From the Laboratory to the Market: How to Ensure Impactful Technology Transfer

Final Report

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CONTENTS

1. Introduction 3
2. Technology Transfer: Defining the Scope of the Debate 5
3. Current State of the Catalan TT System 7
4. Two Case Studies: The Basque Country and Flanders Models 22
5. Barriers to Technology Transfer Affecting Catalonia 25
6. Opportunities and Drivers 26
7. Considerations and Future Lines of Work 28
8. References 32
9. ANNEXES 36

1. Introduction

Technology transfer (TT) is a critical link in the innovation system: it bridges research and development (R&D) – scientific and technological activity aimed at generating new knowledge and developing prototypes or initial solutions – with innovation, understood as the introduction of that knowledge into the market or society through new products, services or processes, and ultimately with the business sector and society at large. In a global context shaped by rapid technological change, the dual green and digital transitions and the growing demand for more knowledge-intensive production models, an agile and effective TT system is essential to convert research into value and innovation into wellbeing.

This document begins with an introductory section framing the theoretical debate (section 2), followed by a brief assessment of Catalonia's current TT system, highlighting its structural strengths and weaknesses from a European perspective (section 3). It then compares Catalonia with two benchmark models: Flanders, which has a highly specialised ecosystem, and the Basque Country, which prioritises the business sector through stable collaboration between technology centres and industry (section 4).

The report concludes with a series of reflections, structured into three sections:

- The main barriers hindering impactful TT in Catalonia (section 5);
- Opportunity drivers that could support the development of a more effective and efficient model (section 6);
- Public policy recommendations, along with proposed lines of future work arising from this analysis (section 7).

This study aims to contribute to strategic reflection on the future of Catalonia's innovation model and to ensure that TT serves as a genuine driver for improving productivity, competitiveness and national progress.

Methodological Note

This report was prepared using data from statistical agencies (Idescat, INE, Eurostat) and other official sources; a review of the literature and secondary sources; ten semi-structured interviews with representatives from key entities within the Catalan, Basque and Flemish TT systems, conducted between May and June 2025; and a questionnaire collecting the views of technology transfer experts from the private sector, research institutions and public administration, who attended the Technology Transfer dialogue session held on 15 July 2025 at the Cercle d'Economia headquarters.

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For more details on the methodology, please contact the IPI Technical Secretariat at: ipi@cercledeconomia.com

2. Technology Transfer: Defining the Scope of the Debate

Although there is no universal definition of technology transfer (TT), it is generally understood as the process by which knowledge generated through scientific and technological research is transformed into practical solutions or applications for the market, and consequently, for society as a whole.[1]

While TT is primarily aimed at commercial outcomes, knowledge transfer is a broader concept. It encompasses the sharing of both technological and non-technological knowledge – skills, working methods, organisational procedures – as well as collaborations that generate mutual learning, not necessarily for commercial purposes.

Despite this conceptual distinction, TT and knowledge transfer are interdependent. In practice, effective TT often depends on prior, efficient knowledge transfer mechanisms. As the World Intellectual Property Organization (WIPO) notes, knowledge and technology transfer is a joint, collaborative process that transforms inventions and research outcomes into products and services with social impact.[2]

Defining TT is relatively straightforward; understanding how it works – and particularly the circumstances under which it works best – is far more complex. The first step is to recognise that TT is not (and should not be) an end in itself, but a key instrument for driving socio-economic progress.

From the seminal work of economist R. Solow (1956) to the endogenous growth models of R. Lucas (1988), P. Romer (1990), and P. Aghion and P. Howitt (1992), the central role of technology and human capital as drivers of economic growth has been widely recognised. M. Porter (1990) adds that a nation's competitiveness depends on the capacity of its industrial base to innovate and modernise. Since then, numerous studies have highlighted the strategic role of TT in enhancing firms' competitiveness in global markets.[3] More recently, the Draghi Report (2024) emphasises Europe's structural difficulty in translating basic research into commercial applications, a gap that partly explains the difference in productivity and per capita income compared with the United States.

A region's capacity to carry out TT determines not only its competitiveness in global markets but also its long-term economic growth. This highlights the strategic importance of TT and explains why the IPI places this debate at the heart of its agenda.

Turning to Catalonia: does it make sense to speak of a "Catalan technology transfer system"? Strictly speaking, TT could be considered a universal, borderless process, since knowledge is global and markets are interdependent.

In practice, however, the mechanisms that facilitate TT and knowledge transfer largely depend on organisations embedded within a specific system – or more precisely, an innovation ecosystem. WIPO defines TT as a "collaborative process" involving multiple stakeholders who organise and operate within defined innovation ecosystems. In Europe, these ecosystems are generally structured at regional or

[1] For example, see the definition provided by the Competence Centre on Technology Transfer (European Commission): What is technology transfer?

[2] WIPO (2025). What is knowledge and technology transfer?

[3] See Dubickis and Gaile-Sarkane (2015), and X.P. López Mendoza and D.S. Mauricio Sanchez (2018) for systematic literature reviews.

national level.

Following the linear innovation model (from basic research to market), Condom-Vilà (2020) identifies the following phases in the innovation process, each represented by one or more key actors:

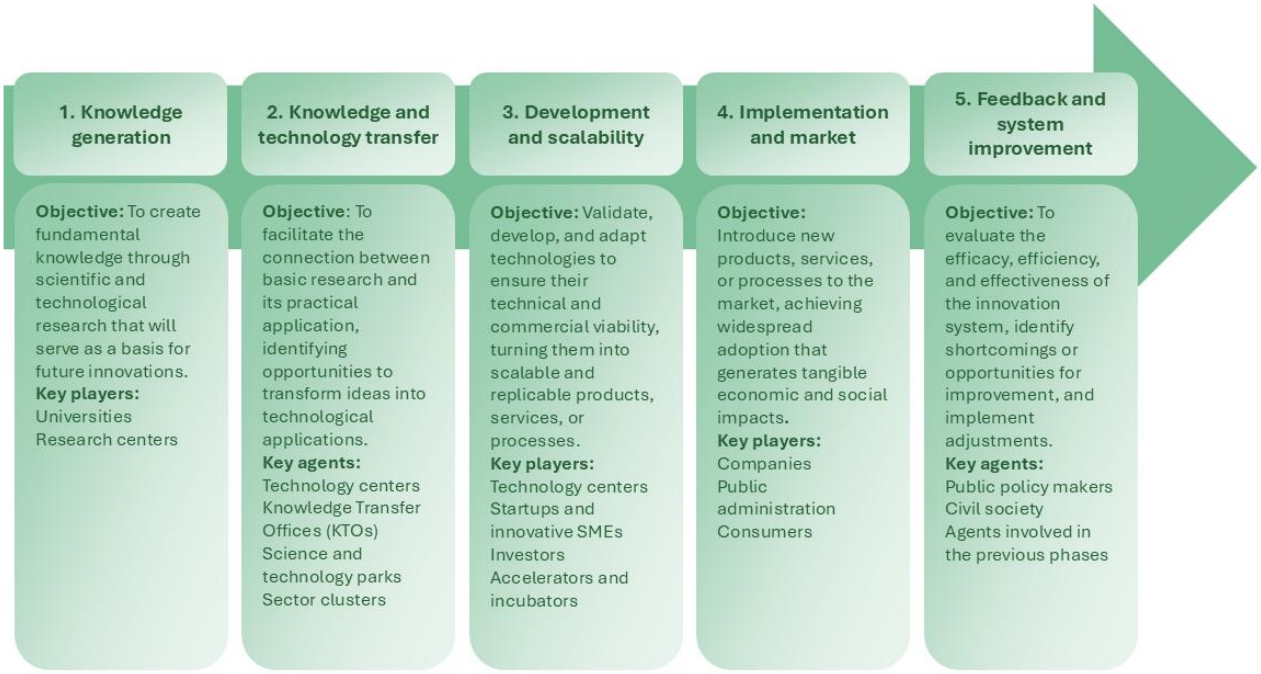

Figure 1. From laboratory to market. Diagram of the innovation process following a linear model
Source: Prepared by the authors based on the scheme proposed by Condom-Vilà (2020).

Although a useful starting point, the linear innovation model has been questioned for years, primarily due to its rigidity.[4] Today, the roles of different ecosystem actors tend to overlap: universities create spin-offs, technology centres conduct research and companies generate and develop their own technologies. The emergence of new models, such as open innovation, which are more collaborative and challenge-oriented, has disrupted the traditional linear sequence.

In addition, this model assumes a closed system in which knowledge and technology are generated in Catalonia and transferred exclusively to Catalan companies. In reality, knowledge and technology are often exported and used by companies outside the region, while Catalan technology centres and companies import knowledge and technologies developed elsewhere to incorporate into their applied solutions. Another point of consideration is the relationship between knowledge generated and its utilisation (transfer) by the market.

This new innovation paradigm highlights the limitations of the linear model, not only conceptually but also in practice. Furthermore, the linear organisation of ecosystems has led to excessive fragmentation of processes, when technology transfer in fact requires multi-stakeholder collaboration to be viable.

In this context, the design of public policies based on a strict separation between research and innovation is also being called into question: investment in R&D alone does not guarantee impactful

[4] See Edgerton (2004), Oliveira (2014) and Macnaghten (2022) for critical reviews of the linear innovation model.

technology transfer,[5] while a narrow focus on innovation as an end in itself is equally insufficient – for instance, public programmes promoting disruptive technologies (technology push) aimed at creating university spin-offs have often resulted in companies with limited viability, either because there is no evident link to the real challenges faced by businesses and market demand, or because the capacity to scale laboratory technologies to an industrial level is lacking.

While there is not yet universal agreement on the optimal combination of supply-side (technology push) and demand-side (market pull) policies[6] to facilitate technology transfer, there is growing evidence that the key to effective public policy lies in **fostering innovation ecosystems that incentivise and enable collaboration and co-creation among different stakeholders**, including technology recipients (end users), especially in the current context of Industry 4.0.[7]

Against this backdrop, it is entirely appropriate to speak of a Catalan technology transfer system, embedded within its own innovation ecosystem, which in turn interacts with the Spanish and European systems. The following section examines its composition and functioning in detail.

3. Current State of the Catalan TT System

This section provides an overview of the TT system in Catalonia, structured around three main elements. First, a map of key stakeholders is presented, detailing the roles and interactions of the main actors within the innovation ecosystem. Second, the institutional and public policy framework that regulates and promotes TT is examined, highlighting the most relevant strategic instruments, priority lines of action and mechanisms for funding and support. Finally, the performance of the Catalan system is assessed from a comparative perspective using data from the European Commission's Regional Innovation Scoreboard (RIS), identifying strengths and weaknesses in comparison with Europe's leading innovation regions.

3.1 Actors in the Innovation Ecosystem

Catalonia's technology transfer system operates as a complex and diverse ecosystem, with multiple stakeholders playing complementary roles in the generation, valorisation and application of knowledge.

1. Universities and Knowledge Transfer Offices (KTOs)

Catalonia has twelve recognised universities, which act as the main drivers of knowledge and talent creation through research and education. The process of transferring and commercialising this knowledge is carried out through **Knowledge Transfer Offices (KTOs)**. These offices act as bridges between academia and industry, playing a crucial role in enhancing innovation capacities and increasing the impact of research and growth. KTOs are officially recognised by the Ministry of Science, Innovation and Universities (MICIU, the Catalan acronym). Catalonia currently has sixteen KTOs, eight of which are affiliated with universities: the Fundació Bosch i Gimpera at the Universitat de Barcelona

[5] Akcigit, U., for the International Monetary Fund (2024). The Innovation Paradox.
[6] Stefano et al. (2012) provide a literature review.
[7] Boyer and Kokosy (2022); Alkhazaleh et al. (2022).

(FBG-UB), the Centre d'Innovació i Tecnologia at UPC (CIT UPC), the Fundació Universitat Rovira i Virgili (URV), the Universitat de Girona (UdG), the Fundació Universitat Oberta de Catalunya (UOC), the Universitat Autònoma de Barcelona (UAB), the Universitat Internacional de Catalunya (UIC) and the Fundació Universitat Pompeu Fabra CCT (UPF).

Some offices stand out for their work in turning generated knowledge into practical market applications. In Catalonia, between 2021 and 2023, 203 new patents were filed, 211 transfer agreements were signed generating €7.4 M and a total of 35 spin-offs were created.[8] FBG-UB and CIT-UPC lead the way in university-level technology transfer: in 2023 alone, FBG-UB filed 16 European patent applications and launched two spin-offs.[9] During 2024, the 23 active UB spin-offs secured €14 M in funding.[10] Meanwhile, CIT-UPC has 46 active spin-offs and has contributed to generating €8.5M in revenue.[11] CIT-UPC's approach is recognised at the national level for its network of over 200 professionals specialised in research commercialisation, supported by a team of legal and intellectual property experts. From here, it drives the translation of research into market-ready solutions from the earliest stages, covering the full value chain.

Despite these best practices, Catalan universities remain far behind, in volume, compared with European benchmarks such as KU Leuven (187 patents and six spin-offs in 2023),[12] and even below some leading Spanish companies in industrial property, such as Amadeus (47 patents) or Multiverse Computing (24).[13]

The remaining eight KTOs in Catalonia are the IDIBAPS Foundation at Hospital Clínic, the Fundació Centre de Regulació Genòmica, the technology centre Eurecat, the Institut de Recerca Biomèdica (IRB), the research institute at Hospital de la Santa Creu i Sant Pau, the Vall d'Hebrón Institute of Research (VHIR), the Parc Taulí Institute (I3PT) and the Institut Català d'Investigació Química (ICIQ).

2. Research Centres

In terms of research centres, Catalonia's **CERCA network** of research centres stands out. Created by the Generalitat Government of Catalonia, it aims to promote a system of research excellence that is highly competitive and internationally recognised. The network's 42 centres are managed by the **Fundació Institució CERCA**, which ensures their quality, efficiency and alignment with public research policies.

Each CERCA centre has its own legal personality and managerial autonomy, allowing it to operate with flexibility and efficiency. They combine structural public funding with resources obtained through competitive calls, both national and international. Their activity is subject to regular evaluations by independent experts, with the aim of guaranteeing quality, impact and continuous improvement.

Their governance and management structures are designed to attract and retain research talent, as

[8] See: Bosch i Gimpera news (2025): Les universitats catalanes reivindiquen la transferència de coneixement com a motor d'innovació i impacte social [Catalan universities highlight knowledge transfer as a driver of innovation and social impact].Fundació Bosch i Gimpera.

[9] Fundació Bosch i Gimpera (2024). «La Universitat de Barcelona és líder de l'Estat en generació de patents segons el primer estudi a llarg termini de l'OEP» [The Universitat de Barcelona leads Spain in patent generation, according to the first long-term study by the Spanish Patent and Trademark Office (OEP)]. Link to the news article.

[10] See: Las 'spin-offs' de la Universidad de Barcelona consiguieron catorce millones de euros de financiación durante el año 2024 [University of Barcelona spin-offs secured €14 million in funding during 2024], Fundació Bosch i Gimpera.

[11] See: List of Spin-offs – Research, Development and Innovation (R+D+i) – UPC. Universitat Politècnica de Catalunya.

[12] Belgian News Agency (2024). "Belgian patent applications declined slightly in 2023". Link to the news article.

[13] Fundació Bosch i Gimpera (2024). Link to the news article.

well as to foster collaboration with other actors in the ecosystem. Moreover, many of these centres hold distinctions such as the Severo Ochoa and María de Maeztu accreditations, recognising their high level of excellence.

Some notable CERCA centres include ICFO (Photonic Sciences), IRB Barcelona (Biomedical Research), CREAF (Ecology and Climate Change), CIMNE (Numerical Engineering), VHIR (Vall d'Hebron Research Institute), the Institut d'Investigació i Tecnologia Agroalimentàries (IRTA) and ICN2 (Nanoscience and Nanotechnology), among many others.

In addition, the **Singular Scientific and Technical Infrastructures (ICTS, Spanish acronym)** also represent a key asset within Catalonia's research and innovation system. There are 13 such facilities in Catalonia, including the Barcelona Supercomputing Center (BSC)[14] and the ALBA Synchrotron. The BSC, for instance, employs 1,300 people and 72 research groups. Over its 20-year history, it has produced 15 patents, 19 software tools, six methodologies and 13 spin-offs, consolidating its position as one of Europe's leading supercomputing centres.

The network of CSIC centres in Catalonia also merits attention. It comprises 21 centres in total – 14 fully owned and seven mixed or jointly managed – alongside several research institutes in the field of medicine that fall outside the CERCA network but remain affiliated with universities, such as the Fundació Pasqual Maragall and the Guttmann Institute.

Through ACCIÓ, the Generalitat Government of Catalonia accredits TECNIO technology transfer actors. These are individual research groups or clusters of groups within the university system, CERCA centres, CSIC centres and other public entities in Catalonia. ACCIÓ accreditation certifies that these agents possess distinctive technological capabilities and a solid track record of collaboration with businesses in R&D projects. Receiving this accreditation enhances their visibility within Catalonia's R&D&I system. For the current period, 2025–2028, there are 75 accredited TECNIO actors in Catalonia.[15]

3. Technology and Applied Research Centres

Technological centres play a key role in linking applied research with business needs. In Catalonia, the two centres recognised by the Generalitat Government of Catalonia are the Fundació Eurecat and the Fundació Leitat. Both aim to generate technological and innovation-oriented knowledge for companies, particularly SMEs, across all sectors and fields.

Eurecat, a private non-profit foundation, is the second largest technological centre in southern Europe, after the Basque centre Tecnalia. It employs over 800 professionals and has a turnover of €69 million, operating under a mixed funding model that combines contracts with companies, core public funding and competitive grants. It currently has ten spin-offs, more than 230 patents and 70% of its activity is directed towards SMEs.[16] In addition, it has its own technological infrastructure for developing technology and accelerating innovation. Leitat, also a non-profit association, employs around 400 professionals and has a turnover of approximately €40 million, of which 60% comes from projects with companies, 32% from public funding and 8% from its own projects.[17]

[14] The Draghi Report identifies it as a strategic centre.

[15] The updated list of TECNIO actors (2025) is available. Link to the list

[16] Data obtained from the official Eurecat website (2025).

[17] Data obtained from the Leitat Annual Report (2023).

4. Business Sector

The business sector is the final recipient of knowledge and an active player in many innovation processes. Major Catalan companies such as SEAT, Grifols and Almirall lead private investment in R&D and take part in co-innovation initiatives with research centres, technology centres and start-ups. SMEs, which account for 99.8% of all companies in Catalonia, often face limitations in their capacity to absorb technology, despite being key to the adoption and diffusion of innovation. Of these, around 8,000 are medium-sized enterprises (10–249 employees), which could play an active role in technology transfer if given appropriate support.

Another key player in the business sector are start-ups and spin-offs, which bring emerging technologies to market. In 2024, Catalonia was home to 2,285 start-ups (9% more than in 2023), employing 22,840 people and generating a turnover of €2.33 billion. Of these, 340 are considered deep-tech firms, with a strong presence in the health sector (34%),[18] while 287 originated from university technology transfer.

According to ACCIÓ's Barometer of Innovation and Digital and Green Transformation (2025), 62.9% of Catalan companies with more than nine employees carried out some form of innovative activity in 2024; of these, 35.2% acquired or developed R&D. The report also highlights a strong link between innovation and internationalisation, particularly in industry, where 84.1% of innovative firms are exporters. Most innovations focused on products and on information and communication systems.[19] The barometer further underlines the collaborative and open-innovation nature of these activities: 68.9% of the companies collaborated mainly with suppliers, specialist consultants, clients and/or technology and research centres. Finally, looking ahead to 2025, 66.7% of firms expect to launch a new product or service, 29.1% to implement a new business model and 15.1% to file patent applications.[20]

Ultimately, the goal of TT is for both existing and newly created companies to embrace innovation as a core strategy for competitiveness and productivity.

5. Supporting Actors and Intermediaries

The system is complemented by a network of intermediary actors that facilitate, finance and structure TT:

- **Public Administration:** The Generalitat Government of Catalonia, primarily through the Departments of Recerca i Universitats [Research and Universities] and Empresa i Treball [Enterprise and Employment], promotes funding and support programmes for TT, including innovation vouchers, tax incentives and innovative public procurement. Other departments, such as DARPA [Department of Agriculture, Livestock, Fisheries and Food], operate an Annual TT Plan (Pla Anual de TT, PATT) to foster training and innovation in experimental and research activities in the agri-food sector.

  The main bodies responsible for implementing TT within the public administration in Catalonia

[18] According to the ACCIÓ report (2025).

[19] Based on the classification in the Oslo Manual: Link to manual

[20] Report "Baròmetre de la innovació i la transformació digital i verda a Catalunya 2025" [Barometer of Innovation and Digital and Green Transformation in Catalonia 2025]. Link to report https://www.accio.gencat.cat/web/.content/bancconeixement/documents/informes/2025/ACCIO-barometre-innovacio-catalunya-2025.pdf

are ACCIÓ and AGAUR. ACCIÓ, reporting to the Enterprise and Employment Department, manages the TECNIO programme as well as grants and initiatives that help Catalan SMEs and companies bring technologies to market. AGAUR, reporting to the Research and Universities Department, focuses on the research and university system, supporting Knowledge Transfer Offices (KTOs), CERCA centres and the transfer of experimental research results. At the national level, CDTI and CSIC also play a key role in Catalonia's TT ecosystem. CDTI provides business innovation instruments and acts as a liaison for international programmes such as Horizon Europe, while CSIC contributes critical research capacity in universities as well as significant funding and innovation instruments.

Local councils also actively support TT. The Barcelona City Council promotes technology transfer through the Barcelona Innovation Coast initiative,[21] which brings together the city's main actors: universities and business schools, research and knowledge transfer centres, business associations, clusters, funding bodies and other public administrations. Reus City Council drives the Reus Ciutat de la Ciència i la Innovació initiative,[22] encompassing 69 innovative projects grouped under citizen, organisation and business themes, including Hub Foodtech & Nutrition and Reus Living Lab. Girona City Council provides a funding line for innovative projects via the ICF Girona Fonts d'Innovació,[23] while Lleida City Council has created the Espai d'Innovació del Comerç (Retail Lab),[24] focused on the digital and technological transition of local commerce.

- **Science and Technology Parks:** Catalonia has 26 parks, 14 of which are part of the XPCAT network. These parks facilitate connections between research and business and host spin-offs and startups in collaborative environments. They are therefore a key instrument for fostering networked open innovation, integrating companies, research centres, technology centres and incubators.

- **Incubators and Accelerators:** These serve as launch platforms for startups. Prominent public initiatives include Barcelona Activa, while private examples include Seedrocket, Esade Creapolis and Nodrizatech.

- **Funding Entities:** Financing is essential for scaling solutions. In the private sector, participation comes from financial institutions (CaixaBank with DayOne, Banco Sabadell with BStartup, Banco Santander with Santander Startups), venture capital firms (Wayra Telefónica, Asabys, Invivo, Antai) and business angels (Carlos Blanco, Adeyemi Ajao, BANC). Public entities, beyond those in government administration, include the Institut Català de Finances (ICF), which provides long-term financing and capital instruments to support business activity, and Catalonia Trade & Investment (CT&I) under ACCIÓ, whose main goal is to attract investment to Catalonia.

- **Technology Consultancies:** These support companies and institutions in taking innovations from the laboratory to the market, offering services in technology valorisation, innovation strategy and change management. This category also includes consultancies specialising in

[21] https://www.barcelona.cat/barcelonaciencia/es/barcelona-innovation-coast
[22] https://www.reus.cat/ciutat-de-la-ciencia-i-la-innovacio
[23] https://www.icf.cat/ca/prestecs/innovacio/icf-girona
[24] https://retaillab.paeria.cat

helping companies access R&D funding.

- **Business and Sector Associations:** They act as intermediaries between technology supply and demand, represent sector interests and coordinate collaborative initiatives. Key examples include Foment, PIMEC, CECOT and the Fundació per la Indústria.
- **Foundations and Organisations Promoting Scientific Research:** Organisations such as the Fundació Catalana per a la Recerca i la Innovació (FCRI) promote scientific culture, fund projects and encourage the use of standardised indicators for impactful research, alongside institutions such as CERCA and ICREA [Catalan Institution for Research and Advanced Studies].

3.2 Key Policies and Governance

Public policies play a pivotal role in defining the instruments, incentives and priorities that steer research and innovation activities towards the market. Catalonia's TT system operates within an institutional and political framework where multiple levels of government, strategic plans and programmes converge.

1. **Framework Policies and Reference Strategies**

The development of Catalan research and innovation policy has been structured through several strategic instruments:

- **National Pact for Research and Innovation (PNRI) (2008)**: established the initial foundations for a shared knowledge policy, aiming to align public and private efforts in research, innovation and training.
- **National Pact for the Knowledge Society (PN@SC) (2020)**: updated and expanded the objectives of the PNRI, providing Catalonia with a long-term vision for progressing towards a knowledge-intensive economy with transformative capacity. TT is one of its central pillars.
- **Strategic Plan for Innovation and Knowledge Transfer (PEITC)**: implemented under Law 9/2022 on Science, this serves as the main operational instrument. Its aim is to position Catalonia among Europe's leading regions in innovation, promoting greater valorisation of knowledge.

These policies are aligned with both the national strategy (Spanish Strategy for Science, Technology and Innovation and National Plan for Transfer and Collaboration) and the European Research and Innovation Strategy.

2. **Institutional Coordination**

Catalonia's research and innovation system is coordinated primarily through two departments:

- The Departament de Recerca i Universitats, responsible for scientific development, the university system and training and mobility programmes.

• The Departament d'Empresa i Treball, which leads business innovation and TT policies, primarily through ACCIÓ.

The Comissió Interdepartamental de Recerca i Innovació (CIRI, Interdepartmental Commission for Research and Innovation) is the collegiate body that ensures coordination and coherence across the departments of the Generalitat Government of Catalonia in the areas of research and innovation. CIRI sets general guidelines, prioritises actions, ensures complementarity among policies and fosters synergies between departments.

As outlined, the agencies ACCIÓ (enterprise and innovation) and AGAUR (research and universities) implement the main programmes, grants and calls. Barcelona City Council also plays a prominent role in the governance of technology transfer and urban innovation, promoting initiatives that complement the Government of Catalonia's policies, such as Barcelona Activa and the development of technology districts and innovation hubs (including 22@). Other notable initiatives include the Parc Agrobiotech in Lleida and the TecnoParc for health, nutrition and tourism in Reus.

3. Specific Mechanisms to Promote TT

The following section describes in greater detail some of the main mechanisms designed to promote TT, based on the framework policies and reference strategies outlined above:

I) Business R&D Project Grants

ACCIÓ issues calls for proposals that fund R&D projects led by companies, often in collaboration with knowledge centres. These cover both individual and collaborative projects, particularly in strategic sectors such as healthcare, energy and advanced materials. Funding also supports activities related to technology valorisation, validation and demonstration (TRL 4–7).

(ii) Knowledge Industry Programme (AGAUR – Generalitat Government of Catalonia)

A key instrument for promoting the valorisation of knowledge generated in universities and public research centres. It includes streams such as Llavor ([Seed] for early-stage projects), Producte (Proof of Concept) and Mercat (Spin-off Creation). The programme also enables companies to access protected research results and validate them for commercial use.

iii) Industrial PhD Plan

This plan supports the placement of research staff in companies to develop applied research projects linked to doctoral theses. It facilitates the flow of knowledge between academia and industry, enhancing companies' capacity for innovation, and helps establish medium-term, stable links between universities and businesses.

(iv) R&D&I Networks and Technology Cooperation Programmes

These programmes encourage collaborative networks among actors within the innovation ecosystem, including clusters, technology centres, universities and companies. Specific initiatives include support for technological innovation hubs, often co-funded with public resources. They focus on co-diagnosis,

co-creation and demonstration projects that bring knowledge closer to specific business challenges.

(v) Technology Intermediation and Advisory Services (ACCIÓ)

ACCIÓ provides direct support to companies to identify technology partners, access publicly developed technologies and explore joint innovation projects. Through innovation and sustainability vouchers, companies can contract services from technology centres or research groups to address specific challenges. ACCIÓ also coordinates the Digital Innovation Hub of Catalonia, co-financed by the EU and the Ministry of Industry, acting as a connecting node within the ecosystem, particularly linking SMEs with Industry 4.0 technology providers.

(vi) Promoting Participation in International Projects (Horizon Europe)

Support programmes assist Catalan companies in joining European R&D&I consortia and promote international collaboration with knowledge centres.

4. Budget

In the 2024 budget, the Generalitat Government of Catalonia allocated €1,000 million[25] for R&D&I, part of which is specifically aimed at strengthening TT ecosystems.

Although detailed figures for research, development and innovation activities in 2024 are not yet available, basic data from 2023 are provided below.[26] In that year, the Generalitat's total R&D&I expenditure amounted to €1,269.90 million, distributed as follows: 41.8% was allocated to grants and core funding for R&D&I (i.e. competitive calls and baseline funding for research and technology centres); 33% went to General University Funds (FGU) for R&D; 22.17% supported R&D&I within the health system; and 2.89% was devoted to innovation projects carried out by the Administration itself.

Of the 41.8% allocated to R&D&I grants and core funding, 14.30% went to CERCA centres, 12.75% to general support for research and knowledge transfer to universities, research groups, science parks and other Generalitat centres, 4.28% to business R&D&I projects (totalling €54.36 million), 1.49% to technology centres and 1.84% to support for major infrastructures such as CSUC or astronomical observatories.

According to the report, in terms of R&D&I funding by department, the Departament de Recerca i Universitats – which held R&D competences in 2023 – accounted for 57.3% of the total; followed by the Departament de Salut [Health Department] with 26.5%. Third in terms of allocation was the Departament d'Acció Climàtica, Alimentació i Agenda Rural [Department for Climate Action, Food and the Rural Agenda] with 7.9%, and the Departament d'Empresa i Treball, responsible for business innovation, with 3.6%. The remaining departments and higher bodies represented 4.7% of R&D&I funding.

[25] Information taken from the Explanatory Report on the Generalitat Government of Catalonia's 2024 Budget.

[26] Refer to the Informe del Finançament de l'RDI de la Generalitat de Catalunya 2023 [2023 Report on RDI Funding by the Generalitat Government of Catalonia].

5. Other Relevant Policies

In addition to specific innovation policies, it is also worth noting other framework policies and strategies that have an impact on the TT system, such as the Pla Catalunya Lidera [Catalonia Leads Plan] and the Pacte Nacional per la Indústria 2022-2025 (PNI 2022-2025) [National Pact for Industry 2022-2025].

Both recognise knowledge and technology transfer as a strategic priority for Catalonia. The former places it within a broader innovation agenda, emphasising technological deployment and venture capital, while the latter dedicates a specific pillar to TT, with clear measures to enhance collaboration between the scientific system and the business sector, as well as instruments to foster the valorisation and impact of research.

The following table summarises the most relevant TT measures included in Pla Catalunya Lidera and PNI 2022-2025:

Scope of Action	Pla Catalunya Lidera	PNI 2022-2025
Budget	€18.5 billion over 5 years	€2.817 million over 4 years[27]
Promotion of Knowledge Transfer	Technological transformation programme for SMEs (Measure 3.5.1)	Agreement to strengthen transfer between the knowledge system and companies (Measure 4.1)
Valorisation of Public Research	Public venture capital fund for innovation (Measure 3.3.1)	Specific programme to support valorisation (licences, spin-offs, patents) (Measure 4.5)
Infrastructure for TT	Investment in singular scientific-technical infrastructures (Measures 3.4.1 and 3.4.2)	Support for technology centres and innovation intermediaries (Measure 4.4)
Funding of Collaborative Projects	No specific measures beyond venture capital	Increased funding for collaborative R&D projects (Measure 4.3)
Reform of the Knowledge System	University and R&D system reform to enhance economic impact	Promotion of new governance and coordination mechanisms

Table 1. Comparative Summary of the Key TT Measures in the Pla Catalunya Lidera and PNI 2022-2025

Source: Prepared by the authors based on data from the Generalitat Government of Catalonia (2025) and Directorate-General for Industry (2022).

[27] Can be increased up to €3.27 billion, depending on the approval of associated European funds.

3.3 The Performance of Catalonia's TT System in a European Context

Assessing the performance of a TT system is a complex task, as TT is a dynamic and collaborative process that is often difficult to quantify. There are no direct or comprehensive indicators that capture all dimensions of the phenomenon, so it is necessary to rely on indirect indicators or proxy variables.

In this context, one of the most comprehensive tools available is the Regional Innovation Scoreboard (RIS), an initiative of the European Commission that evaluates and compares the performance of innovation systems at regional level (NUTS 2) on a biennial basis. Unlike the European Innovation Scoreboard (EIS), which focuses on countries, the RIS provides comparative data for 241 European regions, including regions from non-EU European countries.

The RIS 2025 aggregates twenty-three indicators to produce a composite index, the Regional Innovation Index, ranking regions from the most innovative (innovation leaders) to emerging regions.[28] Although the RIS does not measure TT directly, but rather overall innovation, many of its indicators serve as good proxies – for example, the number of patents, the level of public-private collaboration and the extent to which companies apply innovations to their processes and products.

In 2025, Catalonia ranks 72nd out of 246 regions,[29] improving by nine positions compared with 2023, and is firmly within the Strong Innovator category.[30] It is also the most innovative region in Spain, ahead of the Basque Country and the Community of Madrid (both Strong Innovator-). Over recent years, Catalonia has steadily climbed the rankings, from 98th in 2016.

However, more insightful than Catalonia's exact position – since differences between close ranks often reflect nuances and the methodology for calculating the index has evolved over time – is understanding how far it remains from the most innovative regions, and which specific indicators require attention. The following analysis compares Catalonia's performance across each of the 23 RIS indicators with the EU-27 average and the Top 10 most innovative European regions, which in 2025 include three regions from Sweden, two from the United Kingdom, two from Switzerland, one from Denmark, one from Finland and one from Germany.[31]

In this Top 10, Stockholm leads the 2025 ranking as the most innovative European region, moving up from fourth place in 2023, while the Danish region of Hovedstaden (including Copenhagen) drops to second place.

Overall, there are no major structural changes in the Top 10 between RIS 2023 and RIS 2025, but several notable shifts have occurred. Two of the three German regions included in the Top 10 in 2023 are no longer present, while two UK regions – London, rising to third place, and the Southeast England, ranking seventh – enter the Top 10. This reflects a relative decline in Germany's innovation capacity and a consolidation of the UK's position within the European innovation landscape, despite the post-Brexit

[28] For more information on how the Regional Innovation Index is calculated, see European Commission (2025), "Regional Innovation Scoreboard 2025 – Methodology Report".

[29] In addition to the 241 regions mentioned, five regions that are formally excluded from the RIS – because they are city-states (their NUTS 2 classification corresponds to NUTS 1) – are still included in the ranking calculation.

[30] In 2023, it was classified as a Strong Innovator.

[31] Complete list: Stockholm (Sweden), Hovedstaden (Denmark), London (United Kingdom), Zurich (Switzerland), Upper Bavaria (Germany), Ticino (Switzerland), Southeast England (United Kingdom), Helsinki-Uusimaa (Finland), Western Sweden (Västsverige) and Southern Sweden (Sydsverige).

context.

Graph 2 illustrates how Catalonia compares across the four dimensions used to group the 23 RIS indicators, relative to the Top 10 average. Graph 3 shows the percentage deviation between Catalonia's performance and the Top 10 for each of the 23 RIS indicators. Notably, Catalan companies demonstrate a very high level of innovation, well above the Top 10 average – a trend also observed in other Spanish regions. This finding is based on a subjective indicator reported directly by the companies themselves.

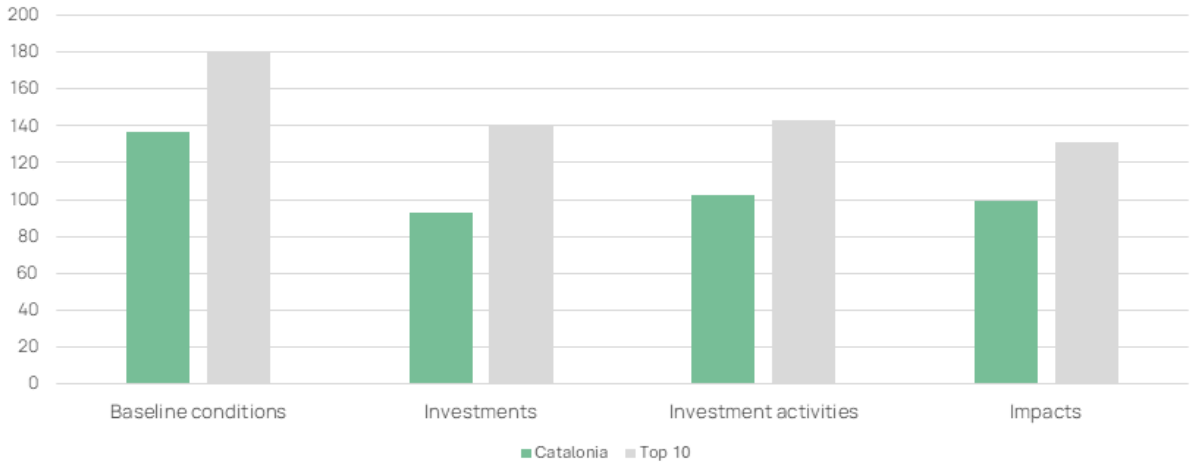

Figure 2. Catalonia Compared with the Top 10 Most Innovative European Regions Across the Four RIS 2025 Dimensions

Source: Prepared by the authors based on data from the Regional Innovation Scoreboard 2025, European Commission.

Figure 3. Relative (%) Difference Between Catalonia and the Top 10 Most Innovative European Regions for Each of the 23 RIS 2025 indicators

Source: Prepared by the authors based on data from the Regional Innovation Scoreboard 2025, European Commission.

Comparison of 2025 Results by Indicator Groups

Regarding the **baseline**, this dimension covers the structural factors that facilitate and enable innovation but are not a direct outcome of innovation policy, such as higher education levels and the most-cited scientific publications. Catalonia performs well (136.4), ranking clearly above the European average both in aggregate and across all six indicators in this dimension, yet it remains below the Top 10 group average (179.6). Catalonia has a solid foundation on which to build its innovation system, with some indicators even exceeding the Top 10 average (high-speed internet access and the proportion of the workforce with higher education). Nonetheless, there is still room for improvement compared with leading regions, particularly in terms of scientific publications with at least one foreign co-author and continuing education for the employed population.

In terms of **investment**, Catalonia scores 92.6 in this dimension, below the EU average and well behind the Top 10 (139.6). It is the dimension with the lowest relative performance, with five of the six indicators falling below the EU-27 average. The results point to a structural shortfall in financial resources devoted to R&D and innovation, both public and private. Private sector investment, in particular, remains low compared with the EU average (17% below). Public sector expenditure, although closer to the EU average, is nearly 30% below the Top 10 benchmark. This structural gap limits the system's capacity to drive transformative projects and to sustain TT strategies over the medium and long term.

It is worth pausing here to quantify and qualify the extent of the R&D spending gap. A recent study by G. Musterni and J. Bascuñana (2025)[32] analyses R&D expenditure in Catalonia in depth. The findings show that Catalonia lags behind both the European average and the Top 10, not only in terms of R&D spending as a percentage of GDP but also in how these funds are allocated.

Catalonia allocates a smaller proportion of R&D expenditure to experimental development – 34% versus 51% for the Top 10 and 31% for Spain overall. Experimental development corresponds to TRL 5–6,[33] an intermediate phase between basic and applied research (TRL 1–4) and innovation and commercialisation (TRL 7–9). It is a critical stage for testing and validating technological applications in a relevant, though still simulated environment.

The study corroborates the RIS 2023 and 2025 findings regarding the relatively low level of private sector R&D spending compared with the Top 10, both in terms of the entities carrying out the research and the sources of funding.

In terms of **innovation activities**, Catalonia scores 102.7 in this dimension, just above the EU average but well below the Top 10 average (143.2). This dimension measures the extent to which businesses implement innovative processes and products or participate in public innovation initiatives. The results show contrasts: four of the seven indicators fall below the EU average, and these are precisely the most critical for ensuring impactful TT – SMEs

[32] Paper presented at the 4th Congress on Economics and Business in Catalonia.

[33] The Technology Readiness Level (TRL) is a standardised scale used to assess how mature a technology is. Originally developed by NASA, it has since been widely adopted in fields such as research, industrial innovation, and R&D&I policy — for instance, within the Horizon Europe programme.

introducing product innovations, SMEs introducing process innovations, innovative SMEs collaborating with external actors and PCT patent applications. Conversely, Catalonia exceeds the Top 10 average in trademark and industrial design applications.

Regarding the **economic and social impacts of innovation**, Catalonia performs at the European average (99.5) but remains below the Top 10 benchmark (130.7). This dimension measures the extent to which innovation efforts result in tangible outcomes, such as new products, innovative sales and job creation in knowledge-intensive sectors. Catalonia stands out particularly in the indicator measuring sales of new innovations, both to the market and within companies, where it exceeds the Top 10 average. This indicator is calculated as the proportion of total SME turnover generated by new or significantly improved products – either new to the market (pioneering innovations) or new to the company (existing innovations adopted for the first time by the firm). It captures both the capacity of companies to develop new solutions (creation) and to adopt and commercialise existing technologies (diffusion).

The strong results in this area reflects the system's transformative potential when innovation mechanisms are effectively deployed. However, other key indicators – such as employment in innovative firms and labour productivity – remain below the EU average.

Evolution Since 2023

According to the Regional Innovation Index, Catalonia has narrowed the gap with the Top 10 most innovative regions since RIS 2023, falling from 43.6 points below the Top 10 average in 2023 to 33.2 points in 2025.

Looking at individual indicators, the most notable progress has been in human capital and digitalisation: the score for adult participation in lifelong learning has risen by over 30%, while the number of employed ICT specialists has increased by 26%. Indicators linked to TT and business impact have also improved: the proportion of innovative SMEs collaborating with other actors has grown by 23%, and sales of new innovations – both to the market and within companies – have risen by nearly 20%. Gains are also evident in employment in innovative firms, research internationalisation and public sector R&D spending.

Nevertheless, there are setbacks in some strategic areas, highlighting ongoing challenges. Catalonia saw declines in trademark applications (–24%) and PCT patent applications (–15%), suggesting comparatively lower efforts in protecting innovations. Scores also fell for CO_2 productivity (measured as fine particulate emissions), spending on non-R&D innovation and the proportion of SMEs introducing product innovations. Finally, the share of scientific publications among the top 10% most cited decreased slightly.

Conclusions

Overall, Catalonia has made **significant progress in the ranking of Europe's most innovative regions**, moving from 81st in 2023 to 72nd in 2025. It has also narrowed the gap with the Top 10 most innovative regions: while this gap was 43.6 points in 2023, it had fallen to

33.2 points by 2025. This reflects positive developments within the Catalan system and ongoing efforts to strengthen its innovation capacity and impact.

Catalonia's innovation system continues to rest on a solid foundation, performing strongly in structural conditions such as higher education levels, basic digitalisation of the population and access to high-speed internet. However, RIS 2025 confirms a persistent weakness in the investment dimension, both public and private, with values below the EU average and well below the Top 10. This structural shortfall limits the system's capacity to develop projects with transformative potential and to consolidate long-term TT strategies.

Meanwhile, performance in **innovation activities and impacts** shows encouraging trends: Catalonia is slightly above the EU average but still behind the European benchmarks. This indicates a gap between the system's innovation potential and its effective translation into tangible results. Nonetheless, there have been very significant improvements in several indicators: adult participation in lifelong learning has risen by 31%, the number of ICT specialists by 26% and innovative SMEs collaborating with other actors by 23%. Progress is also evident in sales of innovations and employment in innovative firms, both key indicators of the economic impact of innovation. Still, thirteen of the 23 RIS 2025 indicators for Catalonia remain below the EU average, highlighting persistent structural imbalances that need to be addressed.

These advances point to a change in trend and suggest that, if support instruments and funding are reinforced – particularly in areas such as private R&D, experimental development and public–private collaboration – Catalonia could harness its potential far more effectively. The data suggest that the main challenge is no longer generating knowledge or talent alone, but linking it to the business ecosystem, the actual needs of companies and market demand. In this context, consolidating an ecosystem focused on knowledge valorisation and applied innovation becomes a strategic priority.

It should be noted, however, that these conclusions are based on RIS data, which are valuable yet limited. For instance, the Regional Innovation Index is calculated as the unweighted average of 23 indicators, which can mask significant imbalances between dimensions; for instance, regions excelling in a few indicators may appear higher ranked than those with more balanced performance.

Studies such as COTEC (2022) suggest alternative methodologies that could place Catalonia in an even more favourable position. Therefore, it is important to consider which indicator systems most accurately reflect the true performance of Catalonia's TT system and to move towards a more robust evaluation model that considers both the quality and the relevance of the results produced (see Section 7.2: Future Lines of Work).

4. Two Case Studies: The Basque Country and Flanders Models

This section presents two case studies of regions with a well-established track record and notable achievements in innovation, aimed at identifying useful benchmarks for strengthening the Catalan innovation system. The regions are the Basque Country, currently the most innovative region in Spain according to the RIS, and Flanders, one of Europe's leading innovation hubs. Analysing these two models helps to understand the strategies, specific instruments and institutional dynamics that have contributed both to intensifying innovation and to strengthening the link between knowledge and the market, with a view to drawing lessons that can be applied to the Catalan context.

Table 2 (Annex) provides a comparison between Catalonia, the Basque Country and Flanders across a selection of relevant indicators, covering both the innovation system and broader macroeconomic and socio-economic dimensions. The remainder of the section offers a more qualitative discussion of the innovation models in these regions, drawing on secondary sources and semi-structured interviews with selected actors from their innovation ecosystems.

4.1 The Basque System

The Basque innovation system is based on a well-established structure that is strongly oriented towards the business sector, the result of sustained institutional commitment since the 1980s and a strategic emphasis on TT as a tool to strengthen business competitiveness.

This model has developed over more than four decades within a context of institutional stability – with only a single change in political leadership – and financial autonomy, enabling the Basque government to design and sustain long-term public policies in R&D&I, consistently focusing on addressing business challenges and providing direct support to industry.

A key element of this ecosystem is the Basque Science, Technology and Innovation Network (RVCTI), created in 1997 to offer a comprehensive and specialised infrastructure for the business sector. The network brings together a range of actors: universities, technology centres, cooperative research centres (CICs), companies and public administrations.

The 17 technology centres that form the network act as engines for the diffusion of innovation and are deeply embedded within the business sector. Many of these centres, such as those integrated into the current TECNALIA (the largest technology centre in Spain and southern Europe), are closely linked to industry, with a clear mission to address companies' technological challenges.

Other centres, such as IKERLAN, which emerged from industrial cooperativism, exemplify an extremely pragmatic model in which all scientific activity must be connected to a business and commercial application.

Funding for the centres is mixed: around 50–60% comes from private contracts with companies, approximately 20% from capped core public funding and the remainder from competitive sources (regional, national or European). Core funding is allocated annually and is performance-based, with continuation contingent on meeting the strategic indicators set by the government. This incentive structure requires the centres to maintain activity focused on effective technology transfer, including applied research, protection of results (such as patents) and the creation of business value.

Specific programmes, such as HAZITEK, with a projected budget of €95 million in 2025, fund collaborative business R&D projects, while the public agency SPRI plays an important role in supporting technological and business development through calls aligned with market demand.

This approach has consolidated a highly market-oriented ecosystem, driven by incremental innovation and stable collaboration between centres and companies, rather than by disruptive innovation. Although the Basque Country lacks critical scientific infrastructure and a university system as competitive as Catalonia's, it has nonetheless generated solid technology-based companies, many of which have emerged directly from the centres themselves. These companies are characterised more by high industrial and technological specialisation than by digital or service-based business models. Meanwhile, the CICs, such as nanoGUNE or bioGUNE, combine excellent research in strategic areas with a clear industrial application and operate under governance structures shared between universities and companies.

At the strategic level, the reference policy is the Science, Technology and Innovation Plan 2030 (PCTI 2030), presented in 2021. Its governance model is organised across three levels: strategic leadership through the Basque Council for Science, Technology and Innovation (presided over by the lehendakari); operational coordination through interdepartmental and interinstitutional committees; and technical participation via pilot groups that ensure alignment among the various actors. The plan also incorporates a monitoring and evaluation system that supports decision-making and ensures the continuous adaptation of policies to the major challenges of the decade: the digital, energy, climate and social transitions.

Despite its maturity, the Basque model faces challenges. On one hand, the technology centre system is highly fragmented, with small centres lacking the critical mass to compete nationally and internationally, suggesting a likely future trend towards consolidation – with fewer, larger and more competitive centres, as already seen in regions such as Flanders and Germany.

On the other hand, the lack of venture capital limits the growth of start-ups, and the region's demographic stagnation hampers the attraction and retention of talent. To address this, the technology centres establish agreements with universities to recruit foreign doctoral students, particularly from Latin America.

4.2 The Flemish System

The TT system in Flanders is characterised by a collaborative, non-competitive and highly specialised structure, designed to respond to the needs of companies and public administrations.

At the heart of the system are four major research and innovation centres — IMEC, VITO, VIB and Flanders Make — each specialising in a different field, with a combined workforce of over 8,000 researchers. Flanders Make, in particular, serves as the main technology centre for the manufacturing industry, employing more than 950 people and maintaining a network of 207 member companies, with a focus on design, motion and advanced production solutions.

The governance of the system is based on a distributed and integrated structure, in which universities (KU Leuven, UGent, VUB, UHasselt and Universiteit Antwerpen) host laboratories and co-creation centres connected to the technology centres. This physical and institutional proximity facilitates collaboration between research and industry.

Funding is predominantly public, complemented by competitive Flemish and European project funds, along with revenue from agreements with large industrial companies. This combination sustains a public–private collaboration model that is strongly oriented towards applied projects driven by real industrial demand.

Transfer projects are defined according to the needs of companies, which actively participate in shaping the technological roadmap of centres such as Flanders Make. This "pull" approach is combined with world-class technological capabilities, extensive participation in European programmes and an internal intelligence system that identifies opportunities and builds competitive consortia at EU level. In addition, the Digital Innovation Hub "Digitalis" promotes digital transformation and links with the European ecosystem, offering services ranging from technology testing to funding and specialised training.

Another key component of the Flemish model is the VLAIO initiative (Agency for Innovation and Enterprise), which acts as an umbrella coordinator for policies supporting innovation and technology transfer. VLAIO provides grants for entrepreneurship, manages support programmes for collaborative projects and research centres and offers tools for exploiting results and creating spin-offs.

Also notable are the sectoral intermediaries and public-private consortia, such as the Spearhead Clusters (Catalisti, Flux50, etc.), which promote challenge-driven innovation and the joint development of priority technologies in key sectors. Flanders also fosters a strong culture of scientific entrepreneurship, with initiatives such as the IOF (Industrial Research Funds) to support technological maturation and the creation of university spin-offs.

Challenges include the complexity of internal coordination between centres, a high dependence on public subsidies (particularly among SMEs) and a limited presence of venture capital, which hinders the scaling of spin-offs and start-ups arising from research. Despite these challenges, the system has succeeded in developing a robust and internationalised environment for applied innovation.

5. Barriers to Technology Transfer Affecting Catalonia

Based on the previous analysis, as well as interviews and questionnaires conducted with various experts and representatives from entities within Catalonia's innovation ecosystem, we have identified a set of barriers to TT that bear a tangible impact.

It should be noted that many of these barriers are not new and have been analysed previously, for example by Cassiman and Mas (2009). In general, time passes, but the structural challenges remain largely unchanged:

1. **Funding and financial mechanisms for transfer are lacking:** Catalonia falls below the European average and lags far behind the most innovative regions in terms of R&D expenditure relative to GDP. Financing instruments are generally considered useful but have gaps in supporting intermediate TRLs (experimental development phases) and private sector R&D expenditure. In addition, the financial support architecture does not always favour high-risk valorisation projects or the scalability of scientific results to the market. Despite public investment, tangible impacts on transfer remain difficult to measure, highlighting the lack of traceability between public funding and actual technological and economic outcomes.

2. **Low technological absorption by the business sector:** RIS 2025 indicators place Catalonia far from leading regions in terms of SMEs' capacity to innovate in products and processes, and to collaborate with each other and with other actors in the ecosystem. While Catalonia does not differ substantially from the European average regarding company size, it has a higher proportion of micro-enterprises (0–9 employees) and a lower share of medium-sized companies. Several stakeholders have emphasised, however, that small companies are not necessarily less productive, but often fail to grow due to deficiencies in resource management and organisational capital. The barrier is not only structural but also cultural, as collaboration between companies, universities and technology centres remains insufficiently embedded. It is important to analyse why, despite the presence of intermediaries and support instruments comparable to other European reference systems, the transfer chain does not generate the expected impact. For example, the characteristics of the business sector create a tension between maintaining control over the company and accepting external, non-bank funding, which enables higher risk-taking and exogenous growth. This may mean that large companies are better able to absorb opportunities than SMEs.

3. **Lack of incentives for transfer within the research sector:** Actors in the research ecosystem agree that structural barriers persist, hindering knowledge and technology transfer. Key obstacles include bureaucratic hurdles that impede the creation of science-based spin-offs and start-ups, and the lack of flexibility to promote researcher mobility and collaboration between the public and private sectors. Despite the regulatory framework established by the Science Law, the effective implementation of transfer is limited by fragmented criteria: each university defines its own internal mechanisms and

policies, often with little coordination and shared vision. There is also a need to define clearer incentives and strengthen funding programmes for spin-off creation from research centres. This fragmentation is further compounded by an academic evaluation system that does not establish clear incentives for transfer.

Transfer interfaces (KTOs, incubators, technology centres) lack sufficient resources, clear incentives and specialised personnel.

4. **Insufficient validation and scaling infrastructures:** One of the key limitations highlighted by interviewees is the lack of intermediate infrastructures — such as testbeds, pilot projects or shared technological experimentation spaces — that allow technologies to be validated in real-world or pre-commercial environments. This gap hinders the maturation of innovations and limits market entry, often referred to as the 'valley of death'. It also constrains Catalonia's capacity to attract investment and position itself as a favourable environment for technological scaling. There is also a shortage of operational actors, such as venture builders specialised in deep tech.

5. **Institutional fragmentation and lack of strategic coordination:** The transfer ecosystem shows a degree of both political and operational fragmentation. The absence of a formal, integrated and stable governance structure — with participation from all relevant actors — prevents the establishment of a shared agenda and the maximisation of synergies among ecosystem actors. This results in poorly coordinated actions that struggle to achieve sustained long-term impact. Despite the implementation of numerous relevant plans and strategies for TT in recent years, clear mechanisms for coordination and leadership remain lacking. There is also no long-term vision for Catalonia's economic and industrial model, nor clarity on which sectors and emerging technologies should be prioritised beyond political cycles.

6. **Impact evaluation:** Although the PEITC [Strategic Plan for Innovation and Technology Transfer in Catalonia] proposes an indicator-based evaluation system, Catalonia lacks a centralised and cohesive indicator system from which disaggregated data and microdata can be obtained to properly monitor the TT system and design evidence-based public policies. This limits the ability to assess the real impact and efficiency of the instruments deployed. It also forces reliance on external indicators (such as the RIS), with their limitations, and prevents a convincing assessment of technological transfer.

6. Opportunities and Drivers

Despite the barriers identified, Catalonia has strategic assets that can act as key drivers in building a stronger TT model:

1. **A leading entrepreneurial ecosystem in Europe, with growing access to funding:** With over 2,200 active start-ups, a cumulative investment of €6.445 billion, and a notable presence of university spin-offs and deep tech ventures, Catalonia has an entrepreneurial ecosystem with significant potential for scaling. Thirty-eight per cent of start-ups have already received funding — nearly half exceeding one million euros — with growing support

from both public and private investors. This emerging ecosystem can act as a driver for technology transfer if accompanying mechanisms and links with the scientific system are reinforced.

2. **Proven capacity to attract European R&D funding:** Catalonia ranks third among European regions in Horizon Europe funding, receiving €1.015 billion between 2021 and 2023. This represents 3.54 % of the European total, double the proportion corresponding to its population, positioning Catalonia as the leading region within Spain, accounting for 32.6 % of the national total. Catalan participation is particularly notable in Pillar I (Scientific Excellence), with 4.4 % of Marie Sklodowska-Curie funds and 3.6 % of ERC grants. Participation in Pillar III (European Innovation Council) is also significant, with 4.5 % of European funds dedicated to disruptive innovation.

   Regarding recipient institutions, research centres and universities account for 61.3 % of European funds captured in Catalonia. Within this, CERCA centres stand out with 26.1 %, ahead of universities (24.5 %) and other R&D centres (11.6 %). This makes the CERCA system the third most active institutional group in Horizon Europe at the European level, behind Germany's Helmholtz centres and France's CNRS, and ahead of other leading institutions such as Fraunhofer or the Max Planck Institute.[34]

3. **Strong scientific base and top-level European research infrastructures:** Institutions such as the CERCA centres, the Barcelona Supercomputing Center (BSC) and the Alba synchrotron position Catalonia as a high-value research and innovation hub, with the ability to attract international talent and knowledge to act as engines for technology transfer and technological validation.

4. **Technology centres connected to the business sector:** Catalonia has technology centres firmly embedded in the region, with a long-standing record of collaboration with companies in the business sector, particularly SMEs, and a clear focus on applied research and TT. These centres have a well-established scientific and technical talent base and possess the infrastructures and laboratories that, with the right reinforcement, could scale up to models similar to application labs or technology pilot lines, which have proven successful in other European regions as platforms for technological co-creation and scaling.

5. **Strategic sectors with a strong technological base:** Areas such as health, biotechnology, sustainability and mobility offer clear opportunities for TT, thanks both to the presence of leading companies and the growing demand for advanced solutions. These sectors are especially receptive to benefiting from the introduction of cross-cutting enabling technologies, or Key Enabling Technologies (KETs). Examples include artificial intelligence, supercomputing, microelectronics and nanotechnology. These technologies can enhance industrial competitiveness across multiple sectors and generate knock-on effects.

6. **Existing strategic and institutional framework:** The PEITC, the Industrial Doctorates

[34] Catalonia Trade C Investment (2024). Web access.

Plan and the Knowledge Industry Programme, together with the established role of ACCIÓ, provide a solid institutional foundation to implement structural improvements, provided that limitations in coordination and governance are addressed.

7. Considerations and Future Lines of Work

7.1 Considerations

Catalonia, like the rest of Europe, stands at a critical juncture in redefining the role that TT should play in its competitiveness strategy. The analysis of barriers and opportunities reveals a complex reality: the region has an innovation ecosystem structurally comparable to other leading European regions, along with substantial scientific and institutional capital, yet the dynamics and incentives needed to translate this potential into economic and social impact are not fully aligned. The gap between laboratory and market is not merely a technical or funding issue; it is a matter of vision, institutional architecture and shared priorities.

Achieving a TT system with tangible impact first requires recognising that technology transfer is not a simple linear flow of knowledge to the market but a systemic process that depends on coordination, trust and leadership. It is therefore necessary to **overcome the current fragmentation through an integrated and stable governance structure**, underpinned by a long-term action plan capable of aligning resources, policies and agendas across the many actors operating in this space. Such governance should combine strategic leadership with executive capacity and result from a pact among political parties, administrations, the research system, the business community and intermediary organisations. Without this shared governance framework, the ecosystem risks continuing to operate in a fragmented way, generating limited and uneven impacts and remaining vulnerable to political cycles.

This new governance should take a systemic view of Europe's declining influence relative to major global competitors and aim to strengthen coordinated European–national–Catalan action to support companies and promote critical technologies (including dual-use technologies) through collective European borrowing.

Attention should also be paid to how European projects are allocated and evaluated. At present, project selection tends to prioritise partnership diversity (as a means of fostering European integration) over the disruptive potential of the technologies being developed. This has led to biases in the organisations that apply for and secure funding, as well as inefficiencies in the use of public resources. Projects should instead be assessed on their transformative potential, as in the case of grants awarded by the European Research Council or the European Innovation Council.

It is also essential to address **the incentive structures that currently shape scientific activity**. Without institutional recognition of the value of technology transfer in academic careers, and without removing regulatory barriers that hinder mobility or the creation of spin-offs, it will be difficult to foster a strong and sustained culture of translation. This also calls for investment in the research system's human capital – the individuals who generate the knowledge forming the foundation of future technologies – by attracting and retaining top-level scientists and

educators with appropriate remuneration. Collaboration between business schools and research centres should be strengthened. In addition, business professionals must receive basic technical and scientific training, while scientists should acquire business knowledge and remain involved in the later stages of innovation as it moves towards the market.

Technology transfer can therefore no longer be treated as a voluntary initiative; it must become an integral, structural dimension of public research, with clear mechanisms for recognition, support and accountability. Greater mobility between the academic and business sectors is also essential to catalyse TT. In this context, the role of industrial doctoral students – who work jointly for companies and research centres – should be reinforced.

Another key factor is the **reinforcement of intermediary organisations**. For technology centres, KTOs and other connecting entities to act effectively as innovation accelerators, their professionalisation, stable funding and ability to collaborate closely with the private sector must be ensured. Leveraging the potential of existing technology centres and transforming them into scaling platforms – with open infrastructures, advanced services and European partnerships – could be one of the most effective drivers for amplifying the impact of applied research, as demonstrated by the Basque and Flemish models. Further initiatives would also be beneficial, such as well-capitalised hybrid platforms (e.g. accelerators or venture builders) that translate research into viable spin-offs, or public funds dedicated to financing basic research aimed at developing technologies with a market horizon of ten years or more. Moreover, TT must focus on addressing the real needs of end-users, clients and companies.

Finally, t**he public innovation policy framework itself requires rethinking – particularly demand-side policy, which can serve as a catalyst through long-term mechanisms such as innovative public procurement**.

It is not enough to implement plans, strategies, instruments or funding lines without a coherent national strategy that defines priority areas, the types of innovation to be promoted and the indicators by which progress will be measured. Equally important is a **stable, dedicated budget** commensurate with the challenges outlined above. In this regard, redefining the indicator system – with particular attention to tracking the economic and social returns of technology transfer – is essential for advancing towards evidence- and impact-based policy. Specific measures could include direct support at early stages, soft financing for scalability and industrialisation, or transparent, R&D-friendly tax policies. All of this must be accompanied by bureaucratic agility that enables the various actors to integrate fully into the ecosystem.

Catalonia therefore possesses all the ingredients needed to make a qualitative leap in TT. But the appropriate mechanisms must be activated so that knowledge not only circulates, but transforms – transforms companies, transforms sectors, transforms territories. Ultimately, this is about moving from a collection of piecemeal efforts to a genuine, impact-driven TT policy: one with leadership, vision and national commitment.

7.2 Future Lines of Work for Further Analysis of the TT System in Catalonia

This initial assessment of Catalonia's technology transfer system, presented in this report, seeks to lay the foundations for a more sustained work agenda by the IPI and its collaborators. To design well-founded public policy proposals, it is essential to gain a better understanding of how the TT ecosystem in Catalonia operates – including its flows, bottlenecks and potential. Accordingly, we propose several complementary lines of work to be undertaken in collaboration with key actors in the ecosystem (universities, KTOs, technology centres, companies, public agencies, etc.).

Some of these lines of work include the following:

- **Building or improving access to databases with disaggregated microdata in order to develop specific indicators for the Catalan TT system** and monitor them systematically (for example, the evolution of spin-offs, transfer contracts, personnel flow and participation in collaborative projects, etc.).
- **Designing a system of specific indicators to evaluate the Catalan TT system**, drawing on international best practice while adapting it to the Catalan context and related public policies. This system should measure:
    - Effectiveness: the extent to which planned objectives are achieved (for example, knowledge transferred, spin-offs created, collaborations increased, patents generated, the proportion of sales of products and services that are new to the market, the proportion of sales of products and services that are new to the company).
    - Efficiency: the ratio between resources used and results obtained (for example, cost per viable spin-off, return per euro invested in valorisation and economic value of patents generated).
    - Effectiveness: the medium- and long-term effects on the economy, society and the innovation system (for example, employment created, ecosystem consolidation and changes in the technological capacities of key sectors).
- **Identifying and mapping real transfer pathways**, using qualitative case studies to gain a better understanding of the key mechanisms that work – or fail – in practice, thereby promoting TT through role modelling. This should include examining successful spin-offs, Key Enabling Technologies and their role in strategic sectors, industrial R&D funding strategies adopted by leading countries, knowledge mobility programmes among ecosystem actors and other comparable initiatives.

- **Analysing the transfer value chain by strategic sector** (such as health, agri-food, mobility or energy) to pinpoint sector-specific obstacles and untapped opportunities and tailoring the analysis to each sector's specific context.

- **Characterising and segmenting potential technology-receiving companies** to better understand their absorption capacity, internal barriers and the conditions necessary for effective collaboration with centres and universities – especially research groups accredited under TECNIO – and facilitating greater access to unique university infrastructures for the business sector.

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9. ANNEXES

Map of Key Actors in Catalonia's Technology Transfer System

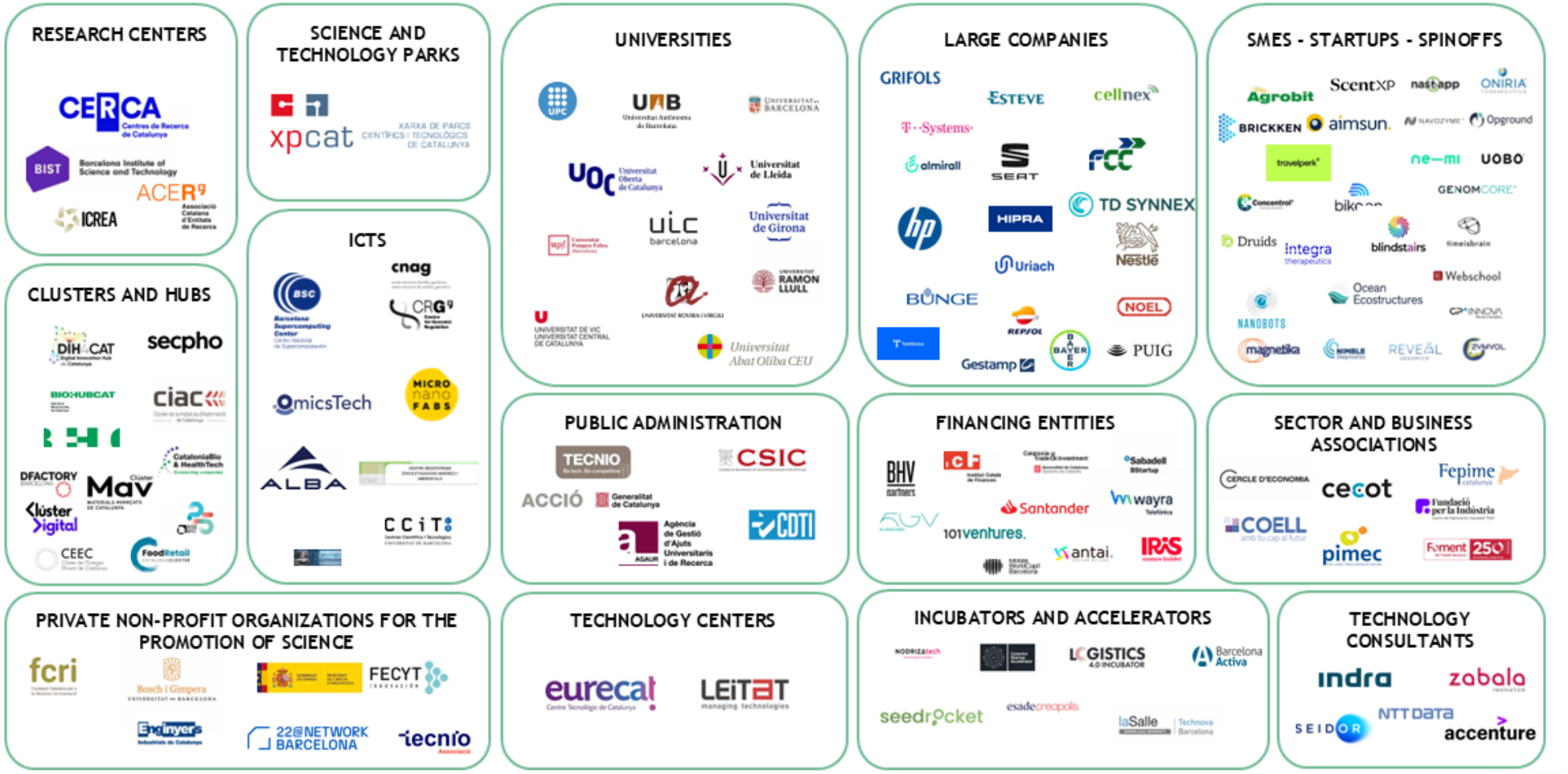

Table 2. Comparison between Catalonia, the Basque Country and Flanders Across a Selection of Socio-economic and Innovation Indicators [35]

Source: Prepared by the authors based on data from various official sources (Eurostat, Idescat, INE, Eustat, Statistics Flanders).

	Catalonia	Basque Country	Flanders[26]
RIS 2025 position	72 (Strong innovator)	81 (Strong Innovator-)	23 (Innovation leader-)
Total population	8,012,231	2,227,684	6,838,869
Population growth since 1990	32.11%	5.23%	19.15%
Unemployment rate	8.90%	8.10%	3.80%
Employment rate	75.70%	74.20%	76.85%
Education expenditure as a percentage of GDP	3.96	5.35	5.4
Total R&D expenditure (% of GDP), 2021	1.78	2.32	3.65
Public administration R&D expenditure (% of GDP), 2021	0.32	0.15	0.41
Higher education R&D expenditure (% of GDP), 2021	0.37	0.37	0.56
Private sector R&D expenditure (% of GDP, including companies and non-profit foundations), 2021	1.1	1.8	2.69
Population with higher education (% of total active population)	45.9	56.2	44.6
Employment rate in high-tech sectors	6.4	4.8	5.4
Graduates in science and technology (HRST) (% of total active population)	52.9	63.2	55.6
R&D personnel (per 1,000 inhabitants)	29	27.1	-
Patents per million inhabitants	89.78	145.48	252.77
Innovation intensity (of all firms)[27]	1.31	1.83	-
SMEs (% of all firms)	99.80%	99.80%	-
Microenterprises (0–9 employees) (% of all firms)	95.00%	94.00%	-
Medium-sized enterprises (% of all firms)	0.70%	0.90%	-

[35] For some indicators, the equivalent data for Flanders has not been provided because the different statistical agencies apply varying criteria.

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