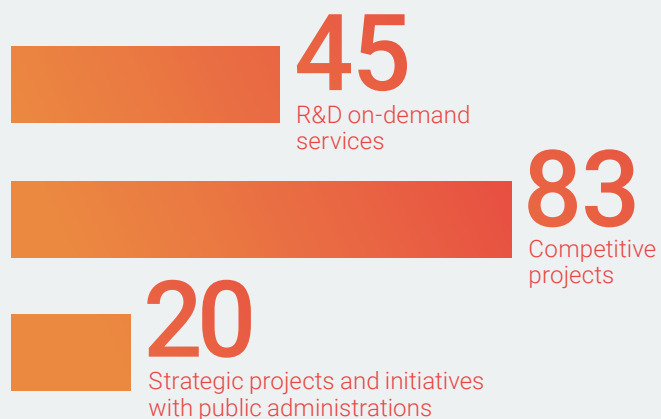
Competitive projects in execution

Total **83**

37
European projects

24
Spanish projects

22
Catalan projects
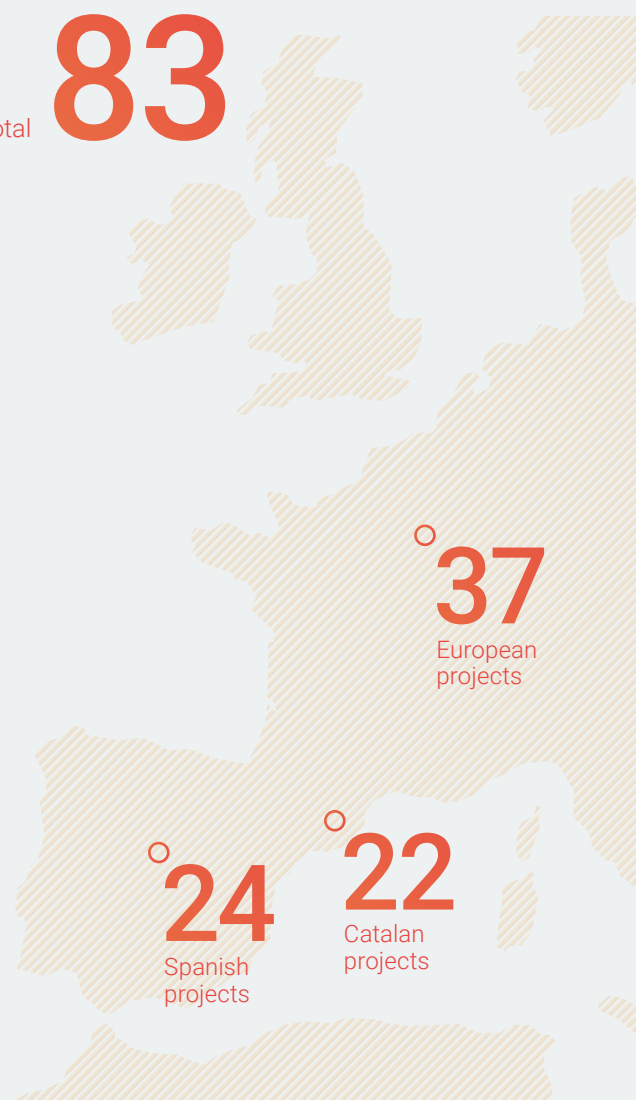
Staff

Total **200**

23
Nationalities
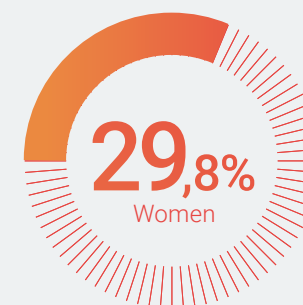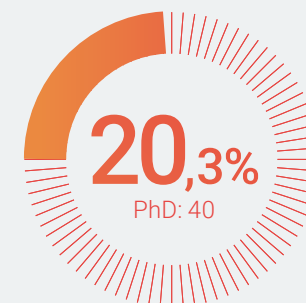
20,3%
PhD: 40

29,8%
Women

39,86%
Staff growth rate

IMPACT-ORIENTED RESEARCH AND INNOVATION ACTIVITIES

IMPACT-ORIENTED RESEARCH AND INNOVATION ACTIVITIES

Smart Services & Networks 6G/5G/IoT/Space Comms

Technological research

TR UNICO I+D 6G

TERMINET

AFFORDABLE 5G

5GaaS

OPEN VERSO
5G and Beyond Technology Enablers

DAEMON

IoT-NGIN

XGain

ZEROSWARM

Applied innovation

Smart Environment

Industry 4.0

5GCLARITY

SMARTY Interreg Europe

5GSMARTFACT

5G VICTORI

Autonomous and Connected Mobility

5GMED

5GCroCo

PODIUM

Creative Industries

PRINGO

Cybersecurity & Blockchain

Technological research

QUANTUMCAT

TR UNICO I+D 6G

Applied innovation

eHealth

SECANT

Industry 4.0

PALANTIR

Autonomous and Connected Mobility

CARAMEL

5GZORRO

Knowledge & Excellence

Digital Innovation Strategies and Policies

Àrees 5G

Estratègia 5G de Catalunya

New Space Strategy for Catalonia

GUIDE
Supporting the Strategic Deployment Agendas for the EU Corridors

TDA 5G RURAL

DIH4CAT
Digital Innovation Hub de Catalunya

TDA Bus Autònom

DIH4CAT
Digital Innovation Hub de Catalunya

TDACiberseguretat

AGÈNCIA DE CIBERSEGURETAT DE CATALUNYA

Digital Transformation

Private-Public Partnerships (PPP)

DCA Digital Catalonia Alliance

FEM-IoT

5G Barcelona

Tech Transfer & Private collaborations

neutroon

NEC

SATELIOT

TRANSCELESTIAL

Open Cosmos

simon

Private-Public Partnerships (PPP)

DCA Digital Catalonia Alliance

Tech Transfer & Private collaborations

BLOCK

GÉANT

FREEVERSE

Unblur

Immersive and Media Technologies

Technological research

Applied innovation

Smart Environment

Creative Industries

Artificial Intelligence

Technological research

Applied innovation

Smart Environment

Industry 4.0

Autonomous and Connected Mobility

Digital Social Technologies

Technological research

Knowledge & Excellence

xReco

6GXR

DIDYMOS XR

UNICO I+D 6G

RESPOND-A

OPEN VERSO
5G and Beyond Technology Enablers

IoT-NGIN

MED GAIMS

ViVIM
Visió per computador per Video Immersiu Multi-plataforma

Holomit 2.0

5GZORRO

AI@EDGE

beGreen

FEM-IoT

Looming Factory

Integra

CARAMEL

INTEGER
INTERCONNECTING 4-HELIX INNOVATION ECOSYSTEMS IN EUROPEAN REGIONS

FORGING

Digital Innovation Strategies and Policies

DIH4CAT
Digital Innovation Hub de Catalunya

DIH4CAT
Digital Innovation Hub de Catalunya

Catalonia.ai

gaia-x

TDACiberseguretat

DIH4CAT
Digital Innovation Hub de Catalunya

Col·laboratori Catalunya

Pla de Xoc Contra la Bretxa Digital

Generalitat de Catalunya
Departament d'Empresa i Treball
Secretaria de Polítiques Digitals

Digital Transformation

Private-Public Partnerships (PPP)

Tech Transfer & Private collaborations

Private-Public Partnerships (PPP)

Tech Transfer & Private collaborations

CREA &PLAY

CISCO

tuUP
upgrade your TV

VISYON

watchity

CIDAI
Centre of Innovation for Data tech and Artificial Intelligence

DCA
Digital Catalonia Alliance

ALSTOM

Telefónica

BOSCH

NEC

mosaicfactor

VAG

CORPORATE HIGHLIGHTS

In 2022, the i2CAT team achieved impressive research results, continued supporting public digital innovation policies and strategies to bring about the digital society of the future, presented cutting-edge assets and participated in pilots that offer a glimpse into what technology will become in the following years.
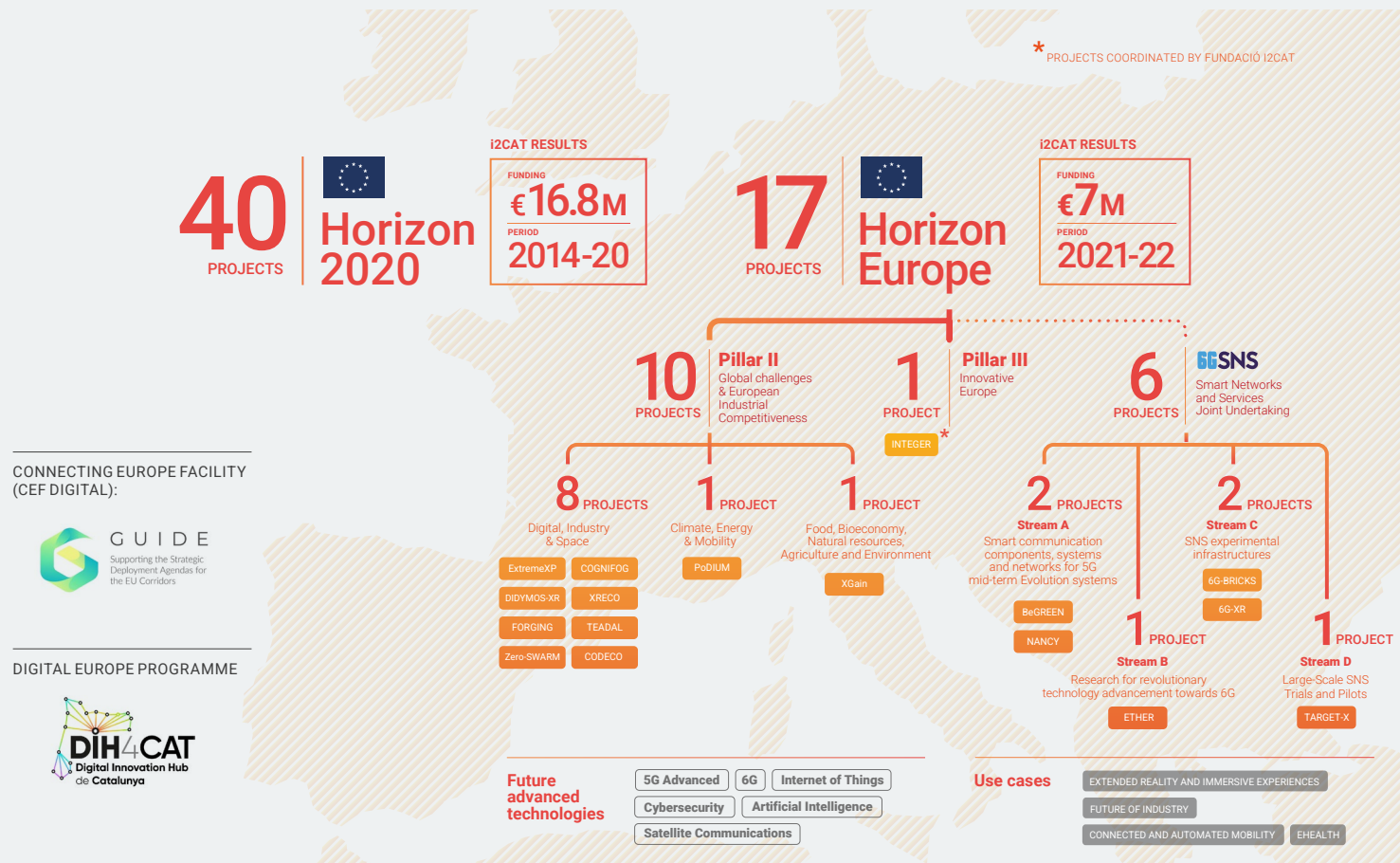
CORPORATE HIGHLIGHTS

Research activities

European research projects are at the core of i2CAT's activity. i2CAT has been the **third-top Catalan institution** in terms of funding return in Horizon 2020 (2014-2020), with 40 projects in total, and has already obtained 17 **Horizon Europe** (2021-2027) projects. Out of those 17 projects, six are part of the first call of the **6G Smart Networks and Services (SNS) Joint Undertaking**, the R&D European programme directed at designing and facilitating advanced 5G and 6G technologies for the next generation of mobile networks.

These numbers are a confirmation of the centre's strength in the EU research arena and a boost to continue contributing to the advance of emerging digital technologies.

EU Research and innovation funding programmes   MORE ↘

* PROJECTS COORDINATED BY FUNDACIÓ I2CAT

40 PROJECTS

Horizon 2020

i2CAT RESULTS
FUNDING **€16.8M**
PERIOD **2014-20**

17 PROJECTS

Horizon Europe

i2CAT RESULTS
FUNDING **€7M**
PERIOD **2021-22**

10 PROJECTS — Pillar II — Global challenges & European Industrial Competitiveness

1 PROJECT — Pillar III — Innovative Europe

INTEGER *

6 PROJECTS — 6GSNS — Smart Networks and Services Joint Undertaking

8 PROJECTS — Digital, Industry & Space
- ExtremeXP
- COGNIFOG
- DIDYMOS-XR
- XRECO
- FORGING
- TEADAL
- Zero-SWARM
- CODECO

1 PROJECT — Climate, Energy & Mobility
- PoDIUM

1 PROJECT — Food, Bioeconomy, Natural resources, Agriculture and Environment
- XGain

2 PROJECTS — Stream A — Smart communication components, systems and networks for 5G mid-term Evolution systems
- BeGREEN
- NANCY

2 PROJECTS — Stream C — SNS experimental infrastructures
- 6G-BRICKS
- 6G-XR

1 PROJECT — Stream B — Research for revolutionary technology advancement towards 6G
- ETHER

1 PROJECT — Stream D — Large-Scale SNS Trials and Pilots
- TARGET-X

CONNECTING EUROPE FACILITY (CEF DIGITAL):

GUIDE — Supporting the Strategic Deployment Agendas for the EU Corridors

DIGITAL EUROPE PROGRAMME

DIH4CAT — Digital Innovation Hub de Catalunya

Future advanced technologies
- 5G Advanced
- 6G
- Internet of Things
- Cybersecurity
- Artificial Intelligence
- Satellite Communications

Use cases
- EXTENDED REALITY AND IMMERSIVE EXPERIENCES
- FUTURE OF INDUSTRY
- CONNECTED AND AUTOMATED MOBILITY
- EHEALTH

CARAMEL project results

In 2022, the H2020 CARAMEL project ended and presented its main results, opening a promising scenario in innovative anti-hacking solutions for the future of connected and automated cars. The project results were compiled in the book **"Artificial Intelligence-based Cybersecurity for Connected and Automated Vehicles"**, published by Now Publishers Inc. It can be consulted online in an open format.

MORE ↘

CARAMEL

5G Clarity tested 5G private network architecture at Bosch production plant

In March 2022, researchers from the Mobile Wireless Internet (MWI) area of the i2CAT Foundation successfully deployed and tested a new type of 5G private network architecture at the Bosch company's production plant in Aranjuez (Madrid). The demonstration proved the advantages of combining **5G, WiFi6 and LiFi connectivity systems** in a real manufacturing environment.

MORE ↘   VIDEO

5G/6G research and outcomes

UNICO I+D 6G Programme

i2CAT's expertise in **5G, advanced 5G** and the **emerging 6G** was recognised by the Ministry of Economic Affairs and Digital Transformation of the Government of Spain and the European Union – NextGeneration EU through the granting of **19 research projects** for a total amount of more than **16M€** in the framework of the UNICO I+D 6G programme. UNICO aims at generating the knowledge needed to facilitate **access to ultra-fast broadband in Spain** and accelerate the deployment of 5G.

The 19 projects, which started in January 2022, are grouped into **six coordinated projects** plus an action to support the promotion of Telecommunications Engineering studies. i2CAT leads all projects, executing 30% of the budget and subcontracting the remaining 70% to large companies, SMEs and research organisations through public procurement procedures.

During 2022, the research centre has been focused on reaching important **collaboration agreements** in the **call for tenders** phase, and 2023 will mark the start of the execution of the different research projects.

19 research projects | **1** promotion of Telecom studies plan

+16M€

ECO6G

i2CAT organised and hosted ECO6G in February 2022, an event that gathered key **5G and 6G** stakeholders to discuss 6G from a European perspective. As one of the main actors in the research and development of 5G networks, i2CAT is determined to shape the road to 6G and is already working on the future of connectivity through initiatives like the 6G White Paper, which presents the centre's research perspective.

+30 international speakers

250 publications on social media

600.000 people reach

1K interactions on social media

NewSpace activities

Enxaneta: a year in orbit

The first Catalan nanosatellite, Enxaneta, provided its first results in 2022 after a year in orbit. It enabled a use case to offer **coverage assistance and sensor monitoring** for high-altitude vineyards in Tremp. The i2CAT Foundation designed the satellite device used to receive sensor data.

MORE ↘

Institutional updates

Mrs Laura Vilagrà Pons, Minister of the Presidency at the Government of Catalonia, entered the i2CAT Foundation's Board of Trustees as its new president.

The Board also incorporated:

Mrs Núria Cuenca León
Secretary General of the Presidency, Government of Catalonia.

Mr Albert Castellanos Maduell
CEO, ACCIÓ.

Mr Sergi Marcén López
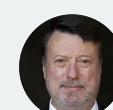Secretary for Telecommunications and Digital Transformation, Government of Catalonia.

Mrs Gina Tost i Faus
Secretary for Digital Policies, Government of Catalonia.

Mr Tomàs Roy Català
general manager, Agència de Ciberseguretat de Catalunya.

Mr Josep Pallarès Marzal
rector, Universitat Rovira i Virgili.

Mr Jordi Teixidó Closa
vice rector, Universitat Ramon Llull.

Digital Innovation Policies & Strategies

Digital transformation

1st-anniversary Digital Catalonia Alliance

2022 marked one year of activity for the DCA, which exceeded **455 members** on its first anniversary. The initiative also incorporated the **DCA-Blockchain** in collaboration with the Centre Blockchain de Catalunya (CBCat). Other milestones include:

36 business opportunities were identified in matchmaking events

131 solutions presented

42 challenges solved

MORE ↘

Àrees 5G covered the whole Catalan territory

The Àrees 5G project continues promoting 5G throughout the region through training and dissemination activities, workshops, concept trials, and laboratories. In 2022, it unveiled the new **5G Area of Aran**, thus covering the whole Catalan territory. It will boost sustainable mobility, improve services in the territory, and promote the local economy and technological training.

MORE ↘

Àrees **5G**

9 5G Areas covering the whole Catalan territory

11 trainings and workshops

5 pilot tests

Partnership with Agència de Ciberseguretat de Catalunya: Cybersecurity Innovation Office (OIC)

In 2022, the i2CAT Foundation reinforced its partnership with the Agència de Ciberseguretat de Catalunya (ACC) to continue adopting innovative solutions and cybersecurity technologies, attracting funding, promoting the Catalan cybersecurity ecosystem and developing cutting-edge pilots.

MORE ↘

AGÈNCIA DE CIBERSEGURETAT DE CATALUNYA

Creation of DIH4CAT

The DIH4CAT project kickstarted its activities in May 2022, becoming one of Europe's first European Digital Innovation Hubs (EDIH). It has established instruments to contribute to SMEs' and startups' digitalisation, such as public funding calls and +40 training and networking activities. i2CAT, in cooperation with Mobile World Capital Barcelona and UPC, is in charge of the **Smart Connectivity node**, allowing businesses to carry out viability studies, testing, validation, prototyping, and training on cybersecurity and technologies like 5G, IoT, and holopresence, as well as access to several tech laboratories in Catalonia.

MORE ↘

DIH4CAT Digital Innovation Hub de Catalunya

Innovative assets: ImmAcc Player v2 and Sync-X

i2CAT strives to make research outcomes contribute to the local and European ecosystems. In 2022, two of the most advanced assets generated from research projects were the **ImmAcc Player v2**, a web player enabling VR360 video and spatial audio consumption with an interactive and hyper-personalised presentation of access service content, and **Sync-X**, a set of software components and potentially cloud server resources that associates distributed media players and provides a group-based synchronised consumption experience.

The Media Internet team has developed both and they are prepared to integrate into third-party systems.

MORE ↘

5G Catalunya: Augmented reality shopping at the Boqueria Market

The partners of the 5G Catalunya project demonstrated a novel experience of virtual shopping through augmented reality that enables clients who cannot shop in person to do so remotely preserving the experience. i2CAT designed and developed the **Augmented Reality Personal Shopper** application, which runs over a private 5G network based on edge computing servers.

The Media Internet team has developed both and they are prepared to integrate into third-party systems.

VIDEO

CIDAI: Traffic risks and flows detection and improvement thanks to AI and Big Data

Within an initiative of the CIDAI, the i2CAT Foundation led the development of a system to detect traffic risks and flows on urban and interurban roads based on AI and big data to proactively prevent traffic accidents by identifying risk situations and analysing traffic flows to detect anomalous behaviour and reduce traffic jams. After live testing in the C31 road and urban intersections in Barcelona, the system demonstrated a **success rate of over 83%.**

MORE ↘   VIDEO   **CIDAI** Centre of Innovation for Data tech and Artificial Intelligence

Organisation chart

Board of Trustees

Laura Vilagrà

Executive Committee

Lluís Rovira

International Scientific Advisory Board

Professor PhD Dimitra Simeonidou

Inder Monga

Management Team

Josep Paradells

Artur Serra

Joan Manel Martín

Sergi Figuerola

RISE
Research and Innovation Policy and Strategy in Europe

6G Program

Jesús Alonso Zarate

Research & Innovation

6G, 5G & IoT
Smart Networks & Services

AI Driven Systems

Xavier Costa

Mobile Wireless Internet

Daniel Camps

Software Networks

Shuaib Sidiqqi

Internet of Things

Marisa Catalán

Distributed Artificial Intelligence

Josep Escrig

Media Internet

Sergi Fernández

Digital Social Technologies

Artur Serra

Cybersecurity & DLT-Blockchain

Shuaib Sidiqqi

Jordi Guijarro

Space Communications
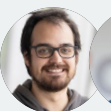
J.A. Ruiz

Pol Guixé

Knowledge & Technology Marketing

Miguel Ángel Pérez

Innovation Business Development

Public Sector

Rosa Paradell

Private Sector

Ana Moliner

Operations and Digital Infrastructure & Service

Eduard Grasa

Digital Innovation Management Office

Carlos López

Software Development

Alejandra Guarnaccia

Support Areas

Project Management Office

Jose Miguel Sanjuan

ERDF & Procurement Office

Flaminio Minerva

Admin & Finance

Rocío Segura

Corporate Development

Susana Otero

People & Talent

Roger Onnen

EVENTS, FAIRS AND CONGRESSES

2022 took i2CAT around the world to learn, connect, demonstrate and explore the future of technology. The team took part in more than 100 events, from technological fairs to territorial activities and co-innovation processes with citizens and private companies. All of them sparked innovation and ideas that will help build the future.

EVENTS, FAIRS AND CONGRESSES

This year, i2CAT organised and participated in more than a hundred events. In-person interaction and networking opportunities returned in full during 2022, and i2CAT was there to share its knowledge and demonstrate the unique advantages of advanced and emerging technologies. Opening research and digital innovation to citizens and territories were also essential to the 2022 activities, generating innovative ideas through workshops and community sessions.

The centre also gained international recognition by hosting the first edition of **ECO6G**, an event born to become a global reference point for 6G discussions. i2CAT gathered distinguished and knowledgeable policymakers, program leaders, industry representatives, users, and critical academic players to explore what 6G will become.

+**100** Events

15 International fairs & congresses

25 Workshops & training sessions

ECO6G

BNEW 3-6 OCTOBER 2022
3rd BARCELONA NEW ECONOMY WEEK

IOT SOLUTIONS WORLD CONGRESS

SMARTCITY EXPO WORLD CONGRESS

BIG DATA & AI CONGRESS BARCELONA

EUCNC 2021
European Conference on Networks and Communications | Porto, Portugal

GSMA MWC Barcelona

MOBILE WORLD CAPITAL BARCELONA

ECO6G

The communications industry has set the ambitious goal to deliver 6G networks by 2030. 6G is expected to be a fundamental enabling technology that will help realise the **United Nations Sustainable Development Goals** and the twin green and digital transition envisioned by the European Commission. As a research and innovation technology centre focused on digital technologies, i2CAT is determined to contribute to **building 6G**. To further explore what 6G will become, the i2CAT Foundation organised the first edition of ECO6G, an event addressed to the European Ecosystem on 6G.

The event was divided into six sessions:

- European Vision, focusing on the European SNS Joint Undertaking
- European Initiatives
- 6G: What users need

- 6G Community: a researcher's perspective
- The operator's perspective on 6G
- The provider's perspective on 6G
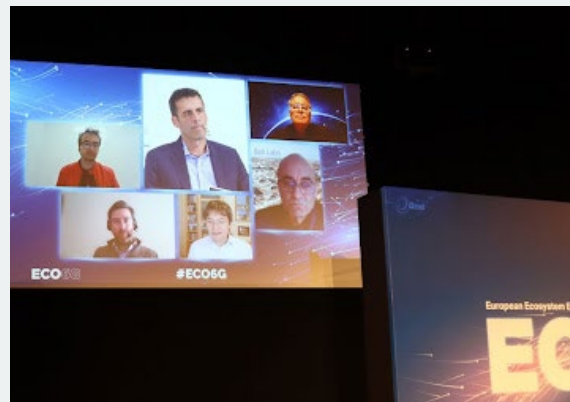
22.676 reproductions on the online platform

600.000 people reach

250 publications on social media

+30 international speakers

1k interactions on social media

MWC 2022

The 2022 edition of the Mobile World Congress meant returning to the presential version of this unmissable event. i2CAT presented a prototype of the nanosatellite **Enxaneta** and demonstrated **HoloMIT**, a Holoportation prototype for a real-time metaverse. It also announced the creation of a private 5G network at the technical centre of **Applus+ IDIADA** to test connected mobility.

i2CAT, together with the Institut d'Estudis Espacials de Catalunya (IEEC) and the Institut Cartogràfic i Geològic de Catalunya (ICGC), was part

of the Government of Catalonia's **New Space strategy** booth, demonstrating the growth of this emerging, innovative sector, its opportunities for competitiveness and novel use cases that were not feasible before.

During the congress, i2CAT achieved 18 digital and printed media impacts. More than 2.000 people visited the event landing page and social media posts.
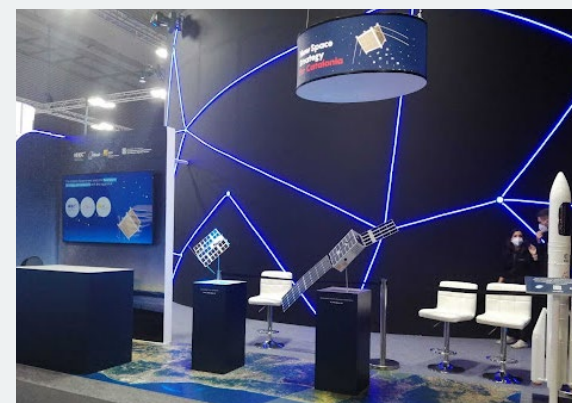
Demo CARAMEL IoTSWC 2022

The H2020 project CARAMEL, coordinated by i2CAT's Cybersecurity area, showcased artificial intelligence-based cybersecurity solutions for the European Cooperative, Connected, and Automated Mobility (CCAM) industry at the **Testbed Area of the IoTSWC22**. Visitors could better understand CARAMEL solutions by participating in the daily guided tours.

The project developed cybersecurity solutions for the new generation of cars (autonomous cars,

5G-connected vehicles, electromobility and remote-controlled vehicles). The project's results mitigated cybersecurity-originated road safety risks by applying a proactive method based on AI and machine learning techniques, introducing innovative anti-hacking intrusion detection/prevention systems for the European automotive industry.

KNOWLEDGE AND EXCELLENCE

As a mission-driven research and innovation centre, i2CAT stands for technological sovereignty and wants to strengthen the European research arena. In 2022, the different centre's research areas reinforced their R&D activities. They carried out work that allowed fundamental advances and direct applications in crucial areas envisioned by the European Commission to complete the double green and digital transition, such as Smart Cities, Cooperative Connected and Automated Mobility (CCAM), Digital Administration, E-Health, Industry 4.0 and agriculture.

KNOWLEDGE & EXCELLENCE

IMMERSIVE & INTERACTIVE TECHNOLOGIES

SMART NETWORKS & SERVICES — 5G, 6G & IOT

CYBERSECURITY & BLOCKCHAIN

ARTIFICIAL INTELLIGENCE

DIGITAL SOCIAL TECHNOLOGIES

SPACE COMMUNICATIONS

SMART CITIES
CCAM COOPERATIVE, CONNECTED AND AUTOMATED MOBILITY
DIGITAL ADMINISTRATION
E-HEALTH
INDUSTRY 5.0
AGRICULTURE

SOME OF OUR PARTNERS:

AGÈNCIA DE CIBERSEGURETAT DE CATALUNYA

TRANSCELESTIAL

GÉANT

Open Cosmos

SĂTELIOT

CERTH CENTRE FOR RESEARCH & TECHNOLOGY HELLAS

Telefónica

CISCO

BLOCK

simon

CVC Centre de Visió per Computador

NEC

mosaicfactor

BOSCH

JOANNEUM RESEARCH COREMED

Research areas roadmap

As a mission-driven research and innovation centre, i2CAT stands for **technological sovereignty** and wants to strengthen the **European research arena**. To this end, during 2022, the different centre's research areas reinforced their R&D activities in 5G/6G, IoT, immersive and interactive technologies, cybersecurity, block-chain, artificial intelligence, space communications and digital social technologies.

AI-Driven Systems

- AI-driven Systems Automation
- Beyond 5G/6G
- Collaborative Smart Networked /Edge Systems
- Drones, Robotics
- Advanced Localization Solutions
- Industrial IoT
- Public Safety
- AI-based Wireless Sensing
- Privacy
- Healthcare
- Smart/Intelligent Surfaces
- Industry 4.0, Logistics

5G, 6G & IoT

- ORAN architecture for beyond 5G networks
- Core network extensions for NTN
- Internet of No Things
- Zero energy devices
- Vehicular digital twins
- "AI-readiness" of Software & Network management systems
- Elastic Slice modelling and management extensions
- Integration and harmonization of NFV, MEC, Cloud-Native VIMs /NFVOs Satellite-, and Security-related elements in the NFV lifecycle
- Network Virtualisation solutions based on RINA, the Recursive Internetwork Architecture

Distributed Artificial Intelligence

- Predictive models for risk detection from data logs
- Deep Reinforcement Learning for Swarm Systems
- Audio classification with Deep Learning methods from cloud to Tiny ML
- Multi-detection and multi-tracking of objects with multi-modal Computer Vision
- Deep Learning for calibration, compression, recognition and generation of volumetric content
- Data Spaces Components based on IDSA and Gaia-X architectures
- Cognitive clouds functions based on AI
- Stretched distributed and federated Data Lakes

Cybersecurity & Blockchain

- Cyber Security as a Service
- Risk Assessment and management
- Privacy Enhancing Technologies (PET)
- Data Security and Privacy.
- Identity Management. Self-Sovereign Identity (SSI)
- Zero Knowledge Technologies & Verifiable Computation
- Web 3.0: Decentralized services, governance systems and new economic models
- Decentralised solutions and service automation for 5G and 6G network management and orchestration.
- Data availability & Decentralized storage
- Data sharing and monetisation while preserving privacy and control.

Media Internet Technologies

- Real-time multi-user holoportation
- Immersive video
- Volumetric video
- Scalable communications
- Point Cloud Compression
- Stream Synchronization
- Multi-camera 3D reconstruction
- Supersampling and denoising
- Quality of Experience
- Adaptive and low-latency streaming

Space Communications

- Sateliot-i2CAT development of Next-Generation Narrowband Internet of Things (NTN NB-IoT) to ensure strict adherence to 3GPP standards.
- Development software virtualisation in space.
- Creation of advanced constellation simulation, management, and orchestration tools.
- Transcelestial-i2CAT implementation of intersatellite communication protocols, which will enable the deployment of satellite networks.

Digital Social Technologies

- Social technologies and regional development
- Regional and local innovation ecosystems design
- 4H Collaboratories, living labs & community building
- Social and digital innovation
- Co-creation, co-design and validation of socio-technical products and services (Usability, UXR)
- Adoption of new technologies, lifestyles & cultural values
- Impact of social and digital technologies & qualitative studies
- Technoanthropology
- Design, implementation and evaluation of innovation policies and strategies

EU funding programmes for research and innovation

i2CAT has a leading role in numerous European research projects that set the way in cutting-edge technologies such as **5G** and **6G, VR, Internet of Things, Artificial Intelligence, Cybersecurity, Blockchain** and **Space Communications**. The centre has achieved great success within the Horizon 2020 and the Horizon Europe funding programmes and has become a benchmark at a European level in mission-oriented R&D activities in advanced digital technologies.

Horizon Europe projects

i2CAT has obtained **19 projects** under the first call of the Horizon Europe programme, the EU's key funding programme for research and innovation, with total funding of more than **7 M€**. The centre has gained ten projects linked to three of the six clusters into which Pillar II – Horizon Europe (Global Challenges & European Industrial Competitiveness) is divided:

• Digital, Industry & Space (8)

• Climate, Energy & Mobility (1)

• Food, Bioeconomy, Natural resources, Agriculture and Environment (1)

19 PROJECTS

7 M€

Another project is linked to Pillar III – Horizon Europe, "Innovative Europe", to stimulate market-creating breakthroughs and ecosystems conducive to innovation.

The remaining six projects are part of the **Smart Network and Services (SNS) Partnership**, which aims to foster European technological leadership in digital and future enabling technologies based on **5G Advanced and 6G**. i2CAT has active participation in the four streams of the SNS, ensuring contributions to the design of 5G Advanced (Stream A), the execution of large-scale demonstrations of 5G for verticals (Stream D), as well as the design of 6G (Stream B) and the future experimental platforms for the next generation (Stream C).

These excellent results will ensure that i2CAT keeps on contributing to the design, development, and testing of future digital technologies, including 5G, 6G, the Internet of Things, Cybersecurity, Satellite Communications, and Artificial Intelligence, all of them at the service of enabling **disruptive use cases**, such as those based on VR and immersive experiences, Connected and Automated Mobility, Industry 4.0, eHealth, and many more.

BeGREEN

BeGREEN will take a holistic view to provide evolving radio networks that accommodate increasing traffic and service levels and consider power consumption as a factor. Determining the metrics by which power consumption should be included is a key feature of the project. An obvious first stage will be to consider the energy cost. Societal factors linked to the necessary reduction in global emissions will also be considered.

TEADAL

TEADAL aims to provide key cornerstone technologies to create stretched data lakes spanning the cloud-edge continuum and multi-cloud, providing privacy, confidentiality, and energy-efficient data management. The TEADAL data lake technologies will enable trusted, verifiable and energy-efficient data flows, both in a stretched data lake and across a trustworthy mediator-less federation of them, based on a shared approach for defining, enforcing, and tracking privacy/confidentiality requirements balanced with the need for energy reduction.

XReco

i2CAT participates as the technical coordinator of XReco, a research project launched in September 2022 oriented at empowering the media sector in Europe and other members of the tourism and mobility industries through innovative solutions based on emerging technologies (AI, blockchain, Virtual Reality). XReco will create a new data-driven ecosystem for the media industry, facilitating data sharing, search, discovery, and supporting news and entertainment content creation. The focus will be on creating and (re-)use of location-related 2D and 3D assets and developing XR experiences.

6G-XR

6G-XR aims to strengthen European leadership in 6G technologies by enabling next-generation eXtended Reality (XR) services and infrastructures that will provide beyond state-of-the-art capabilities towards the 6G era. For that purpose, the project will develop an experimental multisite Research Infrastructure (RI) to provide a validation platform for various 6G use cases by developing enablers for networking and computing, radio access technologies beyond 5G, enablers for XR services with the in-build federation, trial management, abstraction tools as well as energy measurement frameworks.

XGain

XGain fosters a sustainable, balanced, and inclusive development of rural, coastal, and urban areas by facilitating access to relevant stakeholders such as municipalities, policymakers, farmers, foresters, and their associations, to a comprehensive inventory of smart XG, last-mile connectivity and edge computing solutions, and of related assessment methods. The overall project objective is to deliver a Knowledge Facilitation Tool, facilitating business model development and supporting decision-making in the selection of an ecosystem of technologies that consist of connectivity options and edge processing solutions. By following a multi-actor and practitioner oriented approach and by coherently assessing their socio-economic and techno-environmental effects, XGain aims at: increasing systemic resilience and energy efficiency; contributing to climate mitigation; and reducing the digital divides between different types of citizens, farms, sectors and regions.

ZEROSWARM

Zero-SWARM is a mission to achieve climate neutral and digitised production via a multidisciplinary, human centric, objective oriented innovative approach resulting in technical solutions for open swarm framework, non-public 5G network, active information continuum and digital twin. It establishes a unique forum where separately maturing technologies of 5G and cloud-edge continuum, data technologies and analysis (including data spaces and GAIA-X) and operational technology (automation and agility) break their siloes to co-design and co-create through 10 trials. It will showcase key achievements such as smart assembly, sustainable powertrains, 5G powered PLCs for real time distributed control systems, 5G enabled process aware AGVs, mobile intelligent agents for zero plastic waste, and remote quality control for zero defect resilient manufacturing, among others.

Horizon 2020 projects

i2CAT has been the **third-top Catalan institution** regarding funding return in Horizon 2020. The programme has granted **40 projects** to i2CAT in the 2014-2020 period, rising to almost **17 M€.**

5GZORRO

In October 2022, the 5G ZORRO consortium celebrated the project's Final Event to present the latest results and outcomes on the ambitious goal stated at the initial stage: to define solutions for the 5G evolution in longer terms, having Zero-touch automation, security, and trust among multiple parties through blockchains, network slicing across ubiquitous computing and connectivity as key aspects of the investigation. During the session, the researchers involved in the project also presented some demos and the 5G ZORRO platform, instantiated in each operator domain to share heterogeneous types of resources (i.e. spectrum, virtualised radio access, virtualised edge/core, software-defined WAN, etc.) across multiple operators and infrastructure/resource providers.

5G CLARITY

5G-CLARITY aims at developing and demonstrating a beyond 5G system for private networks integrating 5G, Wi-Fi, and LiFi technologies and managed through AI-based autonomic networking. The project brings forward a system design for beyond 5G private networks that addresses spectrum flexibility challenges, delivery of critical services, and autonomic network management. 5G-CLARITY aims to be instrumental in securing the leadership of Europe in the growing markets of private 5G networks and 5G for factory automation.

DAEMON

DAEMON develops and implements innovative and pragmatic approaches to Network Intelligence design that enable high-performance, sustainable and extremely reliable zero-touch network systems. To this end, DAEMON relies on end-to-end coordination of Network Intelligence-assisted functionalities deployed in both control and user planes.

CARAMEL

In 2022, the H2020 CARAMEL project ended by opening a promising scenario in innovative anti-hacking solutions for the future of connected and automated cars. At the end of August, the project's consortium, integrated by 15 organisations from 8 European countries and 3 Korean partners (ETRI, KATECH and MOBIGEN), presented their main results and some simulations to the experts of the European Commission. The final review meeting marked the end of the 33-month project, which applies a proactive approach based on Artificial Intelligence and Machine Learning techniques to detect and prevent potential cybersecurity threats to autonomous and connected vehicles. The project results were compiled in the book "Artificial Intelligence-based Cybersecurity for Connected and Automated Vehicles", launched in December 2022. The book has been published by now Publishers Inc and can be consulted online in an open format.

RESPOND-A

RESPOND-A project aims to develop technologies based on 5G wireless communications, augmented and virtual reality or autonomous robots to optimise first responders' work. RESPOND-A allows first responders to test these technologies and see how efficiently they can be applied within diverse disaster scenarios. With these technological advances, first responders can better predict and assess incidents and safeguard themselves before, during and after disasters.

5GMED

The EU is gearing up to integrate European road and rail transport with 5G technologies that will function seamlessly across borders, enabling connected and automated mobility (CAM). The EU-funded 5GMED project is addressing this goal along the Mediterranean core network corridor, specifically the cross-border connection between Barcelona, Spain and Perpignan, France. Scientists plan to test new technologies to deliver both cooperative connected and automated mobility (CCAM) and future railway mobile communication system (FRMCS) services. The CCAM demonstration will include remote and autonomous driving enabled by extensive sensor deployment along the roads for AI-powered traffic management. FRMCS services will include real-time analysis of high-speed trains via camera data as well as high-speed internet service to passengers. Both will integrate media services for passengers to ensure the seamless migration of functionality across borders.

Connecting Europe Facility (CEF Digital) projects

Supporting the Strategic Deployment Agendas for the EU Corridors (GUIDE).

The **GUIDE project** will coordinate the development of the **5G Strategic Deployment Agenda** (SDA) in the field of **Connected and Automated Mobility**. It will facilitate future CEF2 projects based on the evolution of SDA. This will include the development of deployment roadmaps, cooperation models and 'best practice' approaches to regulation combining input from CEF projects with stakeholder feedback. It will also collect and share best practices from the first round of CEF2 Study and Deployment projects to achieve common approaches across projects leading to a coherent deployment of 5G corridors across the EU.

GUIDE
Supporting the Strategic
Deployment Agendas for
the EU Corridors

Digital Europe projects

The **Digital Innovation Hub of Catalonia** (DIH4CAT) was launched in May 2022 as a non-profit regional innovation ecosystem coordinated with the main digitization support agents in Catalonia, to meet **industry challenges** (especially SMEs) and **public administrations**. It is constituted following the Digital Innovation Hubs model established by the European Commission. The i2CAT Foundation, in cooperation with Mobile World Capital Barcelona and UPC, is in charge of the **Smart Connectivity node**. It allows businesses to carry out viability studies, testing, validation, prototyping, and training on cybersecurity and technologies like 5G, IoT, and holopresence, as well as access to several tech laboratories in Catalonia.

DIH4CAT
Digital Innovation Hub
de Catalunya

UNICO I+D 6G Programme

i2CAT has obtained **19 research** projects for a total amount of more than **16 M€** within the UNICO I+D 6G, a research programme funded by the Ministry of Economic Affairs and Digital Transformation of the Government of Spain and the European Union - NextGeneration EU within the framework of the 'Recovery, Transformation and Resilience Plan'. The main objective of UNICO I+D 6G is to facilitate access to ultra-fast broadband in Spain and accelerate the deployment of 5G.

The 19 projects, which started in January 2022, are grouped into **six coordinated projects** plus an action to support the promotion of Telecommunications Engineering studies, particularly emphasising gender equality and the international arena. i2CAT leads all projects, executing 30% of the budget and subcontracting the remaining 70% to large companies, SMEs and research organisations through public procurement procedures.

6G ENABLERS: The project aims to design and prototype 6G enablers based on artificial intelligence, distributed ledger technologies and cybersecurity.

6G SatNet: Deployment of satellite non-terrestrial networks (NTN). The project leverages constructing a 5G core compatible with non-terrestrial networks and developing new routing and access medium protocols.

6G TWINROAD: This project proposes using 6G technologies to create digital twins for connected and autonomous mobility (CAM). State-of-the-art technologies, such as simulation platforms, advanced HD maps with volumetric information, and artificial vision algorithms, will be used to evaluate the characteristics of the mobile network in urban and interurban mobility environments.

Open6G: The Open RANs for Revolutionary 6G Systems project conducts applied research on open RANs currently underway to design and develop a 6G-based open test platform for the new network and sensing applications related to intelligent surfaces.

6GSMART: This project aims to use 6G technology to improve cyber-physical systems for smart production. These systems are based on 5G/6G private networks, time-sensitive networks, artificial intelligence techniques and Cloud Continuum environments.

6G-OpenVerso: It pursues the design, implementation, evaluation and demonstration of 5G/6G testbeds that will allow scientific experimentation of the next generation of the metaverse and future extended reality services in open 6G ecosystems.

The **Plan for the Promotion of Telecommunications Studies (PPET)** is a transversal activity to all the projects of the UNICO I+D 6G programme. Its main objective is to promote vocation in Telecommunications early to boost talent, particularly in advanced 5G and 6G. The Official College of Telecommunications Engineers (COIT) coordinates the initiative, and all the entities funded within UNICO I+D 6G, including the i2CAT Foundation, contribute to it. The project contemplates six areas of action:

• Area 1: Students up to 14 years old
• Area 2: Students from 14 to 18 years old
• Area 3: Undergraduate students
• Area 4: Master's students
• Area 5: International students
• Area 6: Women's vocations in Telecommunications

19 RESEARCH PROJECTS

16 M€

Talent in research

i2CAT is always striving for excellence to increase the centre's scientific competitiveness. In 2022 it continued to invest in research and innovation talent to maintain its scientific and technological leadership.

Marie Skłodowska-Curie Innovative Training Networks

In 2022, two researchers joined i2CAT under the programme within the project 5GSmartFact.

Programa Investigo

In 2022, two researchers joined the Media Internet and Space Communications areas under the programme.

i2CAT is also committed to academic training initiatives that boost young researchers' personal and professional development. In 2022, the research centre hosted three visiting researchers actively involved in several projects led by different areas. A visiting researcher from the Universidad Carlos III of Madrid participated in a research stay in the AI-Driven Systems area within the **MSCA IF programme**. An **NTT Communications Science Laboratories** (Japan) researcher conducted another research stay in the Media Internet area. Finally, i2CAT welcomed a visiting researcher from **Yeungnam University** (South Corea), who joined the Mobile Wireless Internet area.

Research outcomes: assets and valorisation

At i2CAT, research outcomes are a means to continually contribute to research and innovation in the local and European ecosystems. In 2022, the i2CAT team developed several technology assets due to work on various projects.

3DSAR

3DSAR is a **single-Drone 3D cellular Search and Rescue Solution** Leveraging 5G-NR developed by the AI-Driven Systems area. Its design comprises five main building blocks to improve the localisation accuracy of state-of-the-art systems. It shows an upgrade in positioning error results for single drone solutions compared to 2D and 3D fixed trajectory approaches instead of 3D dynamic prediction trajectory solutions. 3DSAR would interest First Responders (firefighters, law enforcement, military, etc.) for Search and Rescue operations.

ImmAcc Player v2 & Sync-X

The ImmAcc Player v2 provides a new set of presentation methods for **accessibility content adapted to 360 video** scenarios. It consists of a web player that enables VR360 video and spatial audio consumption, augmented with an interactive and hyper-personalised presentation of access service content (subtitles, audio description and sign language) via accessible user interfaces.

Sync-X consists of a set of software components and potentially cloud server resources that can associate distributed media players and provide a **group-based synchronised consumption experience**, both in the context of multi-screen setups and social viewing setups with multiple remote users.

Both have been developed by the Media Internet team and tested as research outcomes from the **ImAc**, **Immersia TV**, **ViViM** and **Respond-A** projects. These two outcomes are prepared to integrate into third-party systems and are in search of licensees.

MOTCAM: Mobile Object Tracking with CAmeras

MOTCAM is a product prototype to **analyse events in mobility**. It includes a set of tools and algorithms needed to deploy the complete system: from the camera calibration to the visualisation and analysis of the events. It can be updated and modified based on the client's preferences to automatically detect traffic risks and flows, allowing administrations to implement proactive prevention plans to substantially reduce traffic accidents and pollution. The technology has been validated in real roads through videos from the Servei Català de Transit. It is currently being considered for exploitation within a mobility data space.

MOTCAM is the main result of the **PAI-Mobility** project within **CIDAI** and is a development of the DAI area.

SPECTOKEN: Spectrum Trading based on NFT

i2CAT is exploring a future in which spectrum will be a resource assigned dynamically, improving or complementing spectrum assignations made by regulators. SPECTOKEN represents the **right to use a spectrum resource**. It describes the spectrum resource as a unique combination of the frequency range(s), duration (start time to end time), geographic area, and beneficiary (the entity with the right to use the spectrum). Based on Non-Fungible Tokens (NFT), a spectoken is unique, non-interchangeable and non-fractionable. The resource that a spectoken represents may be traded, but the trade will result in a new spectoken that represents the new entitlement.

This prototype application has already raised interest from regulators to widen their concept of dynamic spectrum sharing.

V2X Reference Kit

The Vehicle-To-Everything (V2X) Reference Kit is a **software library of parameterisable V2X applications and API**. It includes the transport, network, security, management and access layers of the ETSI C-ITS protocol stack integrated into a containerised (Docker) version of Vanetza. It also provides an easy-to-use interface between the ETSI C-ITS protocol stack and the external software applications (facilities layer).

It aims to facilitate and accelerate the development and integration of software applications on vehicles, vulnerable road users (VRU), and roadside infrastructure that requires the exchange of V2X messages (compliant with ETSI standards) with other actors of the V2X ecosystem.

The Kit, a development of the MWI area, was created within the framework of different public and private projects. It has been tested in real environments and for different use cases.

Research publications

Excellence, cooperation, openness, inspiration, and commitment are i2CAT's hallmarks. In 2022, the research areas of i2CAT worked to produce relevant scientific results to contribute to the general advancement of digital technologies and to boost standard bodies such as **ETSI** and **ISO**. i2CAT is committed to making its scientific outcomes available to everyone and also giving further visibility to the results achieved by its researchers.

In 2022 the research areas produced **42 scientific contributions**. These publications included Journals, Conferences, Workshops and Book Chapters.

12 Journals

25 Conferences

3 Workshops

Books

1 Book

2 Book chapters

The main publications of 2022 are the following ones:

- Garcia-Aviles, G. and Garcia-Saavedra, A. and Gramaglia, M. and Costa-Perez, X. and Serrano, P. and Banchs, A., "Nuberu: Reliable RAN Virtualization in SharedPlatforms." In: The 25th Annual International Conference on Mobile Computing and Networking. 2021, pp. 1–16.

- Montagud, M., Li, J., Cernigliaro, G. et al. Towards socialVR: evaluating a novel technology for watching videos together. *Virtual Reality* 26, 1593–1613 (2022)

- T. Kellermann, R. P. Centelles, D. Camps-Mur, R. Ferrús, M. Guadalupi and A. C. Augé, "Novel Architecture for Cellular IoT in Future Non-Terrestrial Networks: Store and Forward Adaptations for Enabling Discontinuous Feeder Link Operation," in IEEE Access, vol. 10, pp. 68922-68936, 2022

- E. Coronado et al., "Zero Touch Management: A Survey of Network Automation Solutions for 5G and 6G Networks," in *IEEE Communications Surveys & Tutorials*, vol. 24, no. 4, pp. 2535-2578, Fourthquarter 2022

- C. M. Stefanovic, A. G. Armada and X. Costa-Pérez, "Second Order Statistics of -Fisher-Snedecor Distribution and Their Application to Burst Error Rate Analysis of Multi-Hop Communications," in IEEE Open Journal of the Communications Society, vol. 3, pp. 2407-2424, 2022

- E. Carmona-Cejudo, F. Iadanza and M. S. Siddiqui, "Optimal Offloading of Kubernetes Pods in Three-Tier Networks," 2022 IEEE Wireless Communications and Networking Conference (WCNC), Austin, TX, USA, 2022, pp. 280-285, doi: 10.1109/WCNC51071.2022.9771724

- M. T. Ortiz, O. Sallent, D. Camps-Mur, J. E. Escrig and C. Herranz, "Analysis of Vehicular Scenarios and Mitigation of Cell Overload due to Traffic Congestions," 2022 IEEE 95th Vehicular Technology Conference: (VTC2022-Spring), Helsinki, Finland, 2022, pp. 1-6, doi: 10.1109/VTC2022-Spring54318.2022.9860570.

- J. S. Camargo, E. Coronado, B. Gómez, D. Rincón and S. Siddiqui, "Design of AI-based Resource Forecasting Methods for Network Slicing," 2022 International Wireless Communications and Mobile Computing (IWCMC), Dubrovnik, Croatia, 2022, pp. 1064-1069, doi: 10.1109/IWCMC55113.2022.9824551

- C. Delgado, L. Zanzi, X. Li and X. Costa-Perez, "OROS: Orchestrating ROS-driven Collaborative Connected Robots in Mission-Critical Operations," in 2022 IEEE 23rd International Symposium on a World of Wireless, Mobile and Multimedia Networks (WoWMoM), Belfast, United Kingdom, 2022 pp. 147-15

- T. Cogalan, D. Camps-Mur et al., "5G-CLARITY: 5G-Advanced Private Networks Integrating 5GNR, WiFi, and LiFi," in IEEE Communications Magazine, vol. 60, no. 2, pp. 73-79, February 2022.

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RESEARCH PORTAL OF CATALONIA (CORA.PRC)

RESEARCH AND INNOVATION FOR THE SOCIETY AND THE TERRITORY

i2CAT is committed to improving our society. To do so, the centre works to empower citizens digitally, enhance inclusion and prevent the digital divide. From local projects to international initiatives, i2CAT puts technology at the service of people.

RESEARCH AND INNOVATION FOR THE SOCIETY AND THE TERRITORY

Col·laboratori Catalunya

One of i2CAT's undertakings is improving the quality of life of citizens. Making cutting-edge technology available and accessible to everyone will enable full-scale digital transformation and prevent the digital divide.

The Col·laboratori Catalunya initiative aims to deploy an interconnection model of social and digital innovation throughout Catalonia, with the collaboratories as the cornerstone of the **Digital Social Innovation ecosystem**.

The initiative fosters collaboration networks between the five main actors of the **Quadruple Helix** innovation model: citizens, public administrations, private companies and academia. These collaborative networks leverage their stakeholders' expertise, resources and ideas to promote innovation and address social and digital challenges in the territory. The resulting processes span from identifying shared challenges to co-creating solutions.

This project is fostered by the i2CAT Foundation, with the support of the **Secretariat for Digital Policy of the Government of Catalonia**.

In 2022, Col·laboratori Catalunya made significant strides by increasing the number of entities and participants involved in the initiative and its territorial reach. With more stakeholders on board, the initiative is well-positioned to create an interconnected social and digital innovation model throughout Catalonia.

+600 people engaged

+900 potentially identified entities to be part of the initiative

14 divulgation and educational sessions

One of the main milestones of 2022 was the evolution of CatAnoia, which comprised only Anoia region, into **CatCentral**, adding Garraf, Alt and Baix Penedès, Bages, Osona, Vallès Oriental and Vallès Occidental, as a response to the growing interest from stakeholders to be part of the initiative. The restructuring of CatCentral has been undertaken while also working towards consolidating **CatNord**, created in 2021, and **CatSud**, the first col·laboratori to achieve management autonomy.

Col·laboratori Catalunya also worked and cooperated closely with participating entities. By providing expert resources, methodological guidance, digital tools, education and knowledge, the initiative has spurred the appearance of **new innovation projects throughout the territory**, such as the Makeathon 2022 Riu Anoia (CatCentral), the 5Gható to identify 5G opportunities (CoEbreLab, CatSud) and the 1st Drone Course for FP faculty in Catalonia.

It was a year of continued support for the thematic initiatives launched in 2021, specifically in the health and education sectors, two of the most heavily impacted sectors during the pandemic. **As a result**:

- The **Col·laboratori de Salut i Benestar** joined the European project **INTEGER**, coordinated by i2CAT, aimed at accelerating the integration of social actors into the European innovation ecosystem, which will specifically focus on Healthy Living Collaboratory.

- The **Educolab** partnered with five education centres in Catalonia to develop awareness and knowledge of advanced digital technologies (drones, cybersecurity, IoT, 5G) among professionals, preparing them to face new challenges.

- The initiative was presented to more than 400 high school students during the **Video Art Game Experience**, a cultural event related to the digital industry and video. VAG, an active member of CatSud, organised the event.

Col·laboratori CatNord

Col·laboratori CatCentral

Col·laboratori CatSud

Generalitat de Catalunya
Departament d'Empresa i Treball
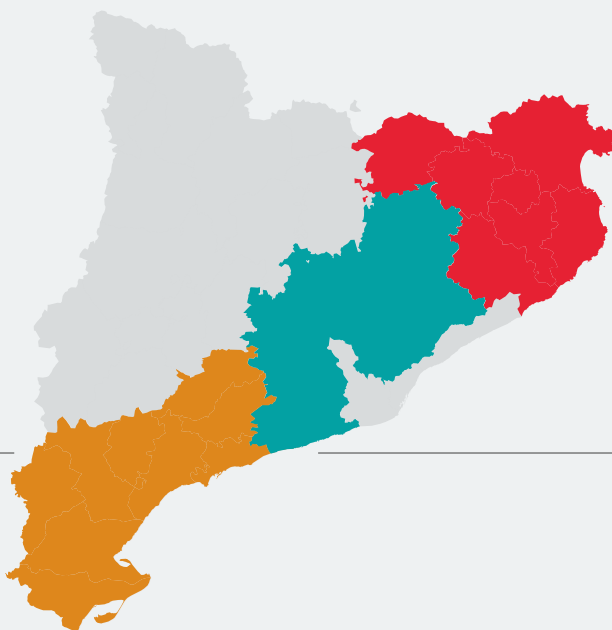
TDA 5G RURAL

This project aims to define a deployment model for 5G technology with the maximum benefits and minimum investment to accelerate the development of **5G connectivity in rural areas** of Catalonia and thus improve competitiveness and services.

TDA 5G Rural is a research and innovation project promoted by the **Generalitat of Catalonia** within the framework of its Digital Catalonia strategy and led by the i2CAT Foundation. The main objective is to define the best technical-economic model for deploying 5G in rural areas with low population density under a Public Private Partnership (PPP) scheme involving operators, manufacturers and public administration.

The project focuses on three fields:

- Deployment of an **experimental 5G network infrastructure** in El Molló industrial area in Móra la Nova (Ribera d'Ebre). This laboratory must enable the validation of a multi-operator model, an **FWA-based** broadband connectivity approach, and a business model for rural environments. It is a **pioneering experience** deploying a test environment offering a dedicated network of remote rural settings and a network of medium-sized cities.

- Including a **distributed** OpenStack-based **private Cloud** to complement this pioneering network to host applications designed for the edge, with a real need for the service. This will validate the behaviour of two environments overlapping in the territory, enabling the deployment of use cases explicitly oriented to the rural environment.

- Deployment of an outdoor infrastructure using the experimental spectrum in the 5G band to implement a **use case on home hospitalization**, together with partners TIC Salut Social, Masimo and Philips.

HOME HOSPITALIZATION USE CASE:

Implementing **X-Gain** will complement these use cases. This Horizon Europe project aims at creating a high-tech ecosystem to reduce the digital gap between urban and rural areas in Europe. Within the project, the i2CAT Foundation will lead a pilot based on applying 5G drones for services with high demand in rural areas. Those 5G drones will monitor plantations and forests in real time to prevent natural disasters, such as fires, and optimise resources (water, fertilisers or treatments for pest control).

Àrees 5G

Àrees 5G is a project that works to boost the Catalan 5G ecosystem, avoid a digital divide in rural areas and transform Catalonia into an international benchmark for 5G

The Àrees 5G **promote 5G throughout the region** through training and dissemination activities, workshops, concept trials, and laboratories. They mainly aim to define a model of broadband connectivity away from urban areas through a high-capacity radio deployment that is tested in different meteorological conditions, analysing technical parameters, costs of unfolding and economic viability. The strategy is to create a permanent infrastructure and ecosystem in the territory.

The **Government of Catalonia** promotes the project in collaboration with **i2CAT, Mobile World Capital Barcelona**, and territorial institutions.

In 2022, the project achieved coverage of the whole Catalan territory with the new **5G Area of Aran**. Other highlights of the initiative include:

- 5 pilots
  - Banc PIRA (Ponent): a new model of 5G-connected urban furniture and scooter parking
  - Baixada de falles (Alt Pirineu): 5G connection for media broadcast in remote locations
  - Aigües de Catalunya (Terres de l'Ebre): 5G for real-time water consumption monitoring
  - UFEC- Esports Igualada (Penedès): live broadcast of sporting events through 5G connectivity for AI cameras
  - Vall d'Aran Artiga de Lin (Aran): broadband satellite connectivity for shelters in remote mountainous areas

- 8 trainings
- 3 workshops
- 4 congresses

FORGING

SmartCatalonia Laboratori

SmartCatalonia Challenge
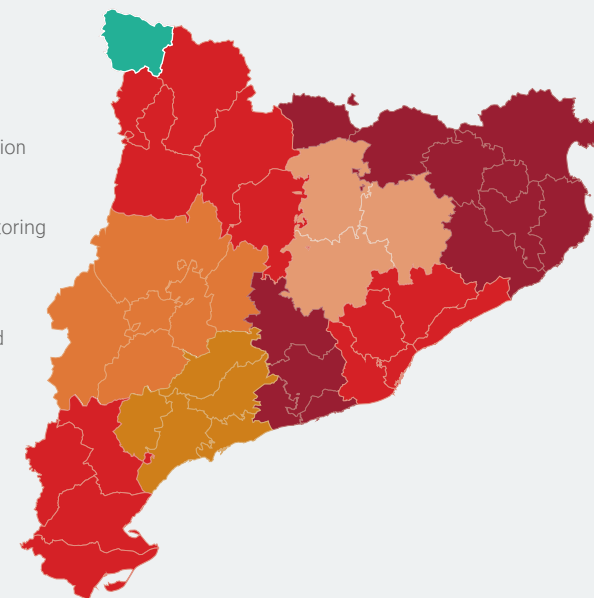
FORGING intends to become a **participatory forum** aimed at catalysing multiple stakeholders from different sectors (academia, industry, society, policymakers, etc.) to contribute to **innovation journeys**. It will also promote the co-creation and absorption of disruptive enabling technologies expected to bring about major transformative shifts from a social and sustainable perspective.

In October 2022, the i2CAT Foundation joined **FORGING** (Forum for **Emerging Enabling Technologies in Support to the Digital and Green Transitions through Value Sensitive Innovations**), a Horizon Europe research and innovation project funded by the European Commission with almost 2.5 million euros. It involves 6 European partners, including research organisations and private companies.

The i2CAT Foundation has extensive experience cooperating with the innovation ecosystem to make social changes and reality and digitally empower citizens. The centre will work within the project to develop a pioneering methodology based on a value-sensitive innovation process that promotes new technological paths attentive to the environment and society. The project contemplates 3 different phases:

1. **Technological discovery** with the help of academia and industry to detect the first signs of emerging technologies.
2. **Social confluence** exploring social desirability and social impact.
3. The openness of **complete co-creation** to the broader community to develop concrete use cases

The project contemplates six major technology areas:

- Human-centric solutions & human-machine interaction
- Bio-inspired technologies and smart materials
- Real-time-based digital twins and simulation
- Cyber-safe data transmission, storage & analysis technologies
- Artificial Intelligence
- Technologies for energy efficiency and trustworthy autonomy

The project will provide three assets: The **FORGING Forum** (a European community of experts in enabling technologies), the **FORGING Playbook** and the **FORGING ToolBox** that will, respectively, bring methodology for guidance and facilitation materials for the exploration, reflection, co-creation and evaluation of emerging technologies.

Funded by the European Union

Laboratori SmartCatalonia is a **community of municipalities** that offer their public space so that small and medium-sized companies can try their ICT solutions.

It structures a network of urban laboratories testing and validating innovative solutions in real environments to tackle the urban challenges of the local municipalities of Catalonia. It aims to promote the technology sector by providing access to infrastructure and equipment and enhancing open innovation in cities by participating in pilot tests.

Within the framework of the SmartCatalonia strategy, the project has spread all over the country by developing projects of impact, providing technical advice and public tenders and promoting the use of open data to help administrations make strategic decisions.

56 municipalities

+150 meetings

15 supra municipalities

+46 technological solutions

38 current pilots

55 technological consultations

126 companies

SmartCatalonia Challenge is a **competition** that connects companies, entrepreneurs, developers, and organisations with municipal and infrastructural needs to improve citizens' life quality through innovative solutions. The initiative offers monetary incentives and the opportunity to conduct pilot tests in a real environment. In 2022, **three editions** were organised in collaboration with **Mossos d'Esquadra, Catalan Museums and the Institut Cartogràfic i Geològic de Catalunya.**

+110 innovative solutions presented

85k in prizes

ICGC Institut Cartogràfic i Geològic de Catalunya

Generalitat de Catalunya

mossos d'esquadra

IEEC

DIGITAL INNOVATION STRATEGIES AND POLICIES

i2CAT works to transfer the knowledge gained in almost 20 years of innovative ICT R&D international initiatives to the digital strategies and policies of the Catalan administration, making every effort to boost the administration's digital transformation and solve social challenges in the territory.

DIGITAL INNOVATION STRATEGIES AND POLICIES
Mission-oriented projects with public administration

TDA Ciberseguretat

Advanced Digital Technologies in Cybersecurity

In response to a challenge posed by the **Agència de Ciberseguretat de Catalunya (ACC)**, the TDA Cybersecurity aims to create a solution to help minimise the success rate of cybersecurity incidents. It will do so by analysing the user's behaviours on a network to calculate the risk and exposure associated with cybersecurity threats, allowing stakeholders to apply preventive measures to mitigate the risk before an incident occurs.

In the context of the TDA Cybersecurity, i2CAT developed **OpenUEBA**, an open-source framework for User and Entity Behaviour Analytics. OpenUEBA is the first data-driven, data-agnostic, open-source framework that provides out-of-the-box UEBA techniques, integrating threat intelligence information. OpenUEBA has developed an AI engine that allows the automatic ingestion of heterogeneous logs of entities and users to define behavioural patterns in the network to calculate exposure to specific threats.

VinclesBCN

i2CAT collaborates with the **Social Rights Area of the Barcelona City Council** to develop the Vincles BCN program, an initiative to help older people lead more active and sociable lives. The program aims to **bridge the digital divide** affecting older people and improve their quality of life by using new digital technologies to communicate (from both the public and personal spheres, such as family, friends, social workers, and volunteers).

In 2022, the Vincles project evolved significantly, with a complete redesign of the backend platform and the Android/iOS mobile applications and the renaming of the platform to **BCN+65.** Considerable changes were made to the image, navigability and content, as well as the incorporation of new features to improve usability and accessibility to all current information and the primary services and resources available to the elderly.

Partnership with Agència de Ciberseguretat de Catalunya: Cybersecurity Innovation Office (OIC)

The i2CAT Foundation maintains a solid partnership with the **Agència de Ciberseguretat de Catalunya (ACC)** with a common goal: to boost the adoption of innovative solutions and cybersecurity technologies within the strategic sectors that the ACC focuses on. The partnership is also centred on reinforcing the Catalan cybersecurity ecosystem. i2CAT leverages its expertise in coordinating innovative communities to achieve this mission by coordinating the Digital Catalonia Alliance cybersecurity (DCA) community.

The activities conducted by the partnership are structured around three main pillars: **Funding, Cybersecurity Ecosystem and Innovation Office**. These activities generate a significant impact on the territory and productive sectors. Some milestones are:

- Increment of **cybersecurity funding**: support in the technical definition of the proposal for a Cybersecurity Dataspaces Demonstrator Center for the national RETECH Cyber call, leveraging i2CAT expertise in GAiA-X-related initiatives. The proposal has granted **2,8 M€** to the Government of Catalonia.

- A fortified **Catalan cyber ecosystem**: DCA-Cyber growth and the celebration of DCA-Cyber activities in the Barcelona Cybersecurity Congress 2022.

- **Innovative pilots** in cooperation with different agents of the ecosystem in the fields of operative excellence through automation, collaborative cybersecurity information sharing, attractive cybersecurity skills evaluation and training, and cybersecurity experimentation infrastructures for threat intel and for 5G.

Participation in digital strategies of the Government of Catalonia

The DIH4CAT project kickstarted its activities in May 2022, becoming one of Europe's first **European Digital Innovation Hubs (EDIH)**. The project has set up mechanisms to contribute to SMEs' and startups' digitalisation in its first months. The i2CAT Foundation, in cooperation with **Mobile World Capital Barcelona** and **UPC**, is in charge of the **Smart Connectivity node**. It allows businesses to carry out viability studies, testing, validation, prototyping, and training on cybersecurity and technologies like 5G, IoT, and holopresence, as well as access to several tech laboratories in Catalonia.

Some of the activities that took place in 2022 are:

- Cupons tecnològics: first public funding supporting digitalisation services by DIH4CAT partners and associates (pilots, tests, and viability studies). Grants up to 10M€ funding almost 100 companies.
- European Digital Innovation Forum by IESE: public presentation of DIH4CAT with 300 attendees.

- +18 networking activities to approach the ecosystem and find potential collaborations with stakeholders, including matchmaking, presentations, webinars and showcases.
- +30 training activities to boost knowledge and capacitate SMEs in advanced digital technologies.

i2CAT leads an **Advanced Research and Innovation Programme in Artificial Intelligence** to foster mission-oriented R&D initiatives. Intending to tackle social and business challenges related to AI, the centre collaborates with other universities, research groups, institutes and public organisations in Catalonia.

i2CAT collaborates with the **Government of Catalonia** to deploy its CATALONIA.AI strategy. This strategy is structured around the following topics: AI ecosystem, R&D, Talent, Infrastructure and Data, AI adoption, Ethics and Society. i2CAT leads or participates directly in several projects within the strategy, such as the **Digital Catalonia Alliance, CIDAI** or the **Tecnologies Digitals Avançades** programme.

i2CAT also specialises in **"data spaces"**, the European architectures and standards for a new generation of distributed data infrastructure that empower governments and busi-

nesses with data sovereignty. i2CAT supported the Government of Catalonia and the region through a strategic project to engage and contribute to national and European data space ecosystems, such as **Gaia-X** and the **International Data Space Association**, while helping the Catalan public and private sectors to understand these new technologies, identify new opportunities and contribute to their future standards. Some examples are the collaboration with **EIT Urban Mobility**, in which i2CAT worked with Catalonia's mobility ecosystem to identify how data spaces can advance sector goals such as multimodal transportation and sustainable mobility services, and the new public-private collaboration and association **Gaia-X Spanish Hub**, where i2CAT is helping Catalan organisations to become actively involved.

i2CAT is a key actor in the **New Space Strategy for Catalonia**. The initiative is a collaboration between the **Institut d'Estudis Espacials de Catalunya (IEEC), i2CAT, Institut Cartogràfic i Geològic de Catalunya (ICGC)**, and the **Government of Catalonia**. It provides unique opportunities to use and exploit space platforms in Earth Observation, Telecommunications, and Global Navigation Satellite Systems (GNSS) and to explore and use the resulting data. Through research, use cases, missions and internationalisation, the strategy carries out activities to boost and promote the Catalan New Space ecosystem.

In 2022, the **first Catalan nanosatellite, Enxaneta**, provided its first results after a year in orbit. Its objective was to deploy global IoT coverage and services to obtain data from sensors located around Catalonia. The first use case enabled by it was the coverage assistance and sensor monitoring for high-altitude vineyards in Tremp. The i2CAT Foundation designed the **satellite device used to receive sensor data**.

In order to identify challenges within the Administration that can be solved with New Space technologies, i2CAT, together with IEEC and ICGC, organised 13 innovation sessions with several departments from the Government of Catalonia. These sessions resulted in several challenges and **3 use cases** leveraging the potential of satellite IoT or Earth Observation.

In September 2022, i2CAT was present at the **International Astronautical Congress (IAC)** in Paris, the world's most important global space event. The Catalonia booth hosted 11 companies of the Catalan space community and the four organisations that cooperate in the New Space Strategy. i2CAT was one of the leading partners of the **New Space Economy Congress**, celebrated in October in Barcelona, and attended by more than 400 people. Sergi Figuerola, i2CAT's CTIO, was one of the featured speakers and Pol Guixé, Innovation Director for Space Communications at the centre, moderated the sector opportunities roundtable.

DIGITAL TRANSFORMATION

Digital transformation is at the heart of i2CAT's activity. With its expertise in international coordination and participation in ICT R&D initiatives, i2CAT wants to revitalise and uplift the social and productive sectors through advanced digital technologies.

DIGITAL TRANSFORMATION
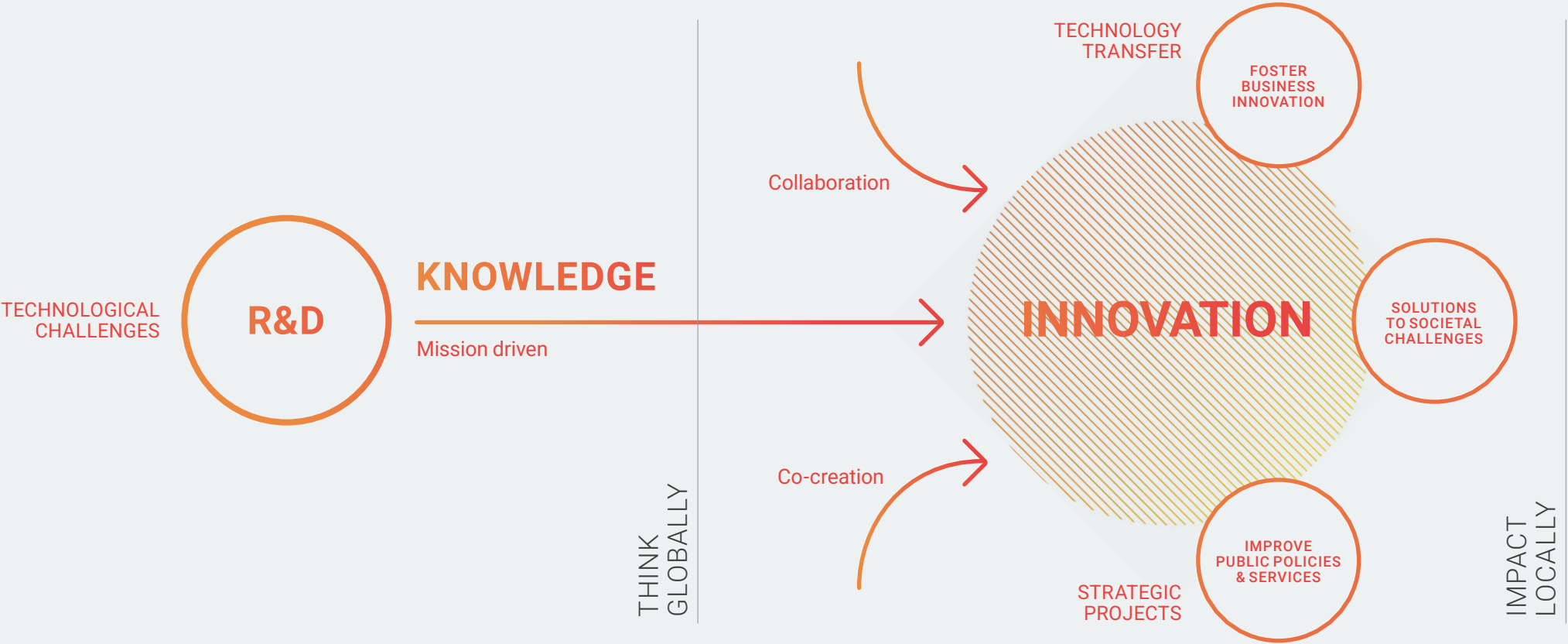
Collaboration and co-creation with the private digital sector

The centre sets strategic alliances with private companies and the innovation ecosystem players to co-create jointly in fields such **as Smart Cities, CCAM, Digital Administration, e-health, and Industry 4.0.**

i2CAT aims to generate impact by transferring the knowledge gained from R&D projects. The centre offers added-value services to the Catalan ICT sector through proofs of concept and valorisation activities.

2022 was a fruitful year which saw the fulfilment of plenty of opportunities and collaborations with private companies to continue uncovering innovative market-oriented solutions based on advanced technologies.

20 new agreements with private companies

Technology transfer

i2CAT strives to generate market-oriented technologies and solutions. The centre establishes agreements with private companies to create joint R&D teams to solve market-driven technical challenges, valorise technologies and exploit the intellectual property rights resulting from research. It also **leads the design and deployment of technical and functional proofs-of-concept, with ICT companies, public administration and end users** to validate technologies and disseminate their adoption.

In 2022, the centre consolidated its **income through royalties**, tech transfer deals, and its position in the market as an invaluable partner to support and advance entrepreneurship and spin-off creation.

Neutroon

i2CAT's spin-off Neutroon has considerably expanded its activity in 2022. The start-up closed an agreement with **Fujitsu** to cover its flagship building for innovation in Barcelona, with the deployment of 32 small cells by 2023. It also launched its first product, the **Nomad 5G**, a Private 5G + Edge pre-integrated solution, assembled and tested in Barcelona and shippable worldwide in its flight case.

Neutron also raised more private funding and underpinned its position in a market that is slowly transitioning to multi-site, multi-vendor deployments. i2CAT continues to collaborate closely with Neutroon on several projects. In 2022, the two organisations participated in Tech Barcelona's TB Insights #2 to present the tech transfer success case that led to the creation of the spin-off.

DOWI

One of the most popular bandwidth-demanding networks nowadays is **Dynamic Adaptive Streaming over HTTP (DASH) video streaming**. DOWI is a novel solution to obtain a proportional allocation of resources among DASH clients in wireless networks according to the properties of the video streams and the characteristics of the wireless channel.

DOWI is a patent-pending method that, integrated into WiFi access points, is expected to enable an outstanding performance and solve problems for streaming in densely populated wireless networks such as sports matches or music festivals, or even transportation, with a good cost-benefit for network owners, avoiding the oversizing of networks or the quality of experience degrading.

In 2022, DOWI obtained funding from the **Indústria del Coneixement Producte** programme (AGAUR), which will be devoted to an implementation demonstrating the performance and benefits of real-environment use cases. DOWI patent applications are published as **EP3923536A1** and **WO2021249925A1.**

Catalonia Valorization Networks

Catalonia Valorization Networks help valorise assets, contribute to patent application funding, execute **Proofs of Concept**, and help disseminate. i2CAT is a member of 5 Valorization Networks that are conceived to bring project results to the market.

RDI-IA
The RDI-IA network was created in 2022 and includes 28 research groups of 16 Catalan institutions focusing on Artificial Intelligence. It aims at underpinning the ecosystem and offers tech transfer and valorisation mechanisms.

AccessCat
In 2022, i2CAT joined AccessCat, a network that gathers 175 researchers with experience in ICT for accessibility. It expects to become a referent in this field, particularly in culture, education and the media.

XAFIR
The Fourth Industrial Revolution Network proposes an action programme to promote knowledge valorisation and technological transfer of research results related to Industry 4.0.

XARTEC
R&D Network in Health Technologies that enhances the quality and value of health research groups' results to increase patents and licenses and promote company creation.

i4KIDS
The Pediatrics Innovation Hub i4Kids promotes the results of collaborative research in paediatrics, increases their value and facilitates their access to the market, contributing to the new knowledge industry.

Royalties

2022 has seen a **60% increase** in royalties income, which positions i2CAT in the European arena. Additionally, the centre continuously contributes to open-source projects like **Magma** or **Vanetza.**

Catalan R&D ecosystem alliances

The i2CAT Foundation seeks to encourage and generate alliances within the Catalan R&D ecosystem by cooperating with other ICT centres, organisations, or research groups to establish joint strategies.

The 'Research and Innovation Strategy for the Smart Specialisation of Catalonia' (RIS3CAT) applies talent, excellent research knowledge and creativity to a diversified business fabric within a dynamic, enterprising, and inclusive society. RIS3CAT boosts R&D projects in various productive and technological fields by promoting cooperation.

The i2CAT Foundation participates in 8 RIS3CAT projects and leads the 5G/IoT Emerging Technology communities.

FEM-IoT

Fostering the Emerging Market of the Internet of Things

The FEM-IoT community promotes and strengthens collaborations within the **Catalan Internet of Things ecosystem**, focusing on increasing the business impact of research and the social impact of Intelligent Mobility and IoT Data Valorization. i2CAT leads this project from its IoT research and innovation expertise, coordinating the twelve partners involved for two years on a **4M€** budget.

In 2022, the project resulted in the **V2X Reference Kit** and contributed to advancing the TRL of V2X simulation tools. The positioning use case developed within the project also achieved contracts with the private sector. Several technological innovations from FEM-IoT were used in projects such as **Looming Factory** or **5GCroCo**, a project which deployed a small-scale trial site in Barcelona using FEM-IoT developments to validate 5G technologies enabling Cooperative Connected and Automatized Mobility services.

The achievements of this community were also presented at the **Smart City Expo World Congress** and **IoT Solutions World Congress**.

Looming Factory

Paving the way for the Catalan Factories of the Future

The Looming Factory project, financed partly by ERDF funds, brought forth **Industry 4.0** research from principal R+D+i centres of Catalonia to demonstrate such technology to the local industry.

In 2022, i2CAT developed a distributed data infrastructure (a "data space") and a marketplace platform for project demonstrators in the area of smart and connected factories. Based on the **International Data Space** (IDS) reference architecture and standards, i2CAT established a secure data flow between factory machinery and externally hosted predictive algorithms developed by partners to optimise the machine's operations and maintenance. These algorithms were added-value services that were hosted in an IDS-compatible AppStore implemented by i2CAT: essentially an on-ramp for data services to be deployed and used in trusted data space environments.

The scenario demonstrated the data sovereignty sought by industry actors, providing them with secure data sharing, traceability and usage control between factories and third-party service providers. Such scenarios are envisioned by EU flagship initiatives like Gaia-X.

RIS3CAT Communities

The RIS3CAT communities are voluntary groups of companies and stakeholders of the Catalan research and innovation system that promote R&D in several areas. Through competitive calls, the Government of Catalonia has accredited them to co-finance their action plan with the Operational Program of the ERDF of Catalonia 2014-2020. i2CAT partners in several communities:

ViVIM

The centre's Media Internet area (MIA) coordinates **ViVIM (Computer Vision for Immersive Multi-platform Video)**, a collaborative project to implement an innovative media production and consumption system. This system focuses on a novel form of audiovisual narrative based on omnidirectional video. The project has developed production tools for immersive screens, support for omnidirectional cameras and coordinated access to content through head-mounted displays, tablet devices and conventional TV. ViVIM tested this system's viability through two demonstrators addressed to live and deferred broadcasting, such as the virtual elevator for Catalan broadcaster **TV3** at the Carnival in **Vilanova i la Geltrú**.

SMARTSPACE

The project SMARTSPACE aims to develop an IoT solution for Catalonia's home furnishing and accessories sector. Its aim is to expand the sector's offer and include connected products and devices, as well as help manufacturers and brands introduce this key aspect in their catalogue and speech. The project aims to ease their connection to this platform or others that may appear in the future.

In 2022, the Media Internet team was at interihotel's **Interiors Living Lab initiative** with a demonstration of **HoloMIT** that was adapted to interior design and the hospitality sector, a presentation framed on SMARTSPACE.

Public-private alliances

5G Barcelona

5G Barcelona is a public-private initiative that positions Barcelona as an innovative and open environment for **validating and adopting 5G technologies** and applications in a real-life setting. Through workshops with private companies, promotion of prototypes and test concepts and dissemination activities, 5G Barcelona aims to bring the technology closer to all interested parties and become one of the leading 5G hubs in Southern Europe. The i2CAT Foundation acts as the CTO of the initiative.

In 2022, 5G Barcelona re-inaugurated its **The Thinx lab**, lead technically by i2CAT, incorporating **Fira de Barcelona** as a partner and relocating to the **Telefonica** building to grow in Blockchain and 5G NSA. The initiative also presented the '5G Connected Vehicle Hub' pilot together with **Applus+ IDIADA**, consisting of the creation of a private 5G network at the company's technical centre in Tarragona, thus transforming the location in the most relevant space in Europe for the development and trial of connected and autonomous vehicles.

CIDAI

The **Centre of Innovation for Data Tech and Artificial Intelligence (CIDAI)** proposes networked services for businesses and institutions promoting technology transfer and cooperation among knowledge-generating organisations (universities, research and innovation centres), companies providing technology and services, and user companies and institutions demanding innovative solutions in applied Artificial Intelligence. Its current partners are the Government of Catalonia, Barcelona City Council, the Barcelona Supercomputing Center, the Computer Vision Center, NTT DATA, the i2CAT Foundation, IDEAI-UPC, Microsoft, SDG Group, SAP, Huawei and Eurecat, who is the coordinator.

The CIDAI is modelled on the Digital Innovation Hubs set up by the European Commission and is conceived as a networked service centre working for businesses and institutions. It is a crucial instrument for the **AI Catalonia Strategy of the Government of Catalonia.**

2022 was a year filled with initiatives and achievements. Some of them are:

- 9 AI-based PoCs in sustainability, farm monitoring, Digital Twins for industrial environments, Catalan language processing, cancer detection, autonomous mobility, gas networks maintenance and stroke detection
- Development of high-impact projects on micro-mobility and agro-food
- Agro-food Whitepaper
- AI & Big Data Congress, with +1300 registered
- 8 masterclasses and workshops in AI techniques and algorithms, AI implementation & development, AI-Driven companies, Data Tech & AI Trends

Digital Catalonia Alliance

The Digital Catalonia Alliance (DCA) is an initiative promoted by the **Government of Catalonia** and **i2CAT** that brings together the ecosystem of emerging technologies in Catalonia into an alliance that supports its growth, stimulates innovation and the development of new solutions and digital applications through the exchange of ideas between members. It is the meeting point and trust of the sector and it ensures its members the best market opportunities to increase their competitiveness.

In 2022, along with the reinforcement of IoT, Drones, AI, NewSpace and Cybersecurity communities, the initiative incorporated the **DCA-Blockchain** in collaboration with the **Centre Blockchain de Catalunya (CBCat)**.

2022 marked one year of activity for the DCA, which exceeded **455 members** on its first anniversary. Other relevant milestones include:

- 179 companies and entities joined the alliance in 2022
- Sectoral revitalisation with 96 networking requests managed
- 36 business opportunities identified in matchmaking events, with 131 solutions presented to solve 42 challenges
- +100K € of potential business value generated through the DCA activity.

151 DCA IoT
COMPANIES / ENTITIES

76 DCA Ciberseguretat
COMPANIES / ENTITIES

36 DCA NewSpace
COMPANIES / ENTITIES

121 DCA Drons
COMPANIES / ENTITIES

58 DCA IA
COMPANIES / ENTITIES

13 DCA Blockchain
COMPANIES / ENTITIES

PARTNERS:

R&D projects & strategic alliances

Beyond 5G

NEC and i2CAT bring the full potential of 5G to the industrial sector

The continued collaboration between NEC and i2CAT in the Beyond 5G technologies area through an industrial research project has produced OROS. This novel orchestration approach minimises mission-critical task completion times of 5G-connected robots by jointly optimising robotic navigation and sensing together with infrastructure resources, thus reducing overall energy consumption.

NEC

Mobile Wireless Internet

i2CAT supports MaxLinear in the development of a network simulator that will help to bring the new generation of WiFi7 chipsets

In 2022, i2CAT closed a project that aimed to design and develop a realistic traffic generator for network simulator NS-3. The work focused on the synthetic generation of application layer traffic that would enable MaxLinear to test the performance of their new WiFi7 chipsets in a scenario as close as possible to reality. The team experimented with two approaches to the traffic models: one based on machine learning and the other based on statistical models.

MAXLINEAR

Space Communications

Open Cosmos, i2CAT and ICGC team up in the Earth Observation Smart Monitoring System (EOSMS) project

Co-funded under the innovation call Innotec by the Catalan Agency for Business Competitiveness (ACCIÓ), the EOSMS project aims at demonstrating the technical and commercial feasibility of an intelligent monitoring system integrating satellite imagery with on-ground measurements, with a particular focus on agriculture and emergency services. i2CAT contributed its extensive knowledge in Machine Learning to develop two models: one capable of defining soil moisture from satellite data and another capable of analysing the value of soil moisture over time and predicting any anomalies that could help agricultural or emergency service users.

Open Cosmos   **ICGC** Institut Cartogràfic i Geològic de Catalunya

Further design and development of the first LEO satellite communications network operating 5G NB-IoT NTN standard

Sateliot, the Catalan satellite operator for the first 5G NB-IoT NTN constellation, joined efforts with i2CAT's research teams to develop the first Core Network with Store and Forward capabilities. In 2022, they worked together on designing and implementing additional features, gradually allowing Sateliot to build their system to full operational capabilities. The team also worked on preparing and coordinating the end-to-end testing activities conducted on the ground, which will be tested in-space after launching their first LEO Satellite in early 2023.

SATELIOT

V2X for Mobility

ACISA and i2CAT develop SAVE: Safe, Accurate & Virtualised Edge solutions for V2X services

Co-funded under the innovation call Nuclis by ACCIÓ, the SAVE-V2X project aims to offer cities the infrastructure needed to deploy connected mobility services, including vehicular communications infrastructure, which enables exchanging information with any vehicle. The project will develop, integrate, and deploy various services on top of ACISA's Mobility Hub platform to demonstrate the benefits of connected infrastructure in urban mobility management. Thanks to the combination of C-V2X technologies, edge computing, virtualisation and precise positioning techniques, the project will showcase traffic control and road safety applications that require high precision in the positioning and location of vulnerable vehicles and users.

acisa

Immersive Media Technologies

i2CAT supports Watchity in developing an immersive live e-commerce platform

In 2022, i2CAT's Media Internet research area started its involvement in designing and developing an innovative e-commerce platform based on holographic communications, augmented reality, and artificial intelligence. The research team is leading the development of the immersive component of the platform, which will enable shoppers to have a more authentic experience thanks to virtual/augmented reality, 3D interactive models and 360º live video combined with traditional 2D video images.

watchity

AI for Industry 4.0

i2CAT helps Mitsubishi Electric in co-creating product evolutions and new use cases for their robotic arms

Thanks to the regional innovation ecosystem, Digital Innovation Hub Catalonia, i2CAT supports Mitsubishi Electric with its knowledge in artificial intelligence applied to advanced manufacturing. i2CAT is producing a twofold analysis: on the one hand, it studies the robotic products and proposes an evolution roadmap based on the use of AI technologies, and on the other hand, it assesses the current use cases for robotic products and proposes new disruptive business models.

MITSUBISHI ELECTRIC Changes for the Better

i2CAT supports the evolution of Group Saltó's nursing care robot with the addition of "speech" capabilities

In 2022, Group Saltó was awarded funding by the Spanish Centre for the Development of Industrial Technology to further research and develop their assistive care robot. The project aims to explore the technical feasibility of adding and testing another type of conversational technology on their robots. Currently, the team is in the process of building a proof of concept for one technology that will allow the company to assess its potential while weighing the added complexity to the operation and maintenance of the system.

GROUP SALTO intelligent technology

SIMON and i2CAT continue their fruitful cooperation in the field of Smart Homes

In 2022, SIMON and i2CAT strengthened their collaboration in developing and evolving SIMON's Smart Home IoT solution. The research teams at i2CAT are contributing their knowledge and experience in wireless technologies and artificial intelligence to further develop SIMON's solution's home automation control mechanisms.

simon

ABOUT US

i2CAT has been at the forefront of innovation for almost 20 years. With the main objective of designing the digital society of the future, the centre strives to excel in advanced digital technologies research and innovation. Talent and cooperation will be the pillars of this future society. Transferring knowledge to the community will be essential to guarantee this vision and achieve technological sovereignty.

ABOUT US

Strategic goals

- Generate excellent and significant knowledge in advanced digital technologies

- Become a benchmark organisation in digital innovation for public administrations

- Foster collaboration with companies to co-create and co-develop innovative digital solutions to meet market and society needs

- Open research and digital social innovation to citizens and the territory

> Driving technological sovereignty from cooperation with a potent research and innovation ecosystem
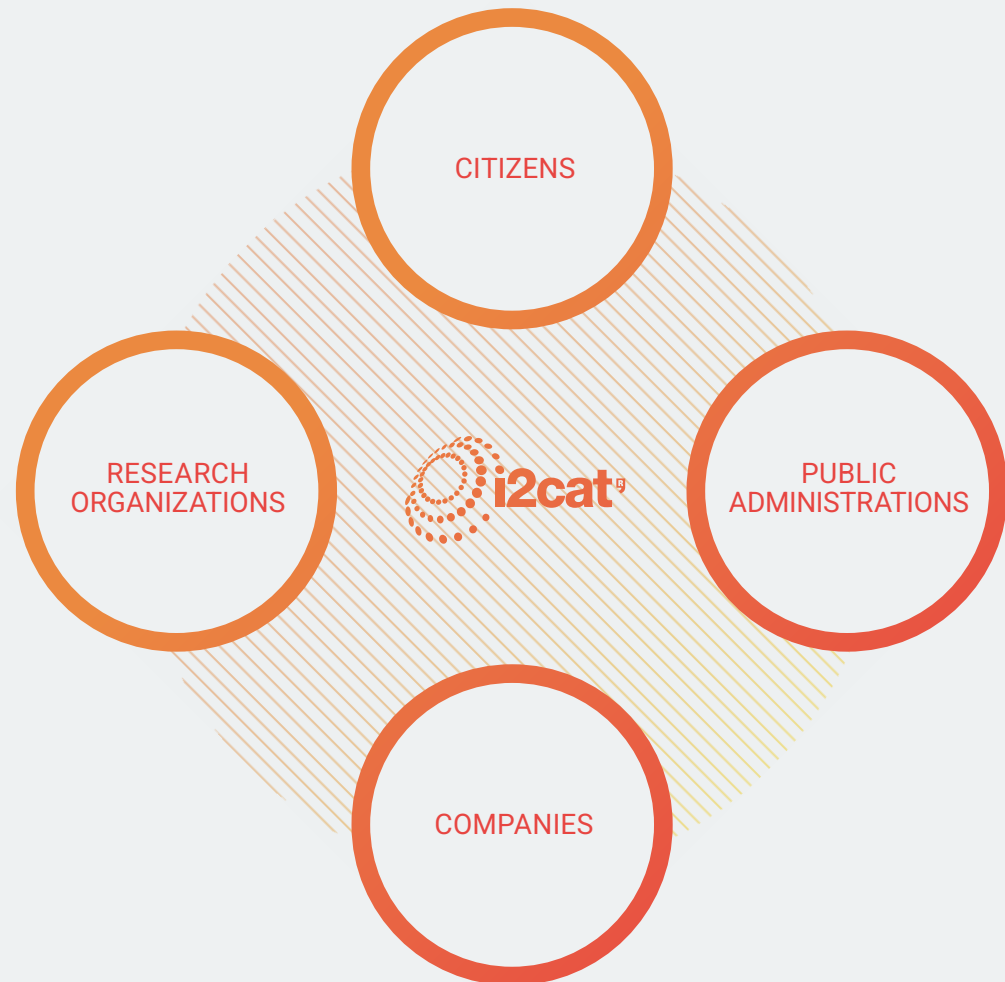
Local Partners

Research and universities

- UAB — Universitat Autònoma de Barcelona
- ICREA
- UNIVERSITAT ROVIRA i VIRGILI
- CIMNE — International Centre for Numerical Methods in Engineering
- UNIVERSITAT RAMON LLULL
- CTTC
- upf. Universitat Pompeu Fabra Barcelona
- CVC — Centre de Visió per Computador
- UNIVERSITAT POLITÈCNICA DE CATALUNYA BARCELONATECH
- IEEC
- Universitat de Girona
- ICFO
- UOC — Universitat Oberta de Catalunya
- eurecat — Centre Tecnològic de Catalunya
- BSC — Barcelona Supercomputing Center — Centro Nacional de Supercomputación

Civil society

- ESPAI MALIV
- ENGINY era
- punt Tic
- ambit — LIVING SPACES CLUSTER
- neàpolis — TECHNOLOGICALLY MEDITERRANEAN
- AENTEG — Associació d'Empreses de Noves Tecnologies de Girona
- ticanoia
- COEbreLAB — espai d'innovació social, digital i col·laborativa
- VALLSGENERA — INSTITUT MUNICIPAL DE DESENVOLUPAMENT LOCAL
- disseny =igualada

Public administration and organisations

- Generalitat de Catalunya — Departament de la Presidència
- Ajuntament de Barcelona
- Generalitat de Catalunya — Departament d'Empresa i Treball
- Ajuntament de Girona
- Generalitat de Catalunya — Departament de Territori
- Ajuntament d'Igualada
- Generalitat de Catalunya — Departament de Cultura
- AJUNTAMENT DE TARRAGONA
- Generalitat de Catalunya — Centre de Telecomunicacions i Tecnologies de la Informació
- MOBILE WORLD CAPITAL BARCELONA
- AGÈNCIA DE CIBERSEGURETAT DE CATALUNYA
- ICGC — Institut Cartogràfic i Geològic de Catalunya
- ACCIÓ — Catalonia Trade & Investment
- fundació .cat
- Fira Barcelona

Catalan companies

- watchity
- NEC
- ALSTOM
- GROUP SALTO — intelligent technology
- Applus+ IDIADA
- FACTUAL
- keonn
- neutroon
- SATELIOT
- parlem telecom
- simon
- Unblur

Mission and vision

To design this digital society of the future, the i2CAT Foundation will boost excellent research, **mission-driven** knowledge addressed at solving business challenges, **cocreate solutions** with a transformative impact, **empower citizens** through open and participative digital social innovation with territorial capillarity and **promote pioneering and strategic initiatives** to increase the international projection of Catalonia as an innovative digital country. The center's activity aims to:

- Generate **excellent and significant knowledge** in advanced digital technologies
- **Become a benchmark** organization in digital innovation for public administrations
- **Support the innovation and digital transformation** of the corporate sector in the country
- **Open research** and digital social innovation to citizens and to the whole territory
- Generation of **research excellence and mission-driven projects** addressed at solving the challenges of businesses, citizens and public administrations, highlighting the value of talented local and international researchers

- **Cooperation** and joint efforts with local research and innovation stakeholders to **co-create solutions and products** with a transformative impact
- **Citizen digital empowerment** through open and participative digital social innovation with territorial capillarity
- **Promotion of pioneering and strategic initiatives** to increase the international projection of Catalonia as an innovative digital country

Core values

EXCELLENCE

CREATIVITY

COMMITMENT

COLLABORATION

Board of trustees

As of April 30th 2023, the members' representatives were:

Executive Committee

As of April 30th 2023,
the members' representatives were:

Mr. Lluís Rovira i Pato
President, Director,
CERCA Institution

Mr. Carles Salvadó Usach
Secretary of the
Telecommunications and
Digital Transformation
Department, Government
of Catalonia

Mr. Sergi Marcén
Secretary of
Telecommunications and
Digital Transformation,
Government of Catalonia

Mrs. Gina Tost
Secretary of Digital Policies,
Government of Catalonia

**Mrs. Montserrat
Cereza Carril**
Territorial Manager of
Institutional Relations, Orange

Mr. Lluís Anaya Torres
Excutive Director for Digital
Innovation and Social Areas,
Centre de Telecomunicacions
i Tecnologies de la Informació,
Government of Catalonia

Mr. Jordi Aguasca
Technology Transformation
and Disruption
Manager, ACCIÓ

Mrs. Rosa Maria Alsina
Engineering Professor,
Universitat Ramon Llull

Mrs. Cristina Villà
Research and Innovation
Director, CCMA

Mr. José Antonio Aranda
Product Strategy and
Innovation Director,
Cellnex Telecom

Joan Guanyabens
Director, TIC Salut
Social Foundation

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Mr. Julián Vinué Biarnés
Digital Innovation
Manager and Institutional
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Director of the Cybersecurity
Agency of Catalonia,
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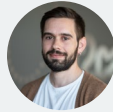
Ivan Rodríguez

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Cybersecurity and DLT-Blockchain

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Innovation Director

Shuaib Siddiqui, PhD
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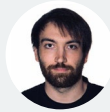
Nil Ortiz

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Sonu Preetam
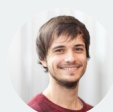
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Digital Innovation Management Office

Carlos López
Director

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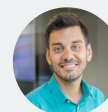
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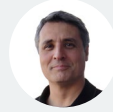
Jordi Colobrans, PhD

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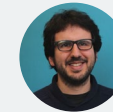
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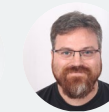
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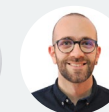
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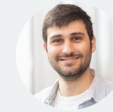
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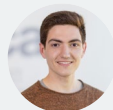
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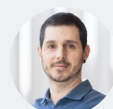
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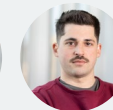
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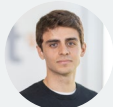
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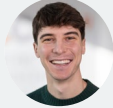
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Oscar Baselga

Victor Montilla

Xavier Jordan

Xavier Tort

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Cesc Betorz

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Government of Catalonia

Ajuntament de Barcelona

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