

TECHNOLOGY TRANSFER PATHWAY:

# The Catalan HealthTech Ecosystem

PROMOTED BY

**XTS** XARTEC SALUT



UNIVERSITAT POLITÈCNICA DE CATALUNYA  
BARCELONATECH  
Biomedical Engineering Research Centre

IN COLLABORATION WITH



XARTEC SALUT IS A PROJECT CO-FUNDED BY



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Agència  
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Generalitat  
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# 1. Glossary

**CDTI:** Centro para el Desarrollo Tecnológico Industrial

**CE:** European Conformity

**CRG:** Centre de Regulació Genòmica

**DTU:** Technical University of Denmark

**EBITDA:** Earnings Before Interest, Taxes, Depreciation, and Amortisation

**ETH:** Swiss Federal Institute of Technology Zürich

**EU:** European Union

**GDP:** Gross Domestic Product

**GDP:** Gross Domestic Product

**GRP:** Gross Regional Product

**I3PT:** Institut d'Investigació i Innovació Parc Taulí

**IBEC:** Institut de Bioenginyeria de Catalunya

**ICF:** Catalan Institute of Finance

**ICT:** Information and Communication Technology

**IDIBAPS:** Institut d'Investigacions Biomèdiques August Pi i Sunyer

**IDIBELL:** Institut d'Investigació Biomèdica de Bellvitge

**IDIBGI:** Institut d'Investigació Biomèdica de Girona

**IGTP:** Institut Germans Trias i Pujol

**IIB Sant Pau:** Institut d'Investigació Biomèdica Sant Pau

**IISPV:** Institut d'Investigació Sanitària Pere Virgili

**IJC:** Institut de Recerca Contra la Leucèmia Josep Carreras

**IMIM:** Institut Hospital del Mar d'Investigacions Mèdiques

**IRB Barcelona:** Institut de Recerca Biomèdica de Barcelona

**IRB Lleida:** Institut de Recerca Biomèdica de Lleida

**IRSI:** Institut de Recerca en Sistemes Informàtics

**ISGlobal:** Institut de Salut Global de Barcelona

**KI:** Karolinska Institute

**KT&T:** Knowledge and Technology Transfer

**KU Leuven:** Catholic University of Leuven

**PMV:** Participatiemaatschappij Vlaanderen

**R&D:** Research and Development

**SJD:** Sant Joan de Déu

**TTOs:** Technology transfer offices

**UB:** Universitat de Barcelona

**UCPH:** University of Copenhagen

**UPC:** Universitat Politècnica de Catalunya

**USZ:** University Hospital Zurich

**UZ Leuven:** University Hospitals Leuven

**VHIO:** Vall d'Hebron Institut d'Oncologia

**VHIR:** Vall d'Hebron Institut de Recerca

**VLAIO:** The Flanders Innovation & Entrepreneurship



## 2. Executive summary

The HealthTech ecosystem in Catalonia has experienced remarkable growth and has positioned itself as a leader in the convergence of the healthcare and technology sectors. Catalonia, a region renowned for its entrepreneurial dynamism, research excellence, and commitment to innovation, has laid the foundation for a robust and vibrant HealthTech ecosystem. This ecosystem has driven the development of innovative and disruptive solutions in the healthcare field, improving the quality of life for individuals and transforming the delivery of healthcare services.

In recent years, Catalonia has experienced significant growth in the HealthTech sector. While in 2017, HealthTech start-ups received €52.03 million in funding, the year 2022 closed with an investment of €319.19 million. This growth has been driven by a combination of factors, including access to a robust research and development infrastructure, a thriving entrepreneurial community, and the presence of internationally renowned hospitals and universities. The region has successfully attracted international talent and fostered the creation of numerous start-ups and companies specialised in HealthTech,

positioning itself as the sector with the highest number of start-ups in Catalonia, accounting for 16.3% or 329 start-ups, according to the "Barcelona & Catalonia Start-up Hub" 2022 report by ACCIÓ.

In the subsequent section of the report, the transfer of technological innovation to the healthcare ecosystem of Catalonia has been analysed in different institutions, including hospitals, universities, research centres, and start-ups. Once the characteristics of these four actors have been analysed, their comparison has been made with different European regions regarding access to the HealthTech innovation market to identify the potential in Catalonia.

In the conducted analysis, it has been observed that Catalonia exhibits quality in the field of technological innovation within the HealthTech sector, but it lacks the resources to facilitate market entry. Furthermore, it has been noted that other regions have greater ease in accessing the market, as their primary objective is to internationalise their products.



## 3. Objectives and methodology

The study, titled "Technology Transfer Pathway: The Catalan HealthTech Ecosystem," aimed to comprehensively investigate key aspects of the HealthTech sector in Catalonia. This study analysed the sector's economic characteristics and identified the transfer of technological innovations to the healthcare ecosystem in Catalonia. The investigation was conducted from the perspectives of universities, research centres, hospitals, and start-ups, with a particular focus on examining different regions to achieve a comprehensive understanding of knowledge and technology transfer at the European level by identifying and implementing the strengths of other leading EU ecosystems.

The methodology employed in the first phase involved the analysis and research for information in various databases to economically characterise the HealthTech sector. Special attention was paid to start-ups, as they

were the actors whose data could be accessed. The study then delved deeper into the primary characteristics and trends of the HealthTech industry.

The second phase of the study, concerning the transfer of technological innovation, involved conducting interviews with key individuals within the Catalan ecosystem. These interviews provided insights into the different stages of innovation development, their distinctive features, specific paths, and noteworthy differences between universities, research centres, hospitals, and start-ups. Additionally, international interviews were conducted to gain an understanding of the HealthTech ecosystems in pioneering European countries, thereby obtaining a broader perspective and identifying fresh opportunities for HealthTech innovation.

# 4. PART 1: Economic Characterization of the HealthTech Start-up Sector in Catalonia

## 4.1. Key characteristics of the sector in Catalonia

Healthcare is one of the sectors where digitalization and technological innovation have the potential to achieve the greatest social impact. According to the WHO, Healthtech is defined as "the application of organised knowledge and skills in the form of devices, medicine, vaccines, procedures and systems developed to solve a health problem and improve the quality of life". When it comes to digital transformation, healthcare applications deserve special attention as they are transforming the industry. Seeking to create value by applying technology to address the current issues in the delivery and management of healthcare, an endless list of the possible uses of technology and its evolving role in the life-sciences sector strives to create value and address unmet needs.

The usage of technologies in healthcare practices aligns with the concept of One Health. Introduced in 2000, the concept of 'One Health' represents the collaborative efforts of various disciplines, including physicians, veterinarians, researchers, and others, operating at both local and global levels to achieve the highest attainable standards of health for humans, animals, and the environment. Advances in healthcare foster greater agility and responsiveness within healthcare systems, promoting optimal care by striking a balance between speed and efficiency. This, in turn, facilitates a patient-centric approach aimed at enhancing quality and nurturing a holistic perspective of healthcare.

Currently, according to the Financial Times' "FDI Cities and Regions of Future 2022/2023" report, Barcelona and Catalonia stand out as regions where the most effective investment attraction strategies in Europe are in place. This fosters a favourable environment for the creation of enhanced opportunities for start-up growth. The transformative applications of new technologies in the field of medicine hold the promise of being progressive, thus start-ups dedicated to innovation in healthcare are gaining momentum. Indeed, Barcelona ranks among the strongest European ecosystems in the HealthTech sector, as indicated by BBVA Spark in their publication dated June 26, 2023. Additionally, it is noteworthy that Barcelona is positioned alongside other prominent start-up hubs such as Paris, Stockholm, Berlin, and Amsterdam, as per the ranking provided by Start-upBlink.

Catalonia's main features are its entrepreneurial mindset and talent, altogether with the key actors that permit to tackle society's future challenges and provide a niche opportunity for entrepreneurs. Among the principal stakeholders who significantly contribute to the field of digital health, it is recognized that research centres, hospitals, universities, and start-ups are interconnected within the entrepreneurial ecosystem to facilitate the transfer of technology, thereby catalysing a transformation in the healthcare paradigm. Via continuous cooperation mechanisms between the key actors, the framework of the HealthTech ecosystem could achieve increased

operational efficiency, benefiting from the potential synergistic effects that may arise to move towards a more sustainable, and inclusive growth model.

Early-stage start-ups are mainly supported by public and private initiatives such as governmental grants such as ACCIÓ with Start-up capital, CDTI with NEOTEC, incubators, accelerators and associations that provide mentoring services and networking opportunities. Nevertheless, public agents and institutions (e.g. Biocat, ACCIÓ, AQuAS and Barcelona Health Hub) also play an

important role, as they provide support with strategic policies to boost Catalonia's competitiveness in terms of the industry business landing.

With an increasingly diversified and consolidated entrepreneurial ecosystem, an innovation support network that grows every day and an unprecedented injection of liquidity in the HealthTech sector, the limits to how technology can revolutionise medicine expands.

## 4.2. Economic analysis: valuation and evolution of the sector in Catalonia

Of the four main actors in the HealthTech ecosystem mentioned earlier (universities, hospitals, research centres, and start-ups), the current project primarily focuses on an economic study of start-ups. Start-ups play a crucial role in materialising the transfer of innovation to the market.

Their impact on the broader economic landscape prompts an assessment of the value they create through financial analysis. By examining their valuation and growth, this study aims to gain insights into the dynamics of innovation and its economic implications. Additionally, the HealthTech sector is considered a relatively young sector, with companies typically under 7 years old.

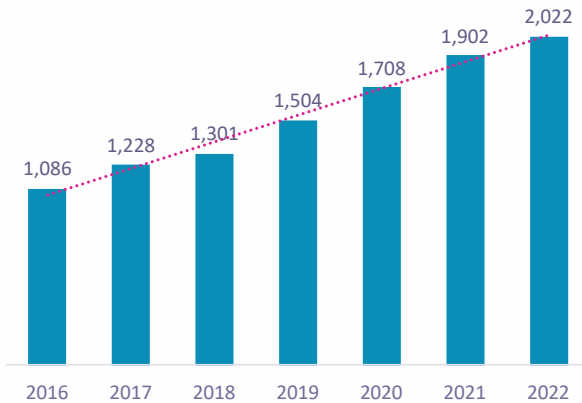
HealthTech start-ups are at the forefront of innovation, introducing competitive dynamics into the economic and business environment.

This report provides a comprehensive examination of the 329 HealthTech start-ups featured in the 2022 analysis report of the Barcelona & Catalunya Start-up Hub, offering detailed insights into Catalonia's HealthTech start-up ecosystem. However, it's important to note that the financial data extracted from the Sabi platform database for these start-ups, made available by the Xartec Salut network, represents approximately 68.3% of the overall sample's representational value.

### 4.2.1. SEGMENTATION OF THE HEALTHTECH SECTOR

According to the Start-up Heatmap Europe report by the consultancy firm DEEP Ecosystems, Barcelona ranks as the third most popular city among entrepreneurs for establishing a start-up. Furthermore, they announce that Barcelona has been designated as the second most favored hub in the European Union for start-up founders for the sixth consecutive year.

Last year, 2,022 start-ups were identified in the Barcelona and Catalonia Start-up Hub analysis 2022 report, representing 86% increase compared to 2016, before the Covid-19 pandemic. Catalonia is positioned as a referent in technological transformation and service innovation in Europe, highlighting the use of deep tech and providing an international outlook, matching the current and prospective demand.

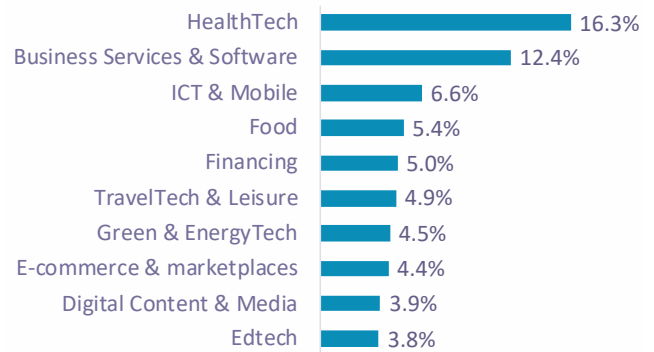


**Figure 1.** Number of start-ups in Catalonia 2016-2022.

**Source:** Barcelona & Catalonia Start-up Hub 2022 analysis by EY

In Catalonia, the sector with the highest number of start-ups is HealthTech, currently accounting for 329 start-ups, which constitutes 16,3% of the total Catalan start-up landscape. A significant portion, 33%, of total start-ups employ artificial intelligence and big data as their principal technologies. Furthermore, a substantial 76% of all start-ups in Catalonia are engaged in innovative technologies associated with Industry 4.0. The concept of '4.0' signifies a commitment to a new revolution that seamlessly combines advanced production and technical operations with intelligent technologies integrated into organizations, individuals, and goods. This plays a pivotal role within the contemporary global economy in the context of technological transformation and digitization.

Indeed, the HealthTech sector covers the intersection of the medical and engineering fields, encompassing



**Figure 2.** Sectorial distribution of start-ups (TOP10 sectors, %).

**Source:** Barcelona & Catalonia Start-up Hub 2022 analysis by EY

MedTech and beyond it, consumer-based health, wellness technologies, diagnosis, medical devices and Digital Health.

The Health sector in Catalonia is represented by over 1350 companies where Biotech is the predominant sector in Catalonia, accounting for 348 companies (25% of the share) followed by sectors such as Digital Health and MedTech which account for 212 and 201 companies respectively, all figures mentioned in the Informe de la BioRegió 2022 from Biocat. Biotech is gaining momentum in Catalonia, altogether with a strong research and innovation ecosystem, with several institutions at the forefront of biotechnology research that foster scientific excellence and advancements in the field.

## 4.2.2. INVESTMENTS IN HEALTHTECH AND SOCIAL IMPACT

Within the start-ups, particularly the HealthTech sector, distinct financial characteristics are evident. As is well-established in financial analyses, there exists a direct relationship between Profitability and Risk, where higher profitability entails higher risk, and vice versa. Given the Royal Spanish Academy's definition of start-ups as "recently created technology-based companies", it follows that they are entities with potentially high returns coupled with commensurate risk. It is important to note

that due to the unique nature of start-ups, profitability cannot be evaluated in the same manner as other enterprises, mainly because these entities typically require 5 to 7 years to mature.

In 2021, 38% of companies in Catalonia achieved positive profitability (ROE). The average profitability ratio, excluding businesses with negative results, stands at 62%. During the initial stages of new ventures, start-up

expenses are often substantial, and revenues take time to materialise. Moreover, HealthTech operates within a highly competitive landscape, and nurturing a start-up can prove to be a formidable challenge. The integration of complex technology can escalate operational costs and hinder the ability to achieve economies of scale, thereby negatively impacting profitability metrics. Furthermore, market dynamics can impede the growth and profitability of nascent enterprises. According to Barcelona & Catalunya Start-up, there was a remarkable 246% growth in investment volume by start-ups in Catalonia between 2020 and 2022, with a 15.4% increase in investment volume in the health sector in 2022.

As observed in the segmentation, there are different typologies of HealthTech start-ups, and their financial treatment varies. In the case of Biotech start-ups, acquisitions are often made before they begin generating revenue, whereas in Digital Health, their worth is measured by their ability to create value as they commence revenue generation.

Regarding investment interests, there are two types: financial, which are evaluated based on Return on Investment (ROI), as analysed in this report, and social impact investments which are taking more importance these days. These investments go beyond financial returns, focusing on addressing social issues. The assessment of what constitutes a social problem is guided by

### 4.2.3. EMPLOYMENT IN THE SECTOR

According to the study "Analysis of the start-up ecosystem in Catalonia 2022" prepared by ACCIÓ-Catalonia Trade & Investment, Catalonia currently has over 2,000 start-ups that generate more than 19,100 jobs. The employment growth has resulted in the start-ups gaining size in recent years: in 2022, 76% of Catalan start-ups had fewer than 10 employees, a percentage that rose to 87% in 2019, given the global outbreak of the coronavirus pandemic. This means that the size of these companies is increasing steadily, which makes them more

the Sustainable Development Goals (SDGs), a set of 17 interconnected global objectives designed to be a "plan to achieve a better and more sustainable future for all." The SDGs were established in 2015 by the United Nations General Assembly, with a target of achieving them by 2030. Consequently, there is currently no universal, objective method for measuring impacts; rather, it is context-specific, depending on the issue at hand, and is assessed based on the specific impact and solution.

Social impact investments are increasingly aligning with the HealthTech sector, particularly within the Catalan ecosystem. An example of this is the BSocial Impact Fund (that belongs to Ship2b), which aims to invest in impact-driven start-ups capable of scaling and addressing issues related to the well-being of vulnerable populations, climate change, and educational challenges. According to Dealroom's database, this fund invested 1.2 million euros in two medical device sector start-ups, showcasing the synergy between social impact and health tech sectors that is already beginning to emerge.

There is a growing interest in these types of investments due to heightened societal awareness of Corporate Social Responsibility (CSR). Additionally, there is an opportunity for the HealthTech sector, as it shares the goal of making a positive impact on society and enhancing the health of citizens.

mature and capable of generating added value, being scalable and having a global impact.

Moreover, The foreign investment experienced by Catalonia's health related start-up environment has created more than 2,900 new jobs for people working in the sector. Specifically, employment in 2022 was up 96% compared to 2018 employment data. Progress in the capacity to attract foreign talent must be highlighted, as around one in four workers is a foreigner.

In entrepreneurship, women form part of the founding or management team in almost 20% of all Catalan start-ups, a figure that, despite being low, is above the European average (17%), according to the study “Barcelona & Catalonia Start-up Hub 2022”. Moreover, in business, women account for over 53% of the pharma industry, whereas 20.3% of the leadership positions are held by women. Thus, the HealthTech sector embraces gender diversity, engaging women, and girls to overcome the biases and gender stereotypes that limit female access and participation in the scientific field, aiming to remove the glass ceiling and reduce the gender scissors in health research circles. From the listed companies provided by Xartec Salut network of HealthTech start-ups, 40% have less than 5 employees, whereas only 25.6% have a work-

force of more than 10 employees. Limited funds make it difficult for start-ups to hire a large workforce, focusing on efficiency, minimising overhead costs, and maximising productivity. By keeping the team small, start-ups are agile and adaptable to navigate uncertainties and rapid changes, enabling faster decision-making and execution.

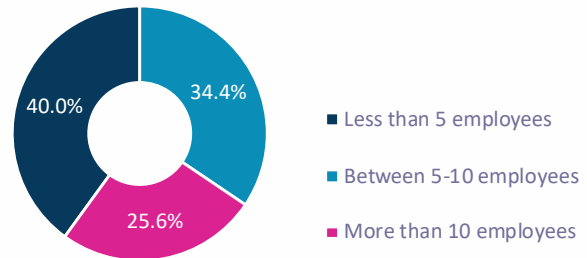


Figure 3. Size distribution of HealthTech start-ups, 2023

Source: Sabi platform, EY analysis.

#### 4.2.4. SECTOR EVOLUTION

The year 2022 marked significant progress and maturation for Catalan start-ups, with remarkable growth in volume and activity, and a record-breaking capital raised. This demonstrates their resilience against global market uncertainties and the current economic context. When we examine the variables that have been analysed, key indicators show a notable expansion of HealthTech start-ups, increased confidence and interest from investors in the sector, and the high maturity of the Catalan start-up ecosystem.

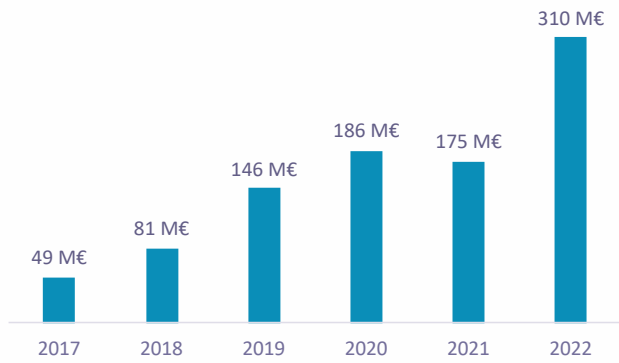
Catalonia exhibits high sectoral diversity, with numerous start-ups concentrated in the HealthTech segment, where the technological impact is increasingly tangible. Given the rapid technological advancements in the HealthTech sector, it is anticipated that new start-ups with substantial funding rounds will emerge, as emerging technologies consistently generate expanding data on a global scale.

Despite the challenges that the sector faced in 2022, it was a year marked by a wave of optimism, materialised in an intense investment flow. In 2022, the total volume of investment in HealthTech start-ups in Catalonia has

held the highest sum of the historical series, reaching 310 €M in funding, which constitutes an increase of 87% compared to previous years. Specifically, the branch that experienced the most growth in 2022 was biotechnology start-ups, which raised more than 180 €M, or 41.5% of the total investment in HealthTech start-ups in Catalonia.

**During the period from 2017 to 2022, investment in Catalan HealthTech start-ups experienced impressive growth, increasing by an average of 49% each year.**

Catalonia is characterised by companies with significant growth rates from 2017-2022, but where the greatest growth is seen is between the years 2020-2022. In 2018, 77% of Catalan start-ups had a turnover of fewer than 500,000 euros, while in 2020 this percentage shifted to 67%, meaning the number of higher-revenue companies increased. Despite the slight decrease in the start-ups



**Figure 4.** Evolution of the investment volume of the HealthTech Catalan start-ups in M euros.

**Source:** Dealroom (19/06/2023) using Catalonia as the founding or HQ location.

turnover in Catalonia when transitioning from 2021 to 2022, once the economy stabilised and operations got back to normal levels, HealthTech results remained optimistic with future growth perspectives.

HealthTech business models are designed to disrupt and scale rapidly, of the total of companies with available financial information, 41% of the start-ups have increased their income when transitioning from the year 2020 to 2021, and approximately 46% of the companies increased their income by 50%. For those companies with positive results (around 35% in both years), the average net income was 183,940€ in 2020 and 278,832€ in 2021, representing a 50% increase.

### 4.3. Sector trends

The healthcare industry has undergone a digital transformation driven by the success and adoption of deep technology across various sectors. Innovative solutions have seamlessly integrated into healthcare workflows, bridging the gap between patients and healthcare providers. This shift has created a conducive environment for emerging HealthTech trends. Furthermore, the pandemic has underscored the viability of remote medical consultations and monitoring, which can reduce costs and enhance accessibility. These trends are expected to improve efficiency, shifting the focus from reactive treat-

ments to preventive measures and providing real-time data for informed decision-making.

However, despite growth in volume and activity, start-ups in the sample have been negatively affected in terms of profitability. 38% of the companies have obtained a positive EBITDA in 2021 according to the dealroom basedates; a possible interpretation is an increasing investment in growth. Nevertheless, investors remain optimistic regarding the future, as it is expected for them to reach positive results in mature stages due to its scalability and potential for significant returns.

This is a clear sign of the potential of the Catalan HealthTech and the interest aroused internationally. The financial insights prove the recovery of the ecosystem after the pandemic shock, the maturity of the projects, the growth and potential impact of the companies, being consolidated as an attractive hub for foreign investments, especially in the digital field.

The analysis confirms that most of the entrepreneurs find it challenging to turn investment into profits, concretely for early-stage HealthTech start-ups. Data supports, on the one hand, that uncertainty continues to hinder emerging businesses despite the rise in financing and increased investor engagement. On the other hand, the current generation of entrepreneurs is conscious of the resources needed to consolidate and scale their businesses.

Consequently, healthcare systems will undergo a shift towards integration due to enhanced connectivity, enabling continuous interoperability through the adoption of cloud computing technologies. This includes the adoption of solutions such as Electronic Health Records (EHR) to enhance healthcare information management. Cloud networks are also paving the way for better telehealth solutions, such as remote medical monitoring and mobile

health services, offering a viable option for patients who prefer to stay at home.

The adoption of AI will also play a significant role in improving the current state of healthcare. It will assist patients at home in better understanding their symptoms and treatments by providing data-driven recommendations based on everyone's unique biological data, often facilitated through wearable applications. Health big data and wearable technology can offer valuable insights into patient care and can be used to predict the onset of chronic diseases in predisposed individuals.

Greater emphasis will be placed on the development of healthcare big data initiatives to enable secure data sharing between healthcare providers and patients. The goal is to create more efficient and effective clinical pathways and enhance hospital operations. However, challenges related to improving cybersecurity and addressing regulatory framework pressures, especially regarding healthcare data privacy, must be swiftly addressed as innovations arise to meet the growing demand for patient-centred care.

Moreover, while HealthTech is intrinsically linked to technology and AI, there is a growing trend of social impact investment in Catalonia. These investments aim to promote solutions that benefit society and the planet's sustainability. Start-ups from various sectors are increasingly interested in such investments, promoting ideas that address social issues, often aligned with the United Nations Sustainable Development Goals (SDGs). An example of this is the University of Catalonia (Universitat Oberta de Catalunya) investing 175,000 euros in social impact projects in 2019, as reported by El Referente. Currently, leading companies such as Danone, Ferrer, ISDIN, among others, have joined the B Corp community, which advocates for a global movement transforming the economy to benefit all people, communities, and the planet.

All these advancements will occur in parallel if there is an increase in venture capital funding for medical innovation, with HealthTech attracting the majority of investors' attention. The rise in funding rounds and capital

invested in recent years aligns with the projected future trends in the sector. Health technology is poised to become the leading segment of healthcare, with a particular focus on social impact investments.

According to Ramón Maspons, Chief Health Innovation Strategist at Catalan Ministry of Health "The primary challenge in the Catalan ecosystem is the transformation of the healthcare system by focusing on keeping citizens healthy for the longest possible time in the long term." This means seeking opportunities for the healthcare sector in terms of products or services, in other words, working on advancements that can expand the healthcare network beyond what we traditionally know. He also notes that "we are moving towards connected healthcare models. This means there will be situations where organisations, including companies, will play a significant role in maintaining people's health without being part of the traditional healthcare system."

Catalonia has a rapidly expanding digital health sector and a robust ecosystem for digital health technology, according to the 2020 Bioregion report. In recent years, technology has driven the healthcare industry, especially in terms of disease detection, prevention, and treatment. This fruitful partnership has led to advances in efficiency and patient-centred care. Key growth factors influencing the sector's prospects include the increasing demand for remote solutions, the rapid expansion of ICT infrastructure, the growing number of smartphone users, the evolution of preferences for personalised care, and greater awareness of physical and mental well-being. In Catalonia, companies and start-ups dedicated to data integration and analysis, home health technology, virtual healthcare, and clinical intelligence will play a crucial role in the coming years, marking the beginning of a new era of healthcare digitization. An example of this in the Catalan ecosystem is the ambitious project in the Department of Health of the Government of Catalonia to digitally transform the pathology services of the Catalan Health Institute (ICS) to improve diagnosis and the quality of care, as reported by El Mundo with the headline: "Digitization for Quality and More Equitable Healthcare."



# 5. PART 2: Transfer of technological innovation to the healthcare ecosystem in Catalonia

The transfer of technological innovation to the health ecosystem plays a crucial role in improving patient care, enhancing efficiency, and driving advancements in medical practices. In the context of Catalonia, the region has been actively engaged in fostering the integration of innovative technologies within its health system to the market through a vibrant ecosystem, fostering start-ups and Research & Development investment. It encourages collaboration across industries to integrate emerging technologies. This section will explore the topic of transferring technological innovation to the health ecosystem of Catalonia from the perspective of four key stakeholders: Hospitals, Universities, Research Centres, and Start-ups. Those

stakeholders were chosen to have a complete understanding of the process that innovation follows from idea development to the access market in the Health-Tech industry. Additionally, they are chosen to analyse the relationship between the public sector and the different stakeholders involved.

By examining the parallels between Catalonia and countries like Switzerland, Denmark, Sweden, and regions like Flanders, insights can be gained into the current status and potential for further developments in the integration of technological innovation and the impact it generates, as well as in the financing and market access for this technology within the health sector of Catalonia.

## 5.1. Description of the development phases of innovation in universities, research centres, hospitals, and start-ups

In this section, it will be described the stages of innovation development among different stakeholders, focusing on universities, hospitals, and research centres. This distinction is made due to the interdependence that exists among these three actors.

It is important to explore the phases of the innovation process and how they relate to the various institutions involved. The innovation process begins with the stages where the idea originates, continues with concept testing, and progresses to the phases where a solution to the main problem is found. Finally, the product is launched into the market.

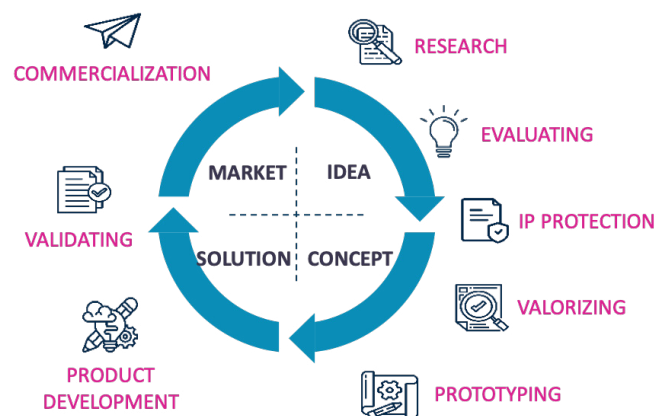


Figure 5. Innovation process.

Source: EY analyses.

### 5.1.1. ROLE OF THE FOUR ACTORS IN THE INNOVATION PROCESS

Transferring knowledge to the **hospital** setting can have relatively direct applications as their primary function is patient care and assistance. In Catalonia, this process is facilitated to some extent due to the robustness of the public hospital network and its proximity to universities. Although the transfer of knowledge remains challenging, there is a certain ease in this regard as some hospital professionals are also involved in basic research within their daily activity in the hospital. Additionally to these professionals, associated research institutes play a role in research. These institutes, located adjacent to hospitals, foster close collaboration between researchers and clinicians who deal with patient issues daily and seek practical solutions to address them.

**Research centres** play a fundamental role in this system where knowledge is generated, and ideas are projected to obtain added value in various forms. Their main objective is to promote and develop research and innovation. These centres can revolve around hospitals but are also found outside hospital campuses, encompassing various complementary fields such as scientific, technical, and technological domains. They are indispensable generators of knowledge that obtain funding mainly from the European Union, as state and economic resources are often limited.

The primary role of **universities** is to educate future professionals and foster cutting edge research across various disciplines and companies aiming to enhance their products and services. Researchers often operate inde-

pendently, seeking research grants and forming interdisciplinary teams. Universities mainly concentrate on early-stage research, providing essential technological resources such as shared services, state-of-the-art equipment, and expansive facilities. However, researchers often do not participate in the subsequent stages of translating their findings, such as securing patents or collaborating with multinational corporations or the healthcare system for further development. This is challenging because conducting high-quality pre-clinical and clinical trials needs substantial financial investments, specialised technological infrastructure, and expertise that are typically inaccessible to universities and the public healthcare system.

**Start-ups or spin-offs** are characterised as important and relevant vehicles for discovering, proposing, and implementing innovative solutions to the market. They can accelerate the valorisation process and conducting proof of concept quickly and efficiently. These emerging companies can identify market opportunities and turn them into tangible value propositions in a short period of time. Furthermore, the entrepreneurial nature of start-ups provides them with the flexibility to explore new forms of valorisation and quickly respond to market demands. The stages that a start-up goes through are as follows.

One of the main challenges of innovation lies in the fact that many promising **ideas fail to advance beyond the initial stages**, such as basic research or concept generation. This problem is due to several factors that can

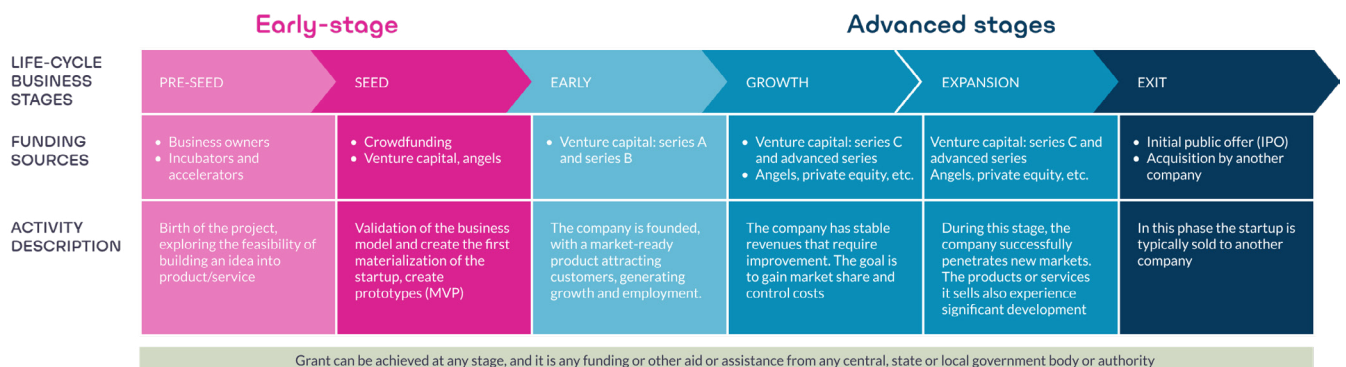


Figure 6. Start-up stages.

Source: Eonomipedia website & EY analyses.

hinder the progress of innovation and limit its potential impact. Firstly, the lack of financial resources is a significant barrier to advancing innovative ideas. Basic research requires considerable investments in equipment, qualified personnel, and experimental activities. Successful innovation often requires a combination of knowledge and skills from diverse disciplines and sectors. Another

factor contributing to the loss of ideas is the risk aversion of investors and organisations. Innovation involves uncertainty and the possibility of failure. Many times, novel and risky ideas are discarded out of fear of potential negative outcomes. This conservative mindset can limit the exploration of new opportunities and reduce the willingness to invest in long-term innovative projects.

### 5.1.2. SPECIFIC PATHWAYS TO REACH THE MARKET

Mechanisms and incentives in the scientific community have traditionally focused on research publication as the main indicator of success. Scientists are remunerated and promoted based on their scientific publications. However, a paradigm shift is being driven in Europe that recognises that innovation is not only limited to the publication of results, but also encompasses knowledge transfer, the creation of start-ups and the commercialisation of patents.

Innovations access the market through various processes and strategies, which can vary depending on the type of innovation, the target market, and the specific characteristics of each case. Below are some common ways in which innovations can access the market:

- **Public procurement of innovation:** It is a management tool for the acquisition of solutions that do not yet exist in the market by developing innovative solutions through public procurement. On one hand, the public buyer describes its need, prompting businesses and researchers to develop innovative products, services, or processes to meet the need. On the other hand, the public buyer acts as an early adopter and buys a product, service or process that is new to the market and contains substantially novel characteristics.
- **Strategic alliances:** Strategic alliances are collaborative agreements between different actors, such as companies, academic or governmental institutions, with the aim of combining resources and knowledge to bring an innovation to the market. These alliances can involve licensing agreements, joint ventures, supply chain cooperation, among others.
- **Creation of spin-offs and start-ups:** Spin-offs are independent companies that are created from a parent institution to commercialise an innovation. Start-ups, on the other hand, are newly established companies formed with the purpose of developing and launching innovations to the market. Both options offer an agile and entrepreneurial approach to accessing the market with disruptive innovations.
- **Mergers and acquisitions (M&A):** It expedite innovation's market entry by offering access to vital resources, complementary capabilities, and intellectual property. It reduces time-to-market, mitigates risks, and enhances efficiency by integrating innovations into existing portfolios. M&A involves identifying suitable partners, conducting due diligence, negotiating terms, and finally, launching the innovation with strengthened market presence.
- **Licensing agreements:** In this strategy, the holder of the innovation grants third parties the right to use and commercialise the technology or product through licensing agreements. This allows the licensee to benefit from the innovation and take on the responsibility of its commercialization, in exchange for royalties or other forms of compensation for the rights holder.

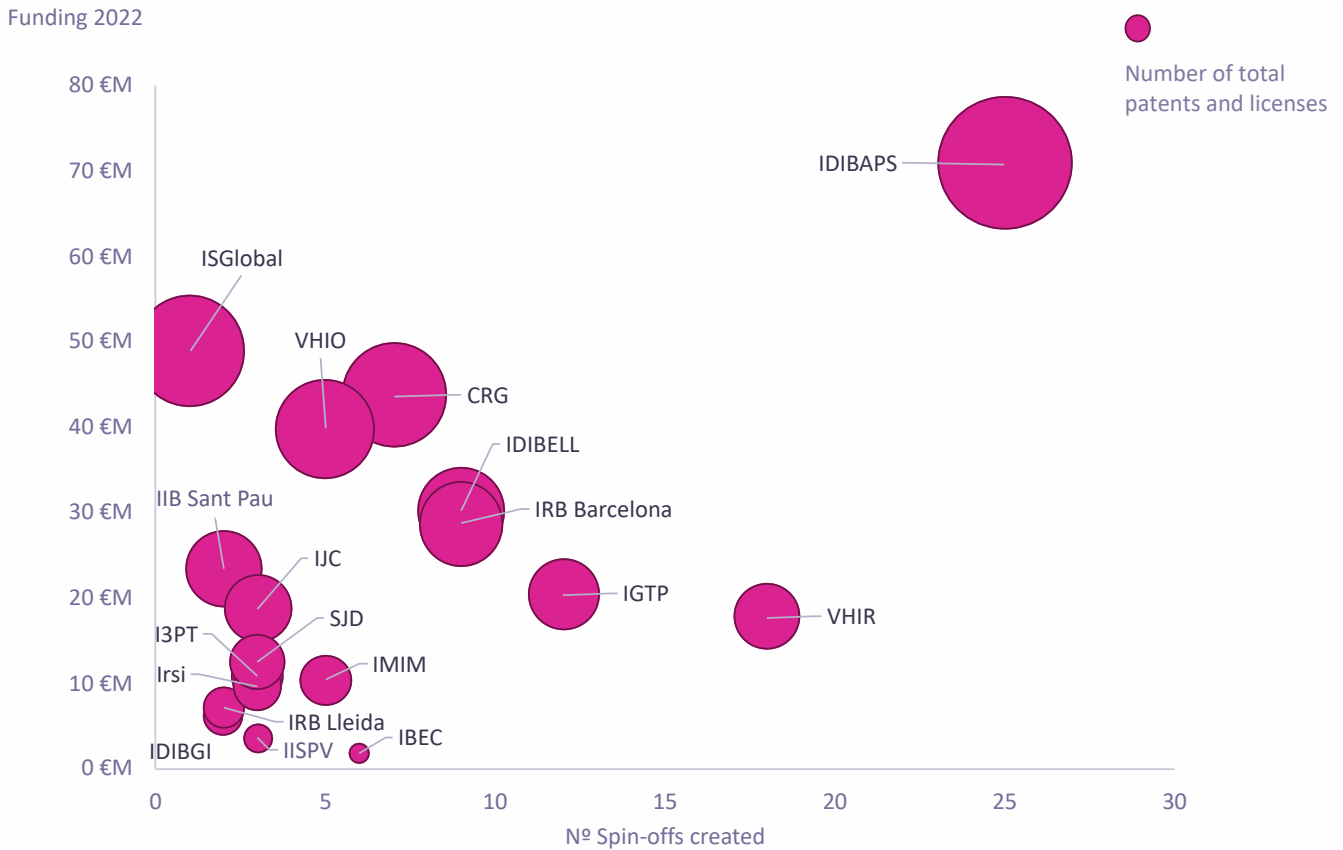


Figure 7. Transfer of research centres in terms of spin-offs, patents, and licenses.

Source: CERCA & EY analyses.

The provided graph illustrates an analysis that considers the attracted funding by each research centre from competitive funding sources such as European Commission and National sources, alongside the number of Spin-offs created. These metrics, in conjunction with licensing agreements and transferred patents, offer a comprehensive perspective on the centres' transfer capabilities.

Although the centre that receives the most funding also generates the highest number of spin-offs, patents, and licensing agreements, this relationship does not apply to the rest of the centres. It is observed that centres with higher funding levels produce fewer spin-offs, patents, and licensing agreements, while those with more limited financial resources create significantly more.

### 5.1.3. HIGH-LEVEL DESCRIPTION OF FUNDING MECHANISMS AT REGIONAL LEVEL

Regarding funding, a few programs promoted by Catalan government, entities and institutions to fund start-ups are as follows:

- **Catalunya Emprèn:** is an initiative by the Catalan government aimed at promoting entrepreneurship and the growth of innovative companies. Through this program, start-ups can access various forms of su-

pport, including funding, mentoring, and incubation and acceleration services. The maximum amount of the subsidy will be up to 80% of the cost of the project, and up to a maximum amount of 60,000 € per project.

- **Neotec-Catalonia:** This program provides funding for research and technological development projects led by companies, including start-ups. It can be relevant

for healthcare start-ups working on technological innovations. Subsidies up to 70% of the eligible budget of the action, with a maximum subsidy amount of 250,000 euros per beneficiary.

- **ICF:** Financing lines from the Catalan Institute of Finance (ICF): The ICF offers various financing options, including loans and credits with favourable terms that start-ups can use to finance their operations and investment projects. ICF's Venture Capital division invests in top-tier teams with innovative and scalable business models that generate solid competitive advantages. Their investment range goes from 300,000 € to 5 €M.
- **ACCIÓ:** It offers various advisory programs and specific grants for innovation and the development of R&D projects. On the one hand, the Activa Start-ups program provides SMEs with grants of up to 40,000 € to drive digital transformation through collaboration with start-ups. The aim of this initiative is to promote open innovation and assist them in incorporating or developing new technologies or moving towards more sustainable business models. On the other hand, the Start-up Capital program provides direct support of up to 100,000 € for recently created technology start-ups. ACCIÓ also offers a technology and R&D project advisory service that helps identify the most suitable options and guides towards carrying out projects in a more efficient manner, with added value, and with greater chances of success in the market.

One example at institutional level is the program Impuls UPC 2023, promoted by Universitat Politècnica de Catalunya (UPC) designed to support start-ups and en-

trepreneurs. This program aims to foster innovation, entrepreneurship, and the transfer of technology from the university to the market. Impuls UPC provides resources and services to help start-ups develop their projects and turn their ideas into successful companies. It offers up to €7,500 per start-up created and up to €3,000 per entrepreneurial project.

For research projects there are also funding opportunities at regional level focused on the technology transfer and research support:

- **AGAUR (Agència de Gestió d'Ajuts Universitaris i de Recerca):** As a Regional Agency backed by the Generalitat de Catalunya it promotes excellence in research and development but also supports the technology transfer of results by launching funding initiatives such as "Ajuts per a l'Indústria del Coneixement" program, to promote advancements in technology development such as prototyping, or giving the possibility to include technology transfer profiles directly to the research team. Another initiative is the "Xarxes d'R+D+I" program, in which the focus is on the creation of networks that allow research to reach the market through the creation of synergies between research groups and actors from the value-chain such as end-users, industrial partners among others. As an example, Xartec Salut is a project funded by the Xarxes R+D+I program, focused on the generation of synergies between research groups from universities, research centres and hospitals with the stakeholders from the Health-Tech ecosystem such as investors, providers, industrial partners to help them in the de-risking of the technological project and boosting the creation of spin-offs.

## 5.2. Access to the HealthTech innovation market at the European level

To contextualise the situation of the HealthTech sector in Catalonia, below is an analysis of the leading European regions in innovation with a similar demographic profile to Catalonia.

### 5.2.1. HIGH-LEVEL ANALYSIS OF THE MAIN EUROPEAN REGIONS



Denmark, the most southerly country in the Nordic Region, is a small, densely populated country. With a population of approximately 5.8 M people, Denmark boasts a prosperous and well-educated society. The country has a robust Gross Domestic Product (GDP), which stood at around 355 billion € in 2021, reflecting its strong economic performance. Furthermore, Denmark has a high GDP per capita, reaching 60,946€, indicating the relatively high-income levels and purchasing power of its citizens. These factors, coupled with Denmark's commitment to innovation and social welfare, contribute to its reputation as a thriving and prosperous nation.

### OVERVIEW OF THE DANISH HEALTHTECH ECOSYSTEM

By international standards, Denmark has a dynamic start-up ecosystem. In 2020, it was ranked as the fourth easiest country of doing business by the World Bank and Copenhagen was ranked as the 12th best city in Europe for start-ups by *Global Start-up Ecosystem Index*.

Between 2010 and 2023, a total of 342 HealthTech start-ups have been established in Denmark. Furthermore, from 2010 to 2023, 2894 start-ups were identified in Denmark. The top start-up sector in the country is HealthTech, representing the 11.82% of the total. Followed by Fintech with 278 start-ups and Enterprise Software with 268 start-ups, representing the 9.61% and 9.26% each one.

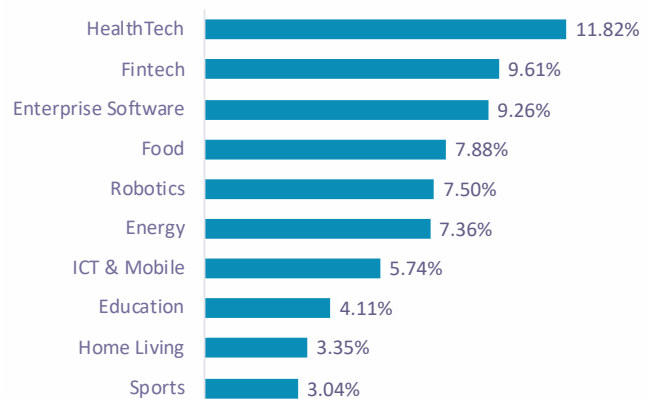


Figure 8. Sectorial distribution of start-ups (TOP10 sectors %).

Source: Start-up Denmark & Dealroom (20/06/202)

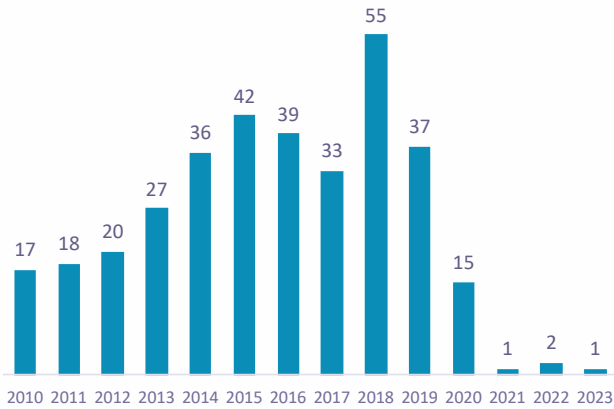


Figure 9. Number of HealthTech Start-up founded by year.

Source: Start-up Denmark & Dealroom (20/06/2023)

The most significant sector within HealthTech is Biotechnology, accounting for 27% of the start-ups. Followed by Medical devices with a 19% share, these start-ups include diagnostic devices, wearable devices, surgical instruments, implantable devices among others.

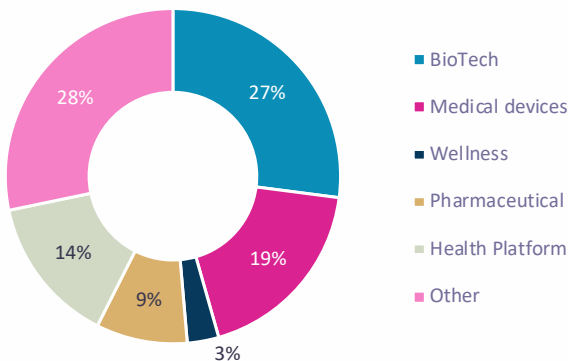


Figure 10. Percentage of start-ups by sector in Denmark.

Source: Dealroom (20/06/2023) & EY analyses

## SECTOR GROWTH

Denmark HealthTech start-ups raised 235 €M annual Venture Capital funding in 2022, despite the economic downturn. The following figure represents a 33,8% decrease from the all-time high in 2021, but still over 35.6% higher than 2017. The year 2021 was marked by investment in IO Biotech, a start-up founded in 2015 that works in the clinical stage of biotechnology, developing disruptive immune therapies for the immunological

However, the percentage of newly created businesses that survive in the first year is approximately 71%. This is the fourth lowest business survival rate in Europe and the lowest of countries compared in this report.

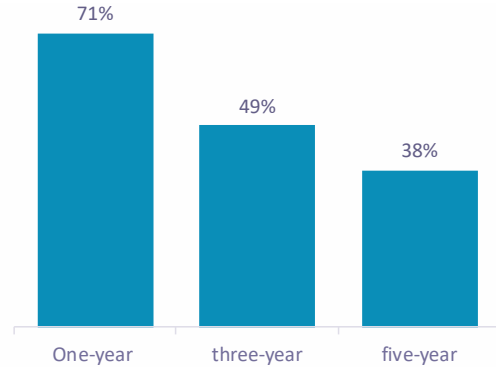


Figure 11. Denmark Business Survival Rate.

Source: OECD ilibrary & EY analyses

The results presented earlier indicate that Denmark’s start-up ecosystem is relatively successful in generating a healthy pipeline of new and innovative business. With the greatest weight within the Danish ecosystem, the HealthTech start-up sector has shown remarkable growth in recent years. However, compared to other countries, Denmark has the lowest rates of business survival in the early years according to OECD library.

treatment of cancer. This company managed to raise 127 €M from various private funds. The majority of the funding is allocated to rounds beyond the early-stage phase (pre-market), where the start-up enters the market after it has developed and tested its minimum viable product (MVP) and is ready to commence its commercialization efforts and generate revenue.

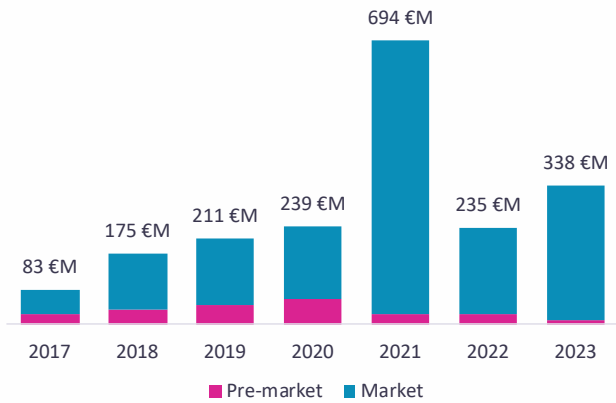


Figure 12. Money raised by HealthTech start-ups per funding round.

Source: Dealroom (21/06/2023) & EY analyses

Danish HealthTech start-ups and scaleups have experienced substantial growth in recent years. Their combined enterprise value has increased by a factor of 3.5

since 2017. Notably, the start-ups and scaleups launched between 1995 and 1999 have shown even greater growth compared to those launched between 1990 and 1994, as well as those launched between 2000 and 2004.

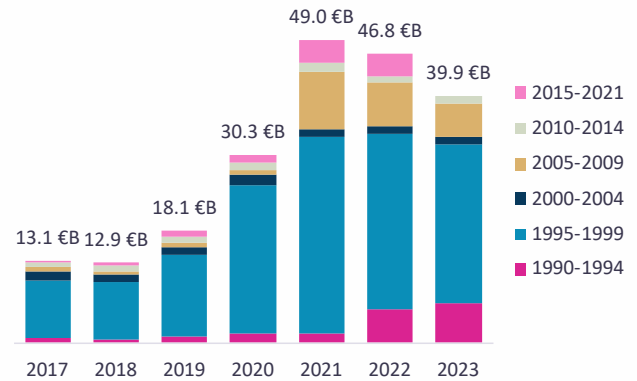


Figure 13. Enterprise value by launch year.

Source: Dealroom (21/06/2023) & EY analyses

## ROLE OF DIFFERENT INSTITUTIONS IN ACESsing THE INNOVATION MARKET.

This chapter explores into the key institutions that contribute to the Danish innovation market, exploring their unique roles and the impact they have on fostering innovation. It examines the crucial contributions of hospitals and research centres, where ground-breaking research is conducted, innovative healthcare solutions are developed, and knowledge is seamlessly transferred to trans-

form patient care. Also, it studies universities, where diverse fields of research are explored, new technologies are harnessed, and entrepreneurial spirits are nurtured. The pivotal role of universities in knowledge transfer, technology commercialization, and the establishment of start-ups is highlighted, propelling Denmark's position as a hotbed for innovation.

### Hospitals and research centres

Hospitals in Denmark are at the forefront of medical research and development, conducting clinical trials, analysing patient data, and collaborating with industry partners for innovative healthcare solutions. They serve as valuable testbeds, ensuring the efficacy and safety of new medical technologies through rigorous validation before market entry. Hospitals also facilitate the transfer of knowledge and expertise from research to practice, collaborating with industry partners, and providing

training to healthcare professionals. Their contributions drive medical innovation, improve patient outcomes, and advance the healthcare landscape in Denmark.

In order to exemplify the role of hospitals and research centres in Denmark, this analysis focuses on the hospitals, recognized by global data firm Statista, as the best in smart technologies in 2023.



## AARHUS UNIVERSITY HOSPITAL

Aarhus University Hospital facilitates the systematic identification, selection, and implementation of new research-related ideas and innovation projects to enhance treatments, processes, and patient outcomes. It has developed a structured approach to innovation that enables the creation, testing, and implementation of new solutions. To reduce barriers to innovation, Aarhus University Hospital actively collaborates with other healthcare professionals nationally and internationally, as well as industry partners. These collaborations, partnerships, and alliances are integral components of their innovation efforts, as they aim to create synergies that accelerate innovation while supporting clinicians and researchers and their respective innovation projects.

To ensure that research is making its way into the clinical setting, Aarhus University Hospital works with BETA.HEALTH.

BETA.HEALTH is Denmark’s national health innovation platform. It is sponsored by the Novo Nordisk Foundation with headquarters at Aarhus University Hospital and Rigshospitalet in Copenhagen. It is driving the collaboration between research teams and clinicians in Denmark to transform healthcare discoveries into tangible impact. With a focus on patient outcomes and real-world needs, BETA.HEALTH works closely with scientists, researchers, and practitioners to translate clinical research into scalable solutions that have the potential to significantly enhance patient outcomes.

## COPENHAGEN UNIVERSITY HOSPITAL (RIGSHOSPITALET)

Rigshospitalet has developed a new approach called “Innovation Plus” with the aim of raising the bar for health innovation in Denmark and make a global imprint in the future of healthcare. The hospital invites external partners to join in developing the future of healthcare. Together, they will raise the bar for health innovation in Denmark and make a global imprint on the future of healthcare. To ensure that innovation at Rigshospitalet

generates value for as many patients as possible, the hospital has developed a model for accelerating new solutions from local to global value. Each step of the model includes specific deliverables, for example within testing, legal issues, data and business development. The innovation team, as well as internal and external collaboration partners, provide such deliverables.

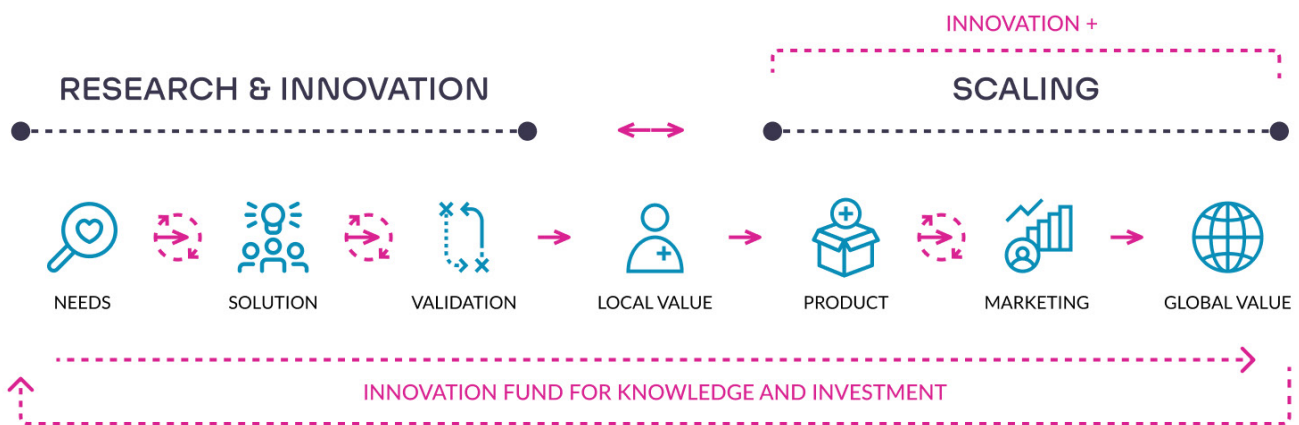


Figure 14. Model for the innovation process.

Source: Innovation Centre Denmark

## Universities

Danish universities play a crucial role in innovation because they foster a culture of creativity, problem-solving, and entrepreneurship among their students and re-

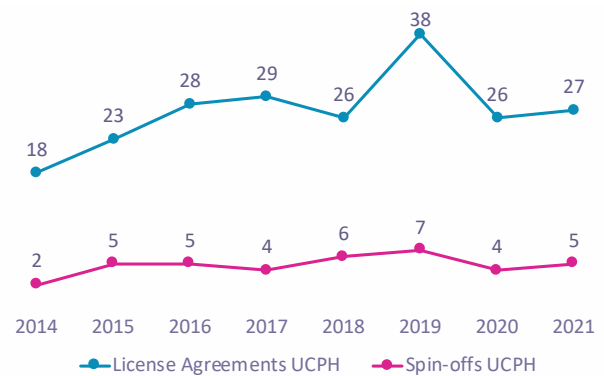
searchers. Denmark has one of the most well-developed ecosystems for innovation and entrepreneurship among technical universities in Europe.

### UNIVERSITY OF COPENHAGEN

The University of Copenhagen (UCPH) is a leading knowledge institution with extensive research activities and talented students, who make a substantial contribution to developing Danish society and the world around them. In a broad sense, innovation is about developing ideas and realising them. At UCPH, innovation is research-based because it is based on researchers' knowledge and on students innovating via the teaching and inspiration they encounter during their studies. Innovation at UCPH is about researchers, students and graduates who make a difference in the business sector, the public sector and civil society. Innovation can also lead to the establishment of new businesses.

Technology Transfer is one of the most important ways to convey university research into society and create impact. For example, by licensing the use of inventions made by university researchers or establishing spin-offs

companies. Licence agreements per year concerning rights to commercial use of a technology from the University of Copenhagen are increasing and reached a total of 27 in 2021. Besides, the number of spin-offs companies that have been established at the University of Copenhagen has remained similar every year.



**Figure 15.** Number of License Agreements and Spin-offs companies by year.  
Source: University of Copenhagen annual report.

### TECHNICAL UNIVERSITY OF DENMARK

DTU is the 166th university ranked of World University Rankings 2023 by Times Higher Education, a list based on 13 carefully calibrated performance indicators that measure an institution's performance across four areas: teaching, research, knowledge transfer and international outlook, with a research score of 44.9 out of 100.0.

With its cutting-edge research facilities, world-class faculty, and interdisciplinary approach, DTU has established itself as a leading catalyst for innovation. Through collaborations with industry partners and the nurturing

of entrepreneurial spirit among its students, DTU actively contributes to technological advancements and the development of ground-breaking solutions.

DTU is currently engaged in more than **200 commercialization projects**. The projects cover many different technology areas targeted at commercialization processes for both start-ups and spin-off technologies and commercialization agreements with established companies, based on long-term strategic research collaborations.

The university had a budget of 797 M euros in the last year. Out of the total budget, 67%, which is nearly 534 M euros, is allocated to R&D.

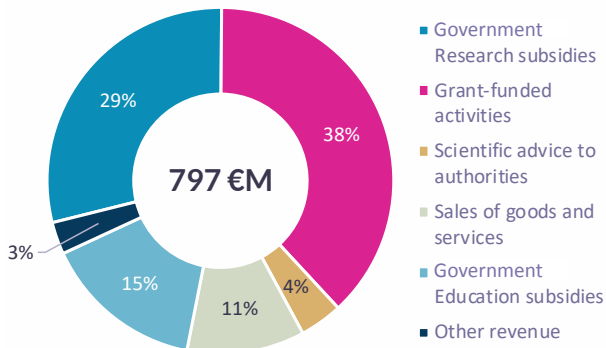


Figure 16. DTU 2022 budget.

Source: DTU financial report 2022.

### Funding opportunities for projects

The University has strengthened the funding for the commercial maturation of ideas and inventions from students and employees through the 'DTU Skylab Funding Programme' and the 'DTU Discovery Grants'.

DTU Skylab two funding programs for start-ups and researchers at the Technical University of Denmark (DTU) seeking to commercialise their innovations. On one hand, the Skylab Incubator is designed for early-stage start-ups that are in the process of determining their product/market fit. On the other hand, the Skylab ignite focuses on providing start-ups with valuable customer feedback and assessing the relevance of their ideas to society. The program includes validation to determine the viability of transforming the idea into a successful start-up. Start-ups also have the opportunity to compete for monetary prizes at the Finals, with a total of 6,708.65 euros.

DTU Discovery Grants is DTU's own instrument for funding commercialisation projects emerging from research done at DTU. It is often the first step on a commercialisation journey for researchers. It is primarily designed to support early technical maturation or refinement of projects towards a commercial application. Applicants can request funding ranging from 2,683.46 to 20,125.95 euros, with a maximum project duration of 6 months. To apply, the project must be endorsed and supported by the department and the DTU Skylab innovation partner.

## WHAT SPECIFIC MECHANISMS IN DENMARK PROMOTE THE TRANSFER OF INNOVATION ALONG ONE PATH OR ANOTHER?

In Denmark, entrepreneurs have access to complimentary guidance provided by public business experts, supported by a robust ecosystem of both public and private entities dedicated to fostering entrepreneurial growth. The country is equipped with "six publicly Danish Business Hubs", strategically located in different regions nationwide. Each local centre offers free, impartial, and professional guidance tailored to the specific needs and potential of businesses. These centres specialise in various aspects of business operations and development. Their comprehensive services include valuable insights on securing loans, exploring venture capital opportunities, and identifying alternative funding sources.

The hubs are a one-stop shop for business services, providing specialised advice on business development as well as grants, access to financing, networks and support services. The business hubs act as a juncture in the business promotion system, helping companies to navigate the various support measures that are available to companies from a range of different organisations. The total budget allocated to the six business hubs in 2022 was 22,943,583 euros. Each hub covers multiple municipalities. More localised business development and government administrative services are provided by the municipal business development offices.

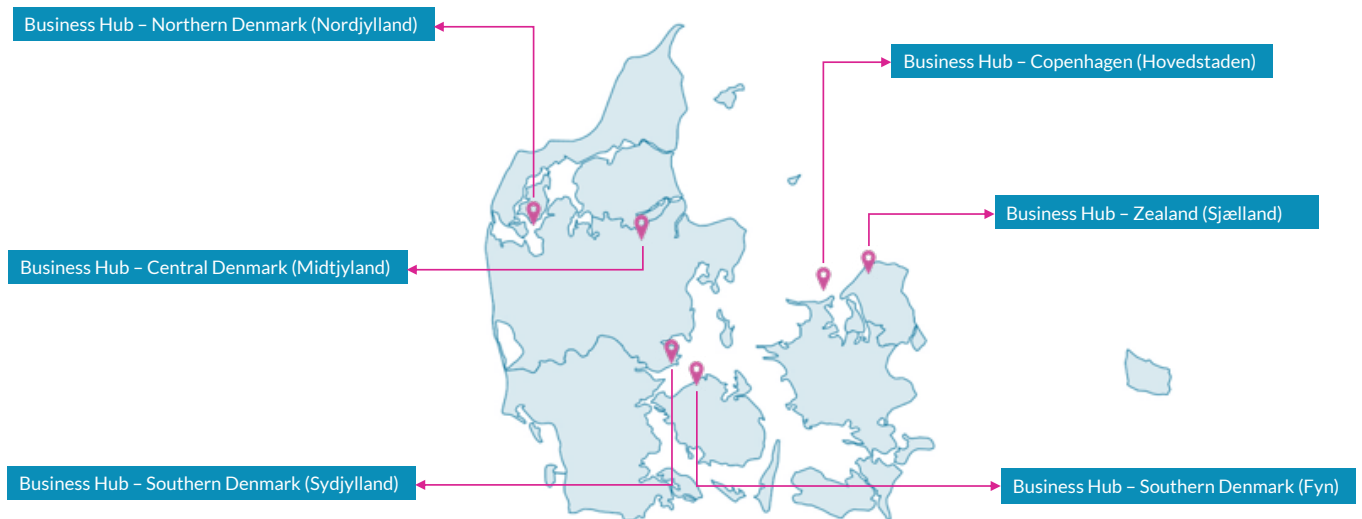


Figure 17. Innovation Hubs in Denmark.

Source: Start-up Denmark

Denmark stands as the sixth country in the European Union when it comes to allocating significant resources towards R&D. Demonstrating its commitment to innovation and advancement, Denmark's investment in R&D amounts to a noteworthy 2.80% of its GDP. This substantial financial dedication highlights the country's recognition of the crucial role that R&D plays in driving economic growth, fostering technological breakthroughs, and nurturing a culture of innovation.

When it comes to public funds, Denmark offers various funding programs and grants aimed at promoting innovation and technology transfer. Firstly, the Danish Growth Fund ("Vækstfonden") is the Danish state's investment fund aimed at promoting the creation and growth of new companies through investments, loans and guarantees. The fund invests equity in start-ups that have significant growth potential yet have trouble raising sufficient venture capital. Those are the different solutions for all stages of a start-up:

- Start Loans are aimed at young companies, which are still in the start-up phase, whose product is fully developed, scalable and has a high level of innovation that differs from others in the market. The loans amount to 53,000 – 200,000 euros.

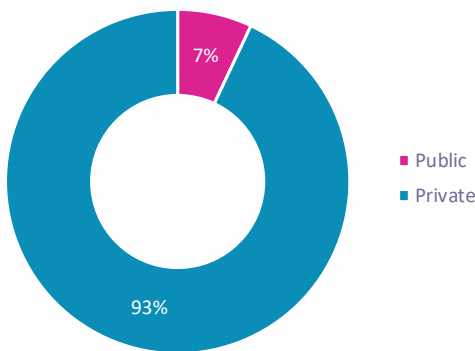
- Loans for entrepreneurs, for a young company that has products and customers but whose short existence makes it difficult to secure financing to accelerate growth. The loan must be a minimum of 134,173 euros and the company must have made a profit from existing customers.
- Venture Debt is a loan for mature start-ups, who already have obtained equity funding from a venture capital fund. Financing amount is minimum 2 €M.

Innovation Fund Denmark ("Innovationsfonden") invests in new initiatives to create growth and employment in Denmark. Investment within "Life science, health and welfare technology" shall contribute to ambitious, and preferably, interdisciplinary research and innovation projects that can create new, specific solutions to important, politically prioritised societal challenges and create value throughout Denmark. Co-financing of expenses with a minimum 20 €M.

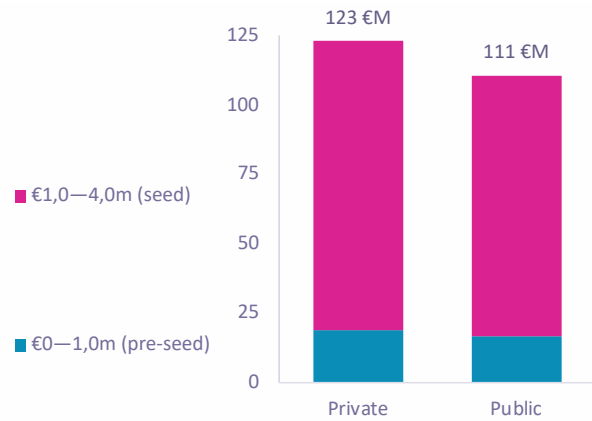
Despite the possibilities offered by the Danish government for public funding of innovation, funding for HealthTech start-ups in Denmark heavily relies on private investment, accounting for an impressive 93% of the total amount invested between 2017 to 2023. Public

institutions, due to their bureaucratic nature, often face challenges in terms of agility and speed. This characteristic is also evident when it comes to funding start-ups. Unlike private investors, public entities cannot provide financial support freely, as they require grants that align with existing initiatives or projects. The need for grant alignment or fitting within established frameworks further contributes to the slower pace of investment from public sources in the HealthTech start-up ecosystem.

However, In the early stage of HealthTech start-ups, there is a remarkable similarity between the investment from public entities and private sources. Public investment represents the 48% of the total funds invested in early-stages.

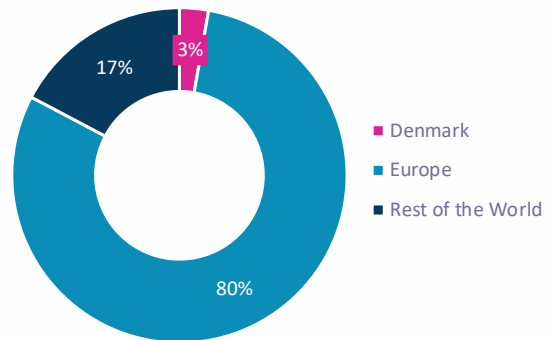


**Figure 18.** Distribution of capital raised in Denmark from 2017 to 2023.  
Source: Dealroom (22/06/2023) & EY analyses.



**Figure 19.** Capital raised from 2017 to 2023 in Early-Stages.  
Source: Dealroom (22/06/2023) & EY analyses.

Of the financing received from public entities, a mere 2.8% originates from Danish government funds. The predominant portion of funding directed towards HealthTech start-ups in Denmark comes from European funds.



**Figure 20.** Public investor location  
Source: Dealroom (22/06/2023) & EY analyses.

### **Innovation incentives and taxation framework**

Although high taxes and wages may present certain challenges, Denmark also yield significant advantages for entrepreneurs. The provision of free education fosters a vast talent pool, with individuals benefiting from accessible healthcare. Furthermore, the Danish workforce demonstrates high levels of productivity. Notably, Denmark's economy ranks as the fourth-most productive globally, even with the fewest actual hours worked.

However, Denmark provides a range of tax benefits for start-ups:

- **Tax-free Company Conversion:** Start-ups can convert their business entity without incurring tax liabilities, allowing for flexibility in adapting to changing business needs.

- **Tax-free Research and Development Activities:** Expenses related to R&D activities can be deducted from taxable income, reducing the tax burden for start-ups engaged in.
- **Tax-free Employee Shares:** Start-ups can provide their employees with tax-advantaged stock options or sha-

res, fostering employee ownership and incentivizing long-term commitment to the company's growth.

- **Company Taxation:** Denmark offers a competitive corporate tax rate of 22%, which is relatively lower compared to other European countries.

## SUMMARY

Denmark is an Innovation Leader with performance at 137.6%, which is just above the average of the EU Innovation Leaders average (133.4%) according to the European Innovation Scoreboard 2023.

Denmark entrepreneurs receive **free guidance from public business experts**, and there exists a robust ecosystem comprising both public and private supporters of entrepreneurship who can assist in business growth. The 6 publicly funded Danish Business Hubs provide free assistance for the development of your business. Furthermore, **Denmark's tax benefits** for start-ups contributed to its ranking as the fourth easiest country of doing business and Copenhagen as the 12th best city in Europe for start-ups in 2020. Also, Denmark has a system of **public universities that promote the transfer of innovation** to the market through programs of assistance and support for start-ups.

Private capital remains the primary driver in the transfer of innovation to the market. With deep market knowledge and a willingness to take risks, they provide essential financing for high-potential start-ups. Their robust financial capacity allows for significant investments, fuelling the growth and expansion of these companies. Moreover, **private investors offer flexibility in negotiating investment terms**, enabling customised agreements tailored to the unique needs of start-ups. Their industry experience, extensive networks, and strategic guidance further contribute to accelerating the growth trajectory of start-ups.

**“Denmark's strength lies** not in being the greatest ideas, but we are excellent to transform ideas to business and bring them to the market (cooperation and access between the market - start-up - customers)”, **CEO at PRECURE - Finn Bech Andersen**. The country's innovation ranking is high due to the willingness within its systems to embrace and experiment with new concepts. It is recognized that conservatism hinders innovation, and Denmark's formal approach to fostering innovation has proven instrumental in overcoming this challenge.



Sweden, located in northern Europe, is a country renowned for its high quality of life and emphasis on innovation. With a population of around 10.4 M people, Sweden stands out for its social welfare and robust welfare system. It is a prosperous economy with a GDP of approximately 580€ billion, making it one of the largest economies in Europe. Moreover, Sweden boasts an impressive GDP per capita, exceeding 46,000€ annually, reflecting the high standard of living and level of economic development in the country. With a solid infrastructure, top-quality education, and a focus on research and innovation, Sweden positions itself as a leader in the global economy.

## OVERVIEW OF THE SWEDISH HEALTHTECH ECOSYSTEM

Sweden has become a prime example to follow in the realm of start-ups, as it has established itself as the most active European country in terms of innovation, technology, and start-ups. It has positioned itself as one of the most significant countries alongside the likes of the United States, Israel, and the United Kingdom, among others. In 2020, it was ranked as the 10th easiest country of doing business and Stockholm was ranked as the 4th best city in Europe for start-ups.

From 2010 to 2023, 3,774 start-ups were identified in Sweden. The top start-up sector in the country is HealthTech, with 13.46% of the total. Followed by Enterprise software with 410 start-ups and FinTech with 383 start-ups. Furthermore, between 2010 and 2023, a total of 508 HealthTech start-ups have been established in Sweden.

The most significant sector within HealthTech is Health platform start-ups, accounting for 31% of the start-ups. Health platform start-ups provide digital platforms and technologies that connect various stakeholders in the healthcare ecosystem, including patients, healthcare providers, and payers. These start-ups aim to improve

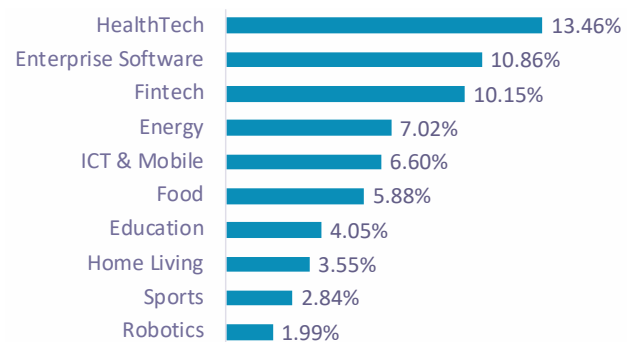


Figure 21. Sectorial distribution of start-ups (TOP10 sectors %).

Source: Sweden Tech Ecosystem & Dealroom (22/06/2023).

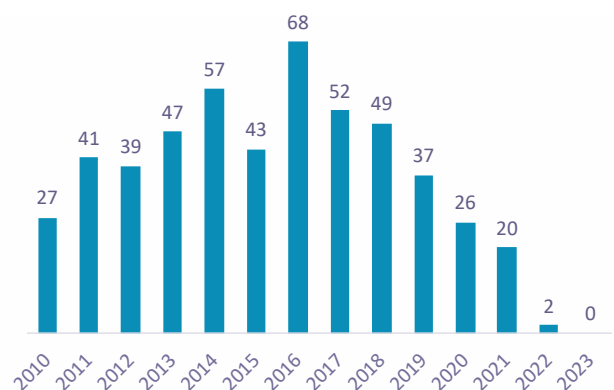


Figure 22. Number of HealthTech Start-up by year.

Source: Sweden Tech Ecosystem & Denmark (22/06/2023)

healthcare delivery, enable remote patient monitoring, facilitate telemedicine consultations, and empower individuals to take control of their health through accessible and user-friendly digital platforms.

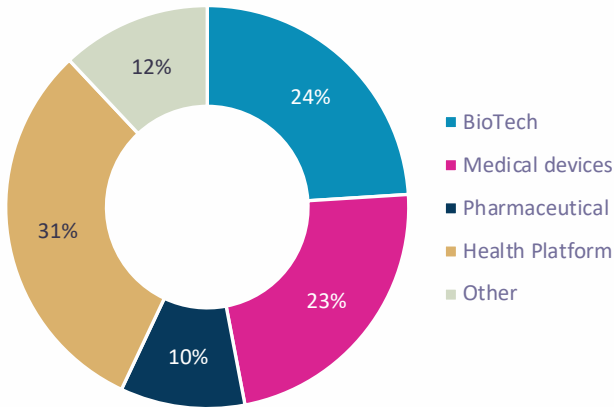


Figure 23. Percentage of start-ups by health sector.

The percentage of newly created businesses that survive in the first year is approximately 97%. This is the highest business survival rate in Europe.

In terms of successful companies, there are numerous individuals who actively mentor and contribute to the community. The presence of angel investors and venture capital firms greatly facilitates guidance and support for areas requiring innovation and development. The overall ecosystem in Sweden is highly favourable, with a strong emphasis on international thinking from the outset. Due to the country's relatively small size, entrepreneurs quickly recognize the need to expand beyond Sweden to build a substantial company. This encourages long-term and global perspectives, acknowledging the challenges presented by the small and competitive market.

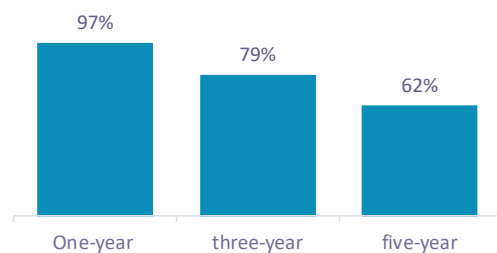


Figure 24. Business survival rates.

Source: OECD ilibrary & EY analyses

## SECTOR GROWTH

Sweden HealthTech start-ups raised 481 €M the second highest annual Venture Capital funding total ever in 2022, despite the economic downturn. The following figure represents a 35.6% decrease from the all-time high in 2021, but still over 58.5% higher than 2017. Most of the funding is allocated to rounds beyond the early-stage phase, where the start-up enters the market after it has developed and tested its minimum viable product (MVP) and is ready to commence its commercialization efforts and generate revenue.

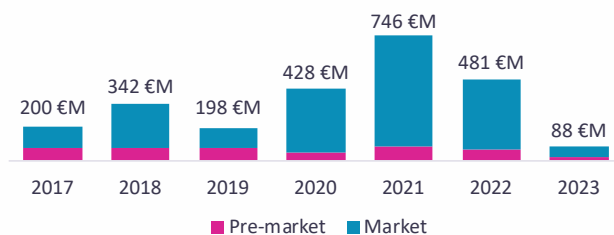


Figure 25. Money raised per funding round.

Sweden HealthTech start-ups and scale-ups have experienced substantial growth in recent years. Their combined enterprise value has increased by a factor of 5.4 since 2017. Notably, the start-ups and scale-ups launched between 2000 and 2004 have shown even greater growth compared to those launched between 1995 and 1999.

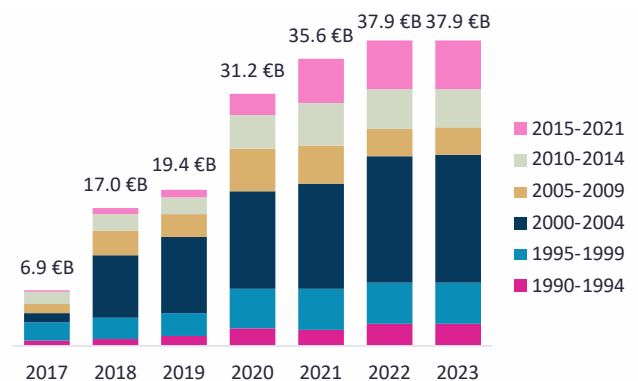


Figure 26. Enterprise value by launch year.

Source: Dealroom (26/06/2023) & EY analyses.



## ROLE OF DIFFERENT INSTITUTIONS IN ACCESSING THE INNOVATION MARKET

In Sweden, hospitals, research centres, and universities play pivotal roles in accessing the innovation market and driving technological advancements. With a strong emphasis on research and development, these institutions serve as fertile grounds for ground-breaking discoveries

and novel solutions to societal challenges. Together, these institutions form a dynamic ecosystem that fosters innovation, propels Sweden's position as a global leader in research and development, and drives economic growth.

### **Hospitals and research centres**

Hospitals and research centres in Sweden are not only providers of healthcare services but also hubs of medical research and development. They actively engage in clinical trials, collect and analyse patient data, and collaborate

with industry partners to develop innovative healthcare solutions. Through their research activities, hospitals contribute to the advancement of medical knowledge and the discovery of new treatments, technologies, and therapies.

### **KAROLINSKA UNIVERSITY HOSPITAL**

Karolinska, as the best hospital in Sweden in 2023 according to Newsweek magazine, innovation plays a crucial role in advancing healthcare and ensuring the provision of exceptional care, and it is deeply ingrained in the Karolinska's vision. The hospital recognizes that innovation should occur at the point of care, tailored to meet the needs of patients. To foster an environment conducive to innovation, Karolinska has enhanced its central support system through the establishment of The Centre for Innovation.

initially established in connection with procurement of medical equipment and have innovation agreements ranging up to 20 years. These innovation partnerships have different focus areas and cover collaborative research, development and innovation. These collaborations have generated a substantial number of scientific publications as well as provide a close link between research and clinical implementation.

The Centre for Innovation helps in promoting internal innovation initiatives within the hospital, as well as facilitating collaborations with industry and academia. The primary objective is to create optimal conditions for innovation at Karolinska, driven by clinical and patient requirements. Additionally, the centre aims to enhance knowledge in innovation management, thereby fostering and maximising the benefits of collaborations between public and private entities.

Karolinska is constantly receiving commercial proposals or different forms of requests for collaborations from industry. Activities to address these requests include matching the demand from the hospital with solutions provided by industry along with knowledge-transfer from the Centre for Innovation internally as well as externally on how to initiate, operate and finalise successful industry collaborations.

Karolinska University Hospital continues to develop strategic collaboration with companies, including so called innovation partnerships. These partnerships were

However, there is often a gap between the needs of the clinical staff on the ground and the requirements of hospital management and personnel. There is a tendency for these organisations to prefer working with established medical device companies they have existing relations-

hips with, rather than engaging with small start-ups. This preference stems from the perceived risks and challenges associated with collaborating with a start-up that may not have a long-term presence. Start-ups face uncertainties regarding their sustainability, potential business failures, or changes within their team. On the other hand,

hospitals are under immense pressure to consistently deliver high-quality care. Innovation, which involves testing and developing new products, introduces an element of uncertainty and change. Therefore, striking a balance becomes crucial, considering both the hospital's need for consistency and the start-up's need for innovation.

## Universities

Universities play a significant role in facilitating access to the market for innovation in Sweden. Through their research and development efforts, universities generate cutting-edge technologies and knowledge. They actively collaborate with industry partners, start-ups, and incubators to transfer technology and foster commercialization. Universities also offer support in the form of

entrepreneurship programs, funding opportunities, and networking platforms, enabling innovators to connect with investors and industry stakeholders. Their expertise, resources, and collaborative ecosystem contribute to a thriving innovation ecosystem and facilitate the successful entry of innovations into the market in Sweden.

### KAROLINSKA INSTITUTET

Karolinska Institutet (KI) is ranked as the 49<sup>th</sup> university of World University Rankings 2023 by Times Higher Education with a research score of 68.8.

The university has a budget of 635.81 €M in the last year. Out of the total budget, 83.8%, which is 533.13 €M, is allocated to research and education at the doctoral level.

Following figures reflect Karolinska Institutet commitment to technology transfer, showcasing the tangible outcomes of their research endeavours. It is observed that, while the number of established spin-offs remains relatively constant over the years, the number of scientific publications increases each year. This underlines their dedication to bridging the gap between academia and industry, effectively translating knowledge into innovation for societal benefit.

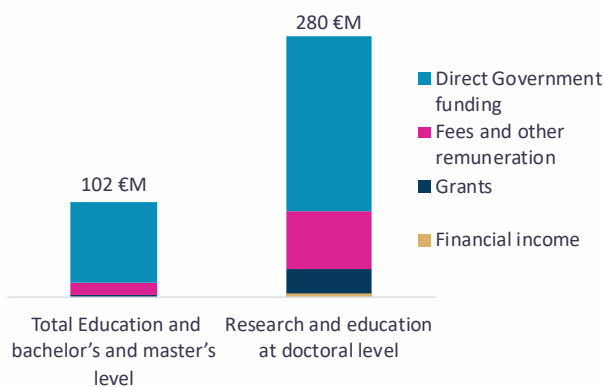


Figure 27. Karolinska Institutet 2022 budget.

Source: KI financial report.

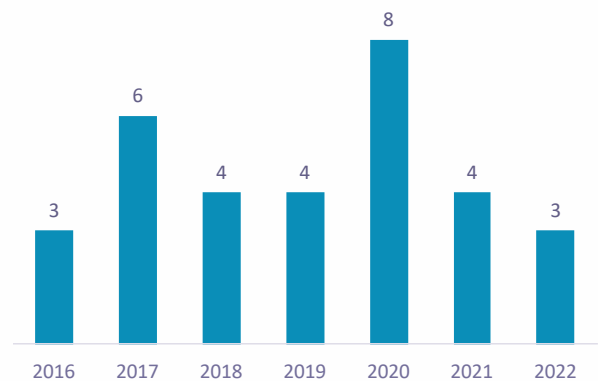


Figure 28. Number of spin-off companies established per year.

Source: Karolinska Institutet annual report.

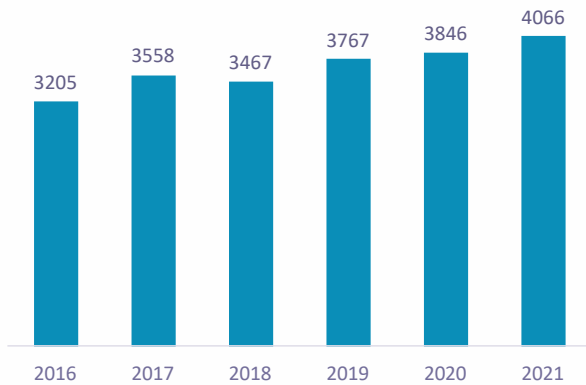


Figure 29. Number of scientific publications per year.

Source: Karolinska Institutet annual report.

KI Innovations serves as the innovation support system at Karolinska Institutet, as well as an incubator, offering comprehensive support and guidance to facilitate the translation of research-based ideas, discoveries, and knowledge into practical applications. Its mission is to contribute to a healthier future for all by harnessing the wealth of research conducted at Karolinska Institutet. At Karolinska Institutet, renowned for its world-leading research in understanding the human body and its diseases, researchers primarily focus on publishing their findings in scientific papers. However, the transition from research to tangible products and services that benefit patients and society is not always a natural progression. KI Innovations, through its services and expertise, bridges this gap by providing researchers with the necessary resources, mentorship, and support to transform their innovative ideas into valuable solutions.

KI Innovations offers several programs to support different stages of innovation, from ideation to market access. At first stages, the START program is designed to assist individuals in validating the potential of their research- or knowledge-based ideas. The program's primary objective is to gain insights into the market landscape, evaluate the feasibility of protecting the idea through patents or trademarks, and ensure that the asset owner possesses the necessary rights to commercialise the concept. As the program progresses, it also aids in identifying key factors essential for advancing the idea to the next level.

For next stages, DRIVE is a specialised life science incubator program aimed at supporting the successful commercial development of life science businesses. It provides a platform for newly established companies that demonstrate a verified business opportunity with a focus on the life science sector. DRIVE offers a flexible approach, adapting to the unique requirements of each participating start-up, and providing them with the necessary tools and opportunities to advance their commercialization efforts. Through this program, KI Innovations aims to foster the growth and success of life science start-ups, ultimately contributing to the advancement of the life science industry and the betterment of healthcare.

## WHAT SPECIFIC MECHANISMS IN SWEDEN PROMOTE THE TRANSFER OF INNOVATION ALONG ONE PATH OR ANOTHER?

Sweden has established itself as the most active European country in terms of innovation, technology, and start-ups. It has positioned itself as one of the most important countries. The success can be attributed to various factors, such as legislative reforms since the 1990s that have empowered and revitalised the business ecosystem according to the Economic and Commercial Office of the Embassy of Spain in Stockholm:

- In the 1990s, Market reforms facilitated the establishment of new companies and challenged monopolistic dominance. The 1993 Competition Act aimed to prevent acquisitions and the formation of monopolies, promoting a more competitive business ecosystem.

- The fiscal reforms in 1990s Sweden included a reduction in the corporate tax rate (from 52% to 30% in 1991, now at 22%) and the elimination of double taxation. These measures contributed to increased dynamism in the Swedish economy.
- Sweden's transition from a protectionist country to an open economy attracted foreign investments, enabling the growth of promising local businesses and the elimination of unsustainable ones. This created opportunities for future enterprises. The opening up also allowed for increased participation of international investors in mature start-ups, resulting in a higher flow of investment into the Swedish start-up ecosystem (with the percentage of Swedish start-ups owned by foreign companies increasing from 7% to 40% during the 1990s).
- The popularisation of the internet played a significant role. During the 1990s, Sweden offered tax incentives to companies that acquired personal computers for their employees. As a result, most individuals under 40 years old possess computer skills beyond a basic user level. Furthermore, the Swedish society's overall computer literacy is advanced, allowing Swedish companies to be technologically more advanced on average compared to companies in other European countries.

Another key to success is the demographics of the country. Sweden has always had a relatively small population compared to other European and non-European countries, which means a small potential market. As a result, entrepreneurs in Sweden create companies with the intention to export and work internationally. This approach enables businesses to have a solid foundation and a more viable and well-planned internationalisation strategy compared to companies from more populous countries

such as the United States, Germany, or Spain, where operating in international markets is essential for survival.

The third key is related to Sweden's extensive welfare state, which protects its citizens and offers them the opportunity to take entrepreneurial risks, knowing that their needs will be covered. University education is free, students can apply for loans to cover their expenses during their years of study, healthcare is free, education and healthcare for children are fully subsidised until the age of 18, and citizens have the right to unemployment benefits without the requirement of having a job. The Swedish government offers various programs and support to promote the creation of start-ups and foster innovation:

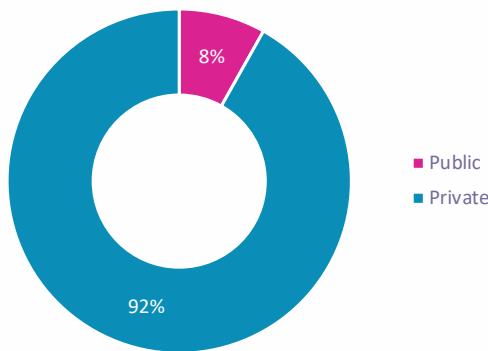
Vinnova is the Swedish government's state agency that promotes entrepreneurship and business innovation in Sweden. It serves as a tool to finance and subsidise R&D projects, with a mission to promote innovation for efficient economic development based on new technologies, transportation, telecommunications, and employment. Among the public organisations providing funding in Sweden, Vinnova is likely the **most significant source of financial support for innovation and start-ups**, although its public grants have more complex requirements to qualify for financial assistance compared to other public funding sources. The financial grant can cover 100% of the project expenses, up to a maximum of 25,184.10 euros.

Almi is a state-owned financial institution aimed at fostering growth and strengthening the Swedish economy by providing loans. The company strives to assist businesses in their innovation projects and promote the international expansion of Swedish companies. Similarly, it grants loans to entrepreneurs with innovative business ideas to implement their projects and enhance competitiveness, thus cultivating a more robust entrepreneurial landscape.

## SWEDISH AGENCY FOR ECONOMIC AND REGIONAL GROWTH (TILLVÄXTVERKET)

The Swedish Agency for Economic and Regional Growth is dedicated to fostering competitiveness and growth in economic sectors in Sweden. It provides funding, networking opportunities, and information dissemination, while also serving as a national authority for promoting the economy and improving labour and business conditions.

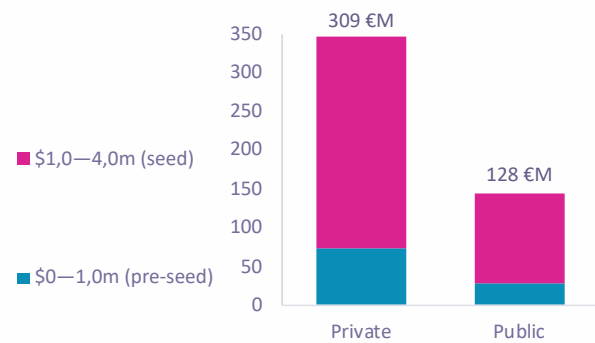
Among the support programs offered by this organisation, the most sought-after are business development vouchers. These financial aids are granted to companies that meet specific requirements and have the intention to grow.



**Figure 30.** Distribution of capital raised between 2017 and 2023.  
 Source: Dealroom (26/06/2023) & EY analyses.

The financial assistance aims to support the purchase of services or investment in business or innovation projects. Funding covers a maximum of half the cost of the requested item, with amounts ranging from 4,196.12 to 16,784.46 euros.

Despite the wide range of funds and public support offered by the Swedish government, the 91.85% of the investment received by Swedish HealthTech start-ups between 2017 and 2023 come from private funds. Although in the early stages, the gap between the public sector and the private sector narrows. Public funding accounts for 30% of the total financing in those stages.



**Figure 31.** Capital raised from 2017 to 2023 in Early-Stages.  
 Source: Dealroom (26/06/2023) & EY analyses.

### Innovation incentives and taxation framework

The start-up law in Sweden is characterised by its limited scope, with only one specific rule dedicated to start-ups. Apart from that, start-ups are subject to the same legislation as any other company in any industry. As a result, the regulatory landscape in Sweden is notably straightforward. It's important to highlight that this simplicity and ease of regulation play a significant role in fostering a dynamic entrepreneurial ecosystem within the country.

There is a single regulation in Sweden that specifically applies to start-ups. This regulation, known as Kvalificerade personaloptioner (KPA), governs a tax incentive aimed at offering stock options as a form of payment to

qualified employees of start-ups. This initiative enables early-stage Swedish start-ups to provide their qualified employees with financially attractive stock option plans as part of their internal incentive programs.

Introduced in 2018, this new measure allows start-ups to grant stock options to their qualified employees. These employees have the right (but not the obligation) to purchase company shares at a predetermined fixed price (typically near zero) on a specified future date, usually between 3 and 10 years later. As for taxation, employees are only required to pay a 25% tax on the future increase in the value of the shares, as any gains from selling the

shares are treated as capital gains. This measure represents an appealing fiscal incentive compared to the previous regulations in place.

Also, Sweden offers a competitive corporate tax rate of 20.6%, which is lower compared to other European countries.

## SUMMARY

Sweden is an Innovation Leader with performance at 134.5% of the EU average according to the European Innovation Scoreboard 2023. Performance is above the average of the Innovation Leaders (133.4%).

Sweden stands as a country at the forefront of innovation, as seen in the European Innovation Scoreboard 2022, driven by a vibrant ecosystem that encompasses universities, hospitals, and public funding programs. The nation's institutions, renowned for their cutting-edge research and interdisciplinary collaboration, play a pivotal role in generating new knowledge and nurturing entrepreneurial talent.

Funding is indeed a recurring challenge as healthcare costs rise throughout the system. With limited resources available, it becomes crucial for government and public funding systems to recognize the need for robust

funding structures to support innovation. Start-ups and companies require sustainable business models beyond their initial stages, enabling them to grow and thrive. The ever-evolving landscape of innovation demands continuous investment and access to adequate funding streams to support research, development, and commercialization efforts.

However, addressing funding challenges remains essential. By ensuring comprehensive support and investment frameworks, "Sweden has a super strong start-up culture, especially outside of healthcare as well, you know we have these companies that have start-ups as a start-up in our global companies like Spotify, Clarna, there's a great entrepreneurial spirit in Stockholm. You see a lot of people talking about wanting to start a start-up and a lot of coworking accelerator programs", **Bioentrepreneurship Stephen Townsend**.



Switzerland, a landlocked country in Central Europe, is known for its landscapes, precision engineering, and high standard of living. With a population of approximately 8.7 M people, Switzerland boasts a diverse and multilingual society. The country's robust economy, fuelled by industries such as pharmaceuticals, banking, and machinery, contributes with a (GDP) of approximately 767.16€ billion. Switzerland has one of the highest GDP per capita figures globally, with 87,410€, reflecting its prosperous economy and high living standards.

## OVERVIEW OF THE SWISS HEALTHTECH ECOSYSTEM

Switzerland has consistently positioned itself at the vanguard of technological advancement, boasting globally renowned achievements in diverse fields such as cutting-edge pharmaceuticals. The factors contributing to Switzerland's status as an ideal environment for innovation include its prevailing culture of tolerance, unwavering focus on research and development, and also its universities, the Swiss Innovation Promotion Agency Innosuisse, and research centres according to the Economic and Commercial Office of the Embassy of Spain in Bern. These elements collectively underpin the nation's sustained success in fostering a thriving innovation ecosystem.

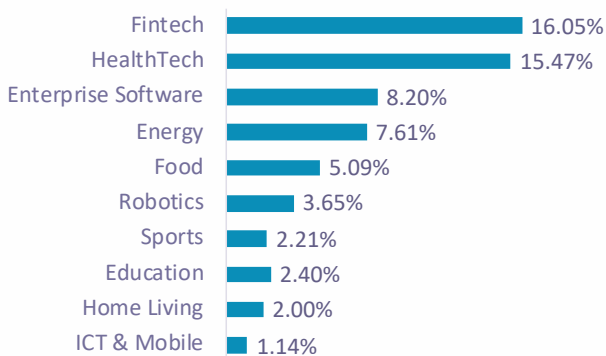


Figure 32. Sectorial distribution of start-ups (TOP10 sectors %).

Source: Dealroom (27/06/2023) & EY analyses.

From 2010 to 2023, 3,756 start-ups were identified in Switzerland. The top start-up sector in the country is Fintech, with 603 representing 16.05% of the total. Followed by HealthTech with 15.47%. Furthermore, between 2010 and 2023, a total of 581 HealthTech start-ups have been established in Switzerland.

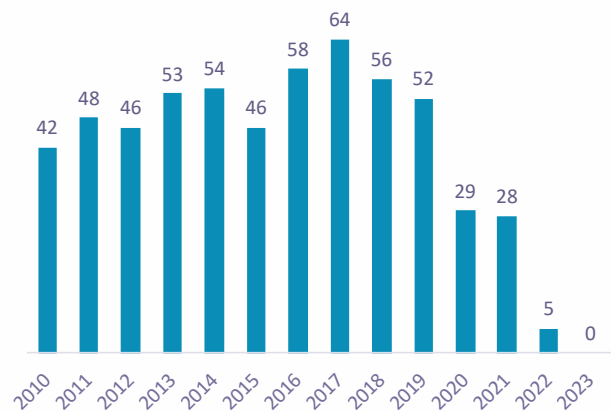
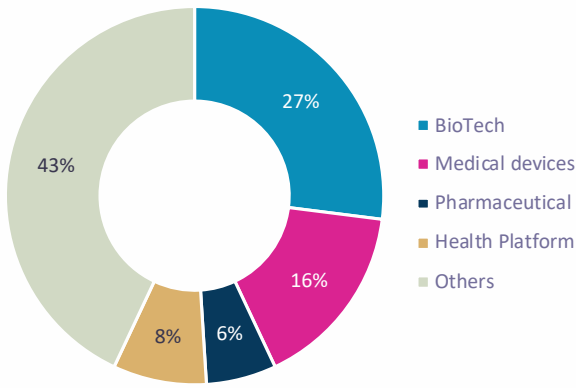


Figure 33. Number of HealthTech Start-up by year.

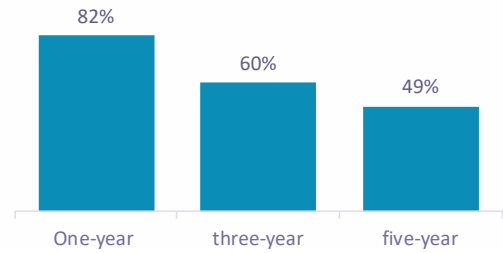
Source: Dealroom (27/06/2023) & EY analyses.

The most significant sector within HealthTech is Biotechnology start-ups, representing 27% of the total. Switzerland is one of the best and most innovative locations for biotechnology in Europe. Local companies hold leading positions throughout many sectors and thus attract capital and researchers from all over the world.



**Figure 34.** Percentage of start-ups by sector.  
 Source: Dealroom (27/06/2023) & EY analyses.

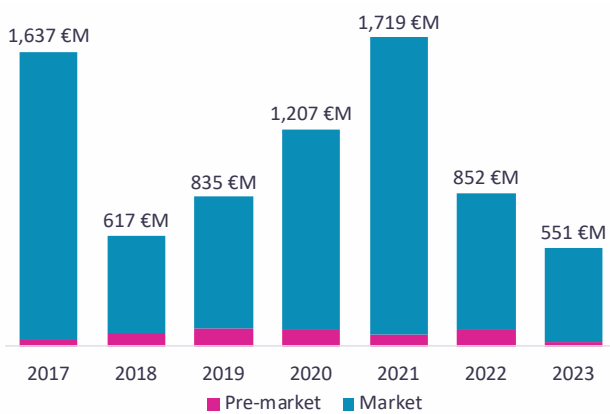
The percentage of newly created businesses that survive in the first year is approximately 82%. This is the third highest business survival in the regions analysed in the report.



**Figure 35.** Business survival rate.  
 Source: OECD ilibrary.

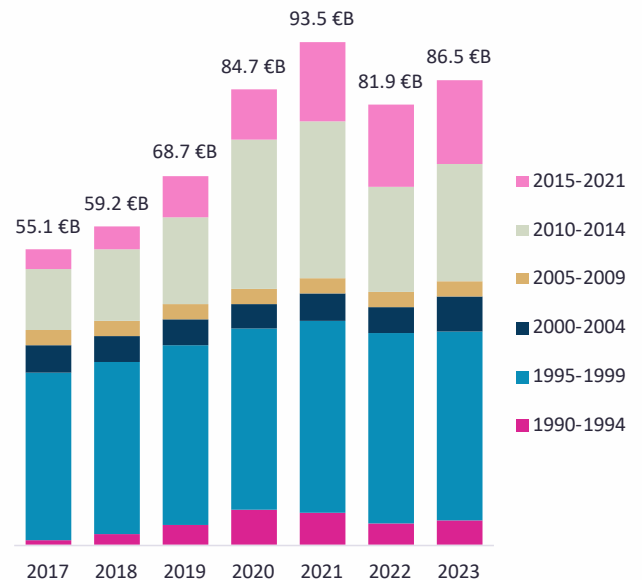
## SECTOR GROWTH

Swiss HealthTech start-ups raised 852 €M of annual Venture Capital funding in 2022, despite the economic downturn. This figure represents a 50.4% decrease from the all-time high in 2021. Most of the funding is allocated to rounds beyond the early-stage phase, where the start-up enters the market after it has developed and tested its minimum viable product (MVP) and is ready to commence its commercialization efforts and generate revenue. In 2017, a private fund invested 1.1 billion € in Roivant Sciences, a HealthTech unicorn founded in 2014.



**Figure 36.** Money raised per funding round.  
 Source: Dealroom (27/06/2023) & EY analyses.

Swiss HealthTech start-ups and scale-ups have experienced substantial growth in recent years. Their combined enterprise value has increased by a factor of 1.6 since 2017. Notably, the start-ups and scale-ups launched between 1995 and 1999 have shown even greater growth compared to those launched between 2000 and 2004.



**Figure 37.** Enterprise value by launch year.  
 Source: Dealroom (27/06/2023) & EY analyses.



## ROLE OF DIFFERENT INSTITUTIONS IN ACCESSING THE INNOVATION MARKET

Collaboration between hospitals and universities is a key driver of innovation in Switzerland. They work together to bridge the gap between academic research and practical applications. Researchers from universities often collaborate with clinicians and healthcare professionals from hospitals to identify unmet medical needs, develop innovative solutions, and validate their effectiveness

through clinical trials. This collaboration fosters a dynamic exchange of knowledge, expertise, and resources, creating a fertile ground for innovation and entrepreneurship. Additionally, hospitals and universities often engage with industry partners, start-ups, and investors to facilitate technology transfer, licensing agreements, and spin-off ventures.

### ***Hospitals and research institutions***

Swiss hospitals are renowned for their cutting-edge medical services, advanced technologies, and high-quality patient care. They often collaborate closely with universities, research institutions, and industry partners to foster innovation. Hospitals provide a real-world testing ground for new medical technologies, pharmaceuticals, and treatment methods. They offer valuable insights into clinical needs, patient feedback, and outcomes, which are critical for refining and commercialising innovations. By actively engaging in research, clinical trials, and collaborations, hospitals contribute to the development and commercialization of innovative healthcare solutions.

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A clear example is the University Hospital Zurich (USZ) with its Health Innovation Hub. The goal of this hub is to promote start-ups and entrepreneurship in healthcare. It supports innovators who want to develop innovative products and services in cooperation with the USZ. Both commercially viable ideas (start-up potential) and projects that lead to open access offers. All supported projects must go beyond pure research and should increase the chances of recovery and the quality of life of patients.

The innovation process in the hub consists of four stages:

- In the discovery stage, the innovation project is screened by the Health Innovation Hub and USZ medical leaders. The needs of the innovation project are evaluated, and a project plan is defined.
- After the definition of the project plan and the documentation of basic business information, the project takes its first steps towards the formation of a company in the delivery stage. With the support of their Entrepreneurs in Residence, the innovation project will create a full business plan and a detailed pitch deck.

- At promotion stage, the team around the innovation project is invited to present its results at the Innovation Board. If promoted by the Board, the innovation project will receive further support by their Entrepreneurs in Residence and financial contributions upwards of 103,818 € to accelerate the business development.

- Finally at Venture stage, the innovation project has graduated the program and the entrepreneurs in Residence will continue to support the project team as needed.

## Universities

Swiss universities have a strong tradition of academic excellence and research. They conduct ground-breaking studies across various disciplines, including medicine, engineering, life sciences, and information technology. Universities play a crucial role in cultivating an atmosphere of innovation through the pursuit of fundamental research, training the next generation of researchers and entrepreneurs, and collaborating with industry partners. They attract top talent, both domestically and internationally, and provide essential infrastructure, such as laboratories and research facilities, for innovation activities. Universities also facilitate knowledge transfer through technology transfer offices, which help translate academic research into marketable products or services.

One of the top-ranked and highly regarded university in Switzerland is the Swiss Federal Institute of Technology Zurich (ETH). ETH promotes technology and knowledge transfer through collaboration and exchange with industry, policymakers, public administration, and society at large, through technology licensing and an entrepreneurial ecosystem to foster spin-offs and start-ups, through education of future innovators and leaders. ETH is ranked as the 11<sup>th</sup> university of World University Rankings 2023 by Times Higher Education with a research score of 95.4. In the past 8 years, a total of 238 ETH spin-offs have been founded. In 2022, a total of 26 spin-offs were established. The evolution of the number of spin-offs established per year remains relatively stable, with an average of 26.4 spin-offs founded per year.

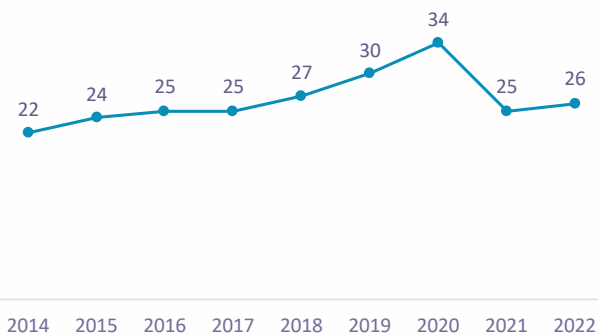


Figure 38. Number of spin-offs established at ETH in recent years.

Source: ETH annual report.

On the other hand, in the year 2022, 104 new patents were granted, representing a 15.56% increase compared to 2017. Additionally, the search for licensees and exploitation efforts resulted in 29 additional licenses in 2022, representing a 63.75% decrease compared to 2017.

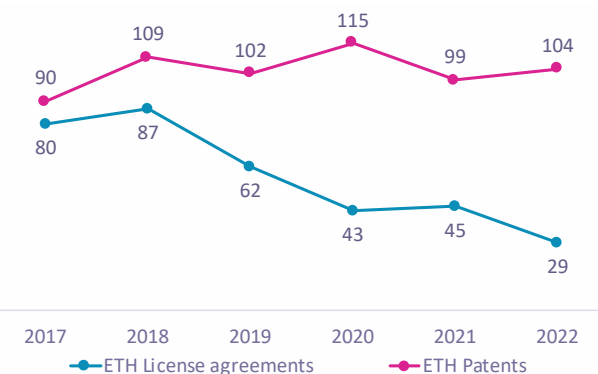


Figure 39. Number of patents and license agreements established at ETH in recent years.

Source: ETH annual report.

The university has a budget of 3,846.46 €M in the last year. Out of the total budget 807,11 €M are directly allocated to research.

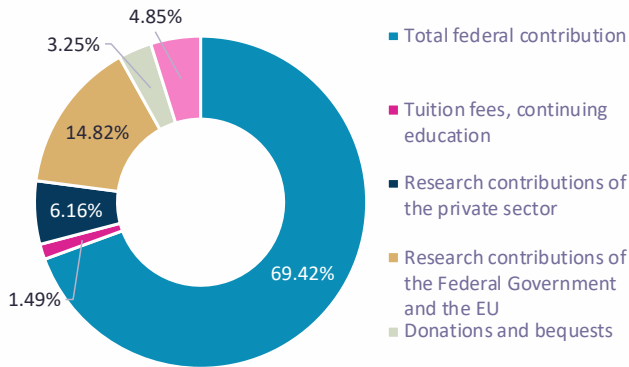


Figure 40. ETH annual budget

Source: ETH annual report & EY analyses

ETH Zurich offers its students, alumni, and entrepreneurs support at every level along their journey - from experimenting with creative ideas, to creating spin-off companies and beyond:

- The Pioneer Fellowship Deep-Tech Acceleration Program enables ETH students and researchers with an entrepreneurial drive to transform their research-based technologies into marketable products and servi-

ces, thereby launching successful ETH Spin-off companies. Selected participants will receive funding of up to 155,727 € for a duration of 18 months and personalised coaching.

- Wyss Zurich provides support for projects that centre around the development of treatment protocols, clinical therapies, novel technologies, and intelligent systems in the emerging fields of regenerative medicine, robotics, and medical devices/bionics technologies. Through the integration of projects from diverse disciplines and the provision of access to top-tier resources, Wyss Zurich aims to translate scientific advancements into tangible improvements in people's lives while fostering an entrepreneurial spirit.
- Venture Kick is a philanthropic three-stage funding model initiated to support Swiss start-ups with enough funding to kick-start their entrepreneurial success. Start-ups can qualify to receive up to 155,727 € in start capital, and an opportunity for an additional 882,456 € in equity funding from the Kick Fund. After the three-stage funding model the team have to be ready for the market. In 2022, the fund directly supported start-ups with 6,270,633 €, of which nearly 30% were allocated to HealthTech.

## WHAT SPECIFIC MECHANISMS IN SWITZERLAND PROMOTE THE TRANSFER OF INNOVATION ALONG ONE PATH OR ANOTHER?

From a Swiss perspective, when discussing the market, the focus primarily lies on exporting. Switzerland has a robust manufacturing sector for medical devices, and it is observed that individual companies export around 95 to 99%, and sometimes even 100% of their products manufactured in Switzerland. Unimpeded access to export markets is crucial for these companies, as any additional obstacles can impact their operations. The Mutual Recognition Agreement (MRA) between the European Union and Switzerland has played a significant role in facilitating trade, particularly in the healthcare technology sector encompassing pharmaceuticals, diagnostics, and

medical devices. However, due to Switzerland's unique relationship with the European Union as a non-member seeking access to the common market, there are concerns about the erosion of easy access and the emergence of additional trade hurdles. This poses challenges for Swiss companies as they navigate the evolving trade landscape.

There are two different forms of entrepreneurial creation in which knowledge and technology transfer plays a significant role. Firstly, a start-up can be driven by an initial business idea. In this case, Knowledge and Technology Transfer (KT&T) serves to assess the techni-

cal-scientific feasibility, often leading to a research contract or research collaboration (such as projects funded by Innosuisse).

On the other hand, scientific-technological discoveries that need to be put into service of the economy and society can also trigger the establishment of a start-up. This often occurs through the creation of university spin-offs. In this case, the challenges of KT&T are not so much related to the research itself but to the transfer of research results into commercial applications and new products. Ensuring intellectual property rights is essential from the perspective of researchers, the research institution, and potential spin-offs. At the same time, this allows the research institution to benefit from potential commercial success in the future. For Swiss universities and research institutes, patents are an important means of ensuring intellectual property for spin-offs. Technology transfer offices typically examine the patentability of new inventions, file patent applications, and pre-finance them until the intellectual property rights can be licensed to spin-off companies, for example. Therefore, universities and research institutes generally remain the owners of intellectual property.

Switzerland is one of the largest R&D investors in the world and two-thirds of all research and development in Switzerland is funded through the private sector. The total amount invested for R&D equates to 3.40% of Swiss GDP. This makes it one of the highest investors in R&D in the world.

Switzerland has a distinguished tradition of promoting innovation through a unique approach that relies less on government funding and more on the entrepreneurial mindset of its people. Unlike some European countries that heavily invest in research infrastructure with government money, Switzerland recognizes that innovation is primarily driven by individuals and companies investing their own resources. This approach ensures a personal stake in the outcome and a better alignment with market needs. While government funding can be beneficial, Switzerland emphasises the importance of individual decision-making and investment. Collaborations with

universities provide additional support, as academic institutions are government-funded, reducing financial burdens for innovators. This ecosystem has evolved over time, cultivating a culture where individuals understand the value of self-investment and collaboration while being mindful of market demands. Switzerland's successful innovation model demonstrates the effectiveness of empowering individuals and their financial commitment to driving meaningful progress and impactful innovation.

This can be observed in the comparison between the public-private balance of start-ups. 96.84% of the funding received by Swiss HealthTech start-ups between the period of 2017 and 2023 came from the private sector. However, in the early-stage phases, the difference narrows as 29.6% of the funding received in these stages comes from public financing. Of this 3.16% of public funding received by start-ups, only 9.03% comes from the Swiss government. With 60.49%, funds from the European Union are the main source of public financing for Swiss HealthTech start-ups.

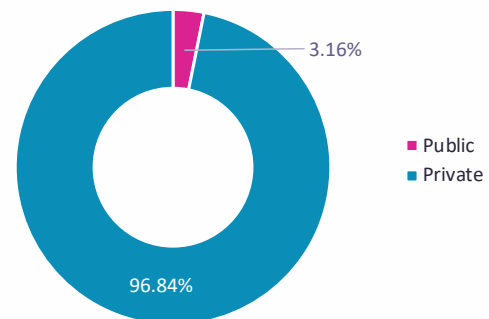


Figure 41. Distribution of capital raised between 2017 and 2023.

Source: Dealroom (27/06/2023) & EY analyses.

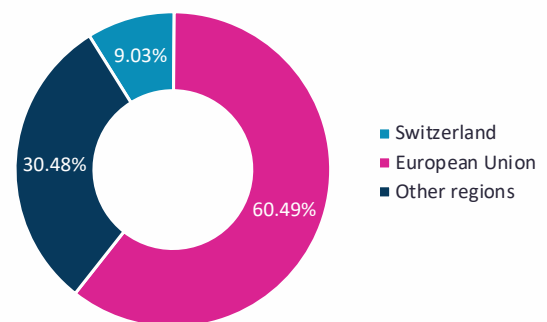


Figure 42. Public investor location.

Source: Dealroom (27/06/2023) & EY analyses.

## ***Innovation incentives and taxation framework***

Switzerland provides a range of tax benefits and incentives aimed at fostering a supportive environment for start-ups. These fiscal advantages play a crucial role in attracting and nurturing innovative ventures in the country. One significant benefit is the tax incentives for R&D. Start-ups engaged in R&D activities can enjoy tax deductions or credits on eligible expenses related to their research projects. This encourages start-ups to invest in cutting-edge technologies and fuels innovation.

Furthermore, certain Swiss cantons offer reduced corporate tax rates specifically tailored to support start-ups. These lower tax rates help alleviate the financial burden for young companies, allowing them to allocate more resources towards growth and development. The overall approximate

range of the maximum rate on profit before tax for federal, cantonal, and communal taxes is between 11.9% and 21.0%.

Another attractive tax benefit is the exemption of capital gains tax on the sale of qualified participations or investments in start-ups. This encourages investment in start-ups and provides an incentive for entrepreneurs and investors to support the growth of these ventures.

Switzerland also implements a patent box regime, which offers favourable tax treatment for income derived from patents and intellectual property rights. This encourages start-ups to protect their innovations and enables them to benefit from reduced tax rates on income generated from their intellectual property.

## **SUMMARY**

Switzerland is the overall best performing country in Europe. It is an Innovation Leader with performance at 139.2% of the EU average according to the European Innovation Scoreboard 2023. Performance is above the average of the Innovation Leaders (133.4%).

Switzerland does not have a national-level innovation policy or industrial policy, similar to Sweden. The country's approach has been to establish a supportive ecosystem without a top-down approach. Rather than imposing strict policies, the focus is on creating favourable framework conditions for companies, innovators, and healthcare providers. This approach allows them to thrive and excel within these established boundaries. Switzerland's innovation ecosystem has developed organically over the course of decades. Collaboration and familiarity among stakeholders have played a significant role in shaping this ecosystem. Participants understand the regulatory framework and work together to push boundaries and explore new possibilities. This bottom-up

approach has proven to be crucial in fostering innovation and maintaining a dynamic and vibrant ecosystem.

Switzerland has a remarkable history of fostering innovation by leveraging a distinctive approach that places less emphasis on government funding and instead highlights the entrepreneurial spirit of its citizens. Swiss companies have a primary objective of exporting their products to foreign markets. This export-centric approach plays a vital role in driving the growth and prosperity of Swiss businesses. Renowned for their exceptional quality, precision, and reliability, Swiss products are in high demand globally. "From a Swiss perspective – given the relatively small domestic market – exports are key to grow a company. This is especially the case for medical devices and pharmaceutical manufacturers, their export share is usually well above 90%. Thus, market access is important.", **Cluster Manager, Member of the Executive Board, Health Tech Cluster Switzerland - Patrick Dümmler.**



Flanders, the Dutch-speaking northern portion of Belgium, is known for its dynamic economy and rich cultural heritage. With a population of over 6.5 M people, Flanders thrives as a diverse and bustling community. Its Gross Regional Product (GRP) of Flanders is €296 billion (excluding Brussels) ranks high among European regions, reflecting its robust economic performance and strong business landscape. Flanders boasts a €43,330 GDP per capita, indicating a relatively high standard of living for its residents. The region's economic success, driven by sectors such as manufacturing, technology, and services, contributes to its reputation as a prosperous and forward-thinking destination.

## OVERVIEW OF THE FLEMISH HEALTHTECH ECOSYSTEM

Flanders boasts an innovation-driven economy that offers an ideal environment for companies seeking sustainable growth opportunities, supported by exceptional research and development (R&D) facilities situated at the heart of Europe. This advantageous setting is not a mere happenstance, but the result of concerted efforts by private, public, and academic entities in Flanders, diligently collaborating and fostering innovation, often through the formation of clusters. It was ranked as the 3<sup>rd</sup>-best innovative system in the world in 2020.

From 2010 to 2023, 1,716 start-ups were identified in Flanders. The top start-up sector in the country is Enterprise Software, with 212 representing 12.35% of the total. Followed by HealthTech representing 11.47%. Furthermore, between 2010 and 2023, a total of 197 HealthTech start-ups have been established in Flanders

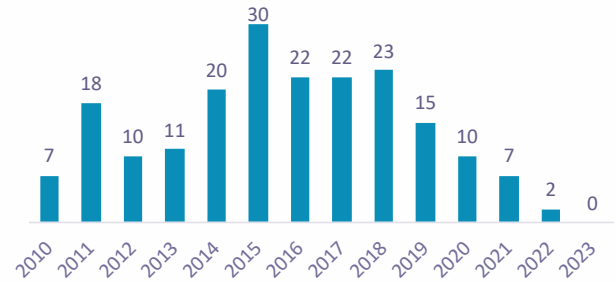


Figure 44. Number of HealthTech Start-up by year.

Source: Dealroom (28/06/2023) & EY analyses.

The most significant sector within HealthTech is Biotechnology, representing 26% of the total. Flanders offers a concentrated hub of knowledge institutes, corporations and other stakeholders for biotech R&D. Also, it is home to competitive biotech incubators and accelerators.

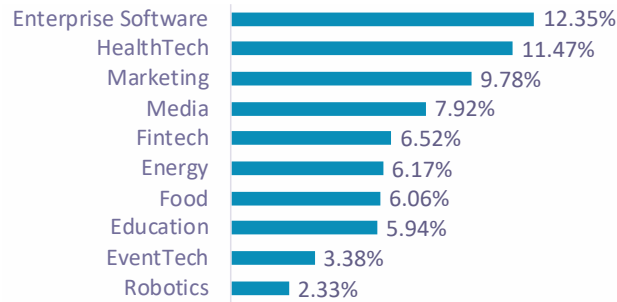


Figure 43. Sectorial distribution of start-ups (TOP10 sectors %).

Source: Dealroom (28/06/2023) & EY analyses.

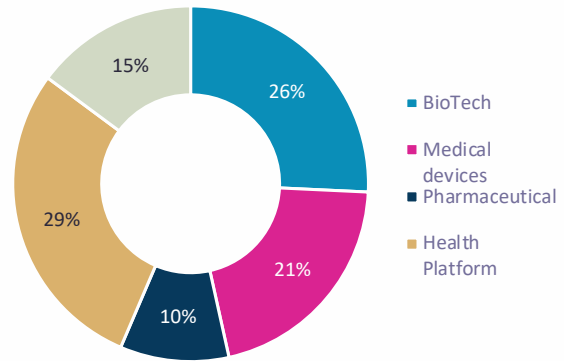


Figure 45. Percentage of start-ups by sector.

Source: Dealroom (28/06/2023) & EY analyses.

The percentage of newly created businesses that survive in the first year is approximately 92%. This is the second highest business survival in the report.

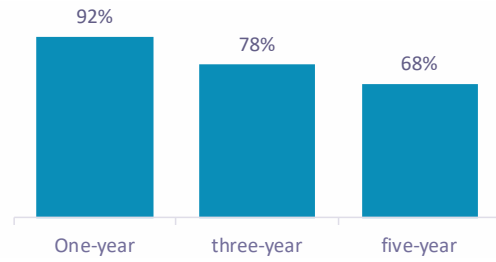


Figure 46. Business survival rate.

Source: OECD ilibrary.

## SECTOR GROWTH

Flemish HealthTech start-ups raised 190 €M of annual Venture Capital funding in 2022, despite the economic downturn. This figure represents a 23.08% decrease from the all-time high in 2019. Most of the funding is allocated to rounds beyond the early-stage phase, where the start-up enters the market after it has developed and tested its minimum viable product (MVP) and is ready to commence its commercialization efforts and generate revenue.

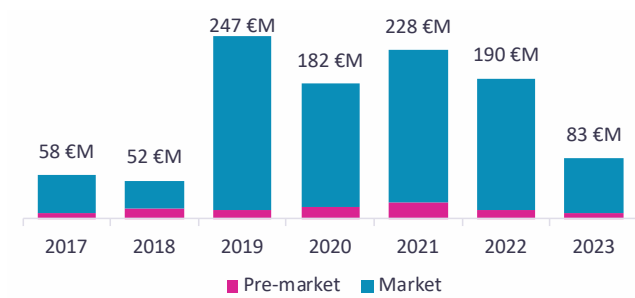


Figure 47. Money raised per funding round.

Source: Dealroom (28/06/2023) & EY analyses..

Flemish HealthTech start-ups and scale-ups have experienced substantial growth in recent years. Their combined enterprise value has increased by a factor of 4.6 since 2017. Notably, the start-ups and scale-ups launched between 2005 and 2009 have shown even greater growth compared to those launched between 2010 and 2014.

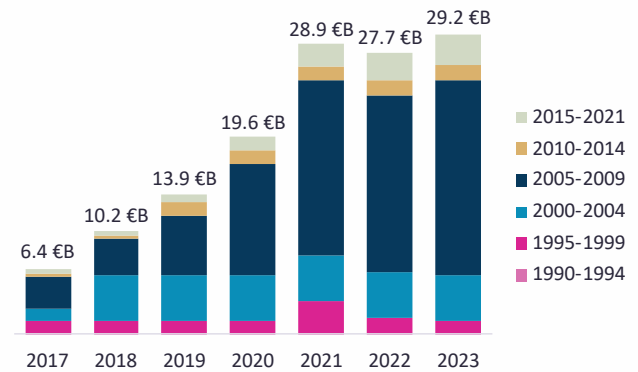


Figure 48. Enterprise value by launch year.

Source: Dealroom (28/06/2023) & EY analyses.

## ROLE OF DIFFERENT INSTITUTIONS IN ACCESSING THE INNOVATION MARKET

### Hospitals and research institutions

Hospitals play a crucial role as key partners for companies, including spin-off companies from universities, as well as more established and larger corporations, seeking to validate their innovations in clinical settings. Hospitals hold significant importance in meeting regulatory requirements and ensuring the security and efficacy of new

solutions. They actively collect diverse data pertaining to the safety and effectiveness of these innovations. Therefore, hospitals function as vital players in the healthcare ecosystem, facilitating the adoption and advancement of novel technologies and treatments.

## UNIVERSITY HOSPITAL LEUVEN

The University hospital Leuven is the largest university hospital in Belgium. Through constant investment in research, new treatments and the latest technology, UZ Leuven is among the Belgian and international top in many disciplines.

The innovation process within the organisation follows a hands-on and ad hoc approach. Many of the innovation projects originate from identified needs within the clinical environment, often identified by clinicians themselves while treating patients. This patient-centric perspective drives the initiation of these projects. Subsequently, the organisation conducts a search to determine if existing solutions partially fulfil the clinician's requirements. This search involves exploring available options offered by established companies or assessing the need for new research and development efforts.

The decision on which track to pursue is heavily influenced by the availability of a suitable solution. If an adequate

solution already exists, the organisation may collaborate with existing companies to bring the innovation to market. On the other hand, if there is a lack of an appropriate solution, the organisation may initially develop prototypes and conduct research in a university setting, often in collaboration with partner institutions. Following this initial phase, the organisation approaches existing companies with the intellectual property and a compelling value proposition, seeking their interest and potential partnership to bring the innovation to the market. This collaborative route with established companies forms one of the primary approaches taken by the organisation. Another route pursued by the organisation involves creating spin-off companies to independently bring the innovation to market. In such cases, the organisation forms a new company with the parties involved in the project, paving the way for commercialization through the spin-off entity.

## Universities

Universities in Flanders have a vital role in accessing the innovation market. They conduct research across diverse disciplines and provide education and training to future innovators. Universities engage in collaborative research projects with businesses and industries, fostering knowledge exchange and technology transfer. They

also support entrepreneurship and the creation of spin-off companies through their technology transfer offices. Universities act as hubs of innovation, providing expertise, infrastructure, and resources to entrepreneurs and businesses looking to access the market with innovative ideas and solutions.

## KU LEUVEN

**KU Leuven** is one of the oldest and most renowned universities in Europe. It has a strong focus on research and innovation, with a wide range of programs and initiatives promoting interdisciplinary collaboration and entrepreneurship. The university conducts cutting-edge research that leads to the development of innovative technologies, products, and solutions. This research forms the basis for accessing the innovation market. It is ranked as

the 42<sup>nd</sup> university of World University Rankings 2023 by Times Higher Education with a research score of 74.9.

The university supports researchers in transforming their innovative ideas and technologies into new and promising high-tech companies with its Spin-off & Innovation Unit. They offer guidance in business plan development, market validation, team building, and company

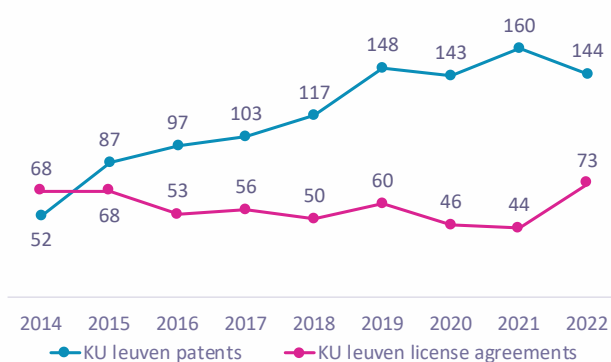


growth. Their team consists of experts with international experience who are ready to provide support. Between 2014 and 2022, 49 spin-off companies were founded. In 2022, 2 new spin-off companies were established, which represents a 77.7% decrease compared to 2019.



**Figure 49.** Number of spin-offs established at KU Leuven in recent years.

Source: KU Leuven annual report.



**Figure 50.** Number of patents and licence agreements established at KU Leuven in recent years.

Source: KU Leuven annual report.

On the other hand, in 2022, KU Leuven University's successful implementation of intellectual property strategies led to the grant of 144 new patents, representing a 77% increase compared to 2014. Moreover, their efforts in seeking licensees and exploitation resulted in an additional 73 licences in 2022.

KU Leuven offers support in obtaining and managing national translational funds and programs such as:

- The Odysseus program of the Research Foundation - Flanders (FWO) offers outstanding incoming researchers up to 5 €M of start-up project funding to establish a research group at KU Leuven, over a 5 year period. Successful candidates also receive an academic staff position at KU Leuven.
- Project collaborations with Flemish enterprises seeking co-funding to collaborate with research groups of the KU Leuven association.

It also offers support in obtaining the international European Innovation Council's Pathfinder, Transition and Accelerator under the Horizon Europe umbrella, which can also greatly accelerate spin-off creation and anything beyond.

## WHAT SPECIFIC MECHANISMS IN FLANDERS PROMOTE THE TRANSFER OF INNOVATION ALONG ONE PATH OR ANOTHER?

Flanders has implemented several mechanisms to promote the transfer of innovation along different paths. These mechanisms facilitate the exchange of knowledge, technology, and expertise between research institutions, industry, and other stakeholders.

On one hand, Flanders has the Tech Transfer Offices that is a joint initiative of the five Flemish universities: Ghent University, University of Antwerp, KU Leuven, Vrije Universiteit Brussel and Hasselt University. The technology transfer offices (TTOs) of these universities are responsible for the transfer of knowledge and technology from

universities and associated university colleges to private and public partners. They offer a unique portal to the knowledge and technology of the Flemish universities and university colleges and aims to be a unique point of contact for industry looking for research expertise and licensing opportunities. Also, maximise the valorisation of the available university knowledge and technology for the benefit of the economy and society.

On the other hand, Flanders offers various funding programs and grants to support innovation and technology transfer. These programs provide financial resources to

researchers, entrepreneurs, and businesses for research and development activities, prototype development, market validation, and commercialization efforts. They stimulate innovation-driven projects and incentivize the transfer of innovation to the market. Some notable funding programs and grants in Flanders include:

- The Flanders Innovation & Entrepreneurship (VLAIO) provides a comprehensive set of funding programs and grants to support innovation and entrepreneurship. The support agency aims to stimulate innovation at companies using two main support instruments. First one, for research projects focusing on knowledge building that can lead to important changes within the company in the long haul. It can amount to 25% to 60% of the project budget, with a minimum support amount of 100,000€. Secondly, development projects for innovative ideas that can change and enhance a company in the short term. It amounts to 25% to 50% of the project budget, with a minimum support amount of 25,000€.
- Participatiemaatschappij Vlaanderen (PMV) finances promising companies at all stages of development, from start-up to growth and internationalisation. It also works with and for the government of Flanders and other partners to support projects that contribute to prosperity and well-being. PMV provides venture capital – always in co-financing with the market – both at an early stage and to more mature companies.

Belgium is one of the largest R&D investors in the world. The total amount invested for R&D equates to 3.22% of Belgium GDP, making it one of the highest investors in R&D in the world.

However, 95.48% of the investment received by Flemish HealthTech start-ups between 2017 and 2023 comes from private funds. Although in the early stages, the gap between public private sector funding narrows, with public funding accounting for 45% of the total financing.

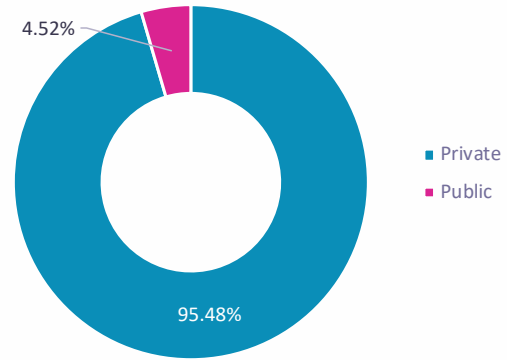


Figure 51. Distribution of capital raised between 2017 and 2023.

Source: Dealroom (28/06/2023) & EY analyses.

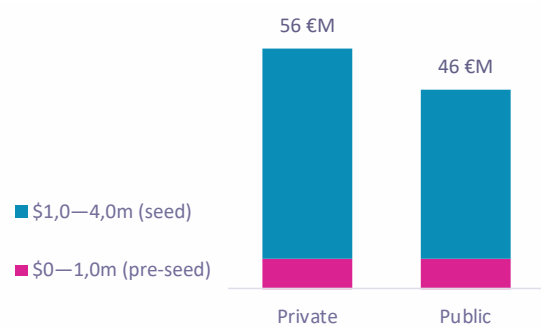


Figure 52. Capital raised from 2017 to 2023 in Early-Stages.

Source: Dealroom (28/06/2023) & EY analyses.

Out of the 4.52% of public funding received by start-ups, 46.03% comes from the Flemish government. This percentage allows the evaluation of the effectiveness of Flemish funds, notably the Flanders Innovation & Entrepreneurship (VLAIO) fund, which constitutes the majority of the public funding.

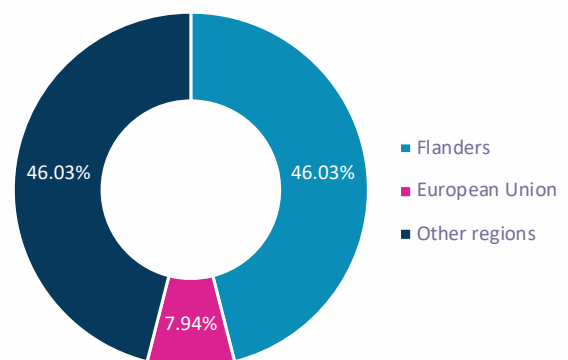


Figure 53. Public investor location.

Source: Dealroom (28/06/2023) & EY analyses.

## ***Innovation incentives and taxation framework***

Companies, associations and organisations with legal personalities are subject to Belgian corporate income tax if they are engaged in a business or profit-generating activity and have their registered office, main establishment or place of effective management in Belgium. The standard corporate income tax rate in Belgium is 25%, but certain qualifying start-ups in Flanders may be eligible for a reduced corporate income tax rate of 20.4%.

Also, the Belgian government introduced a tax shelter scheme for start-ups to encourage investment in ear-

ly-stage businesses. This scheme allows individual investors to benefit from a tax reduction or tax credit when investing in eligible start-ups. The specific conditions and requirements for the tax shelter scheme can vary, so it's important to check the current regulations.

The dividends received by foreign businesses with local holdings in Flanders are 100% exempt from taxation. What's more, zero capital duty is levied on their capital contribution, while their capital gains on shares are also 100% exempt from taxes.

## **SUMMARY**

Flanders is a region of Belgium which is considered as an Innovation Leader - with performance at 130.3% of the EU average according to the Regional Innovation Scoreboard - Regional profiles Belgium 2023. Performance is below the average of the Innovation Leaders (133.4%).

Working relationships between the regional government of Flanders and the federal government, which retains responsibility for healthcare, contribute to the support and promotion of bringing innovations to the market.

Furthermore, strong universities, not only within Flanders but also in other regions, actively collaborate in the pursuit of innovative solutions for patients. This collaboration extends beyond individual hospitals, aiming to reach a broader patient population. The willingness of different institutions to collaborate is a crucial factor in fostering successful innovation initiatives. In addition to financial support, the presence of incubators and business support organisations plays a vital role in the innovation ecosystem. These entities work closely together, providing infrastructure and assistance to in-

novators, start-ups, and spin-off companies. The combination of financial support, collaborative partnerships, and the availability of incubators and business support organisations collectively contributes to the favourable innovation environment within Flanders.

**Not only the financial instruments that the Flemish Government installed which have increased over the past few years in a significant way, really also supporting collaborations between for example hospitals and companies. So that is definitely a good thing**

Innovation Manager at UZ Leuven  
**Bart de Greef**

### 5.3. Comparative analysis of the regions

Catalonia has a population of approximately 7.8 M inhabitants and a GDP of approximately 270 billion euros, of which only 1.67% is allocated to R&D. As seen in figure 54, Catalonia remains below the analysed regions in terms of R&D expenditure and GDP. For reference, Catalonia's GDP per capita stands at 34,535€, placing it below the other analysed regions.

**Catalonia allocated 1.67% of its GDP to research and development activities in 2021, in contrast to the average of 3.2% allocated by other regions, such as Sweden, Denmark, Switzerland, and Flanders.**

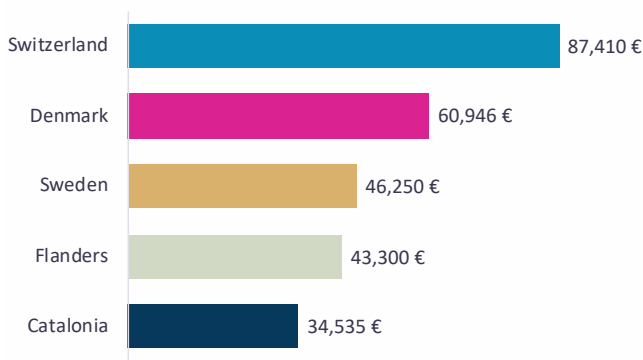


Figure 54. Gross domestic product per capita.

Source: Idescat & EY analyses.

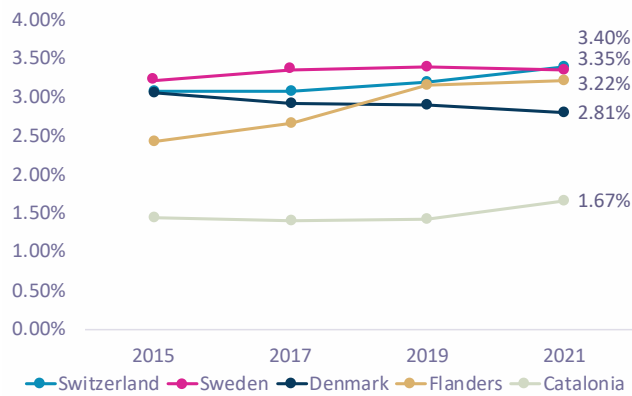


Figure 55. Gross domestic spending on R&D.

Source: Idescat & EY analyses.

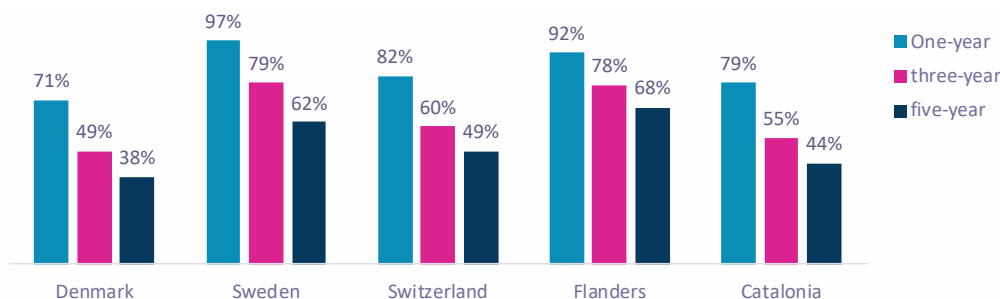


Figure 56. Business Survival Rate.

Source: OECD ilibraries.

Catalonia has consolidated its position as one of the most important European start-up ecosystems. It is ranked as the 5<sup>th</sup> best ecosystem in the European Union (the first in Southern Europe), the 2<sup>nd</sup> region most preferred by entrepreneurs (according to Start-up Heatmap Europe) and the 4<sup>th</sup> in funding rounds raised.

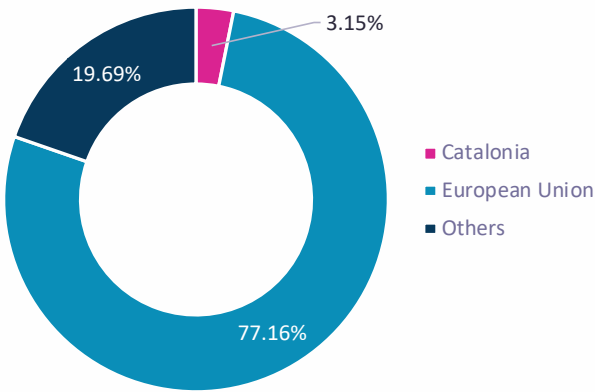
Catalonia boasts a thriving HealthTech ecosystem, with a remarkable total of 329 start-ups dedicated to the sector, accounting for 16.3% of all start-ups in the region. While Catalonia exhibits survival rates similar to Switzerland and surpassing those of Denmark, it falls short of the survival rates observed in Sweden and Flanders. In Catalonia, a below-average survival rate has been observed during the first year of start-up creation. However, as these companies reach the five-year milestone, they exhibit a convergence towards the average. This pattern suggests that the Catalan entrepreneurial ecosystem undergoes a process of maturation and strengthening over time, leading to an improved long-term survival capacity of start-ups.

### 5.3.1. PUBLIC FUNDING

In 2022, the sector raised a total of 319.19 M euros, which is six times more than in 2017. between 2017 and 2022, 11.84% of the capital invested in HealthTech start-ups in Catalonia came from public funds. This percentage is the highest among regions, although 77.16% of public funds originate from the European Union.

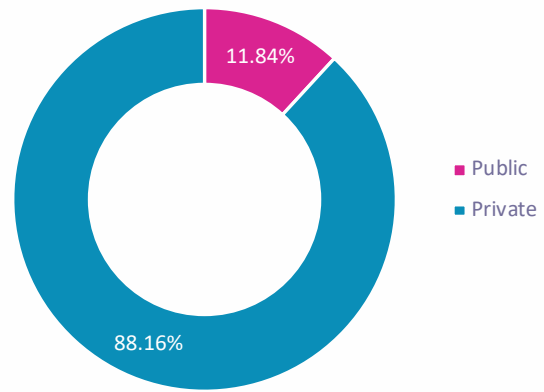
Catalonia primarily relies on European Union funds for start-up support, as *Figure 63*. This distinguishes it from other countries, highlighting substantial EU financial aid

to Catalan start-ups. This data underscores EU contributions to regional start-up development, demonstrating Catalonia's ability to secure diverse funding sources and positioning it favourably in the global start-up landscape. Catalonia has received 103 million euros in public funds from the European Union, a figure comparable to the funds received in Sweden, Denmark, and Switzerland. In contrast, start-ups in Flanders primarily rely on national funds for their public assistance.



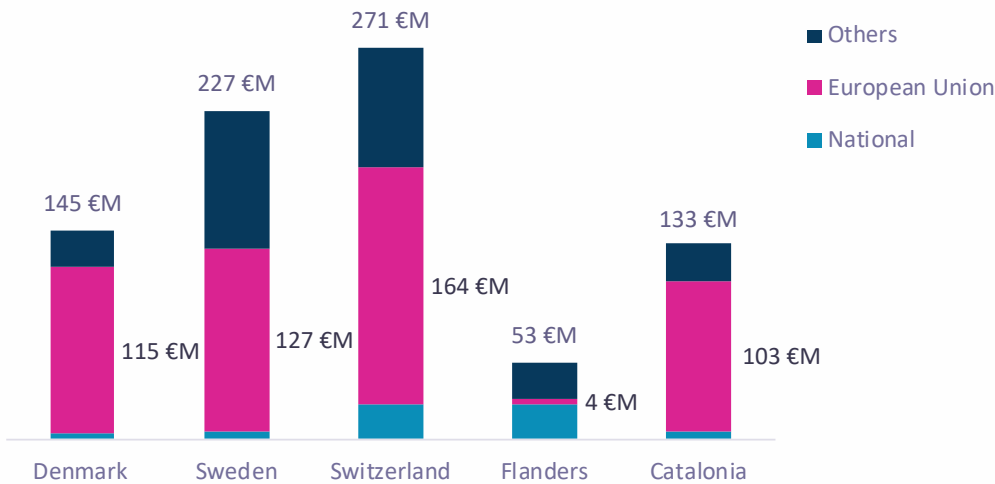
**Figure 58.** Public investor location.

Source: Dealroom (28/06/2023) & EY analyses.



**Figure 59.** Distribution of capital raised between 2017 and 2023.

Source: Dealroom (28/06/2023) & EY analyses.



**Figure 57.** Distribution of public capital raised between 2017 and 2023 by investor location.

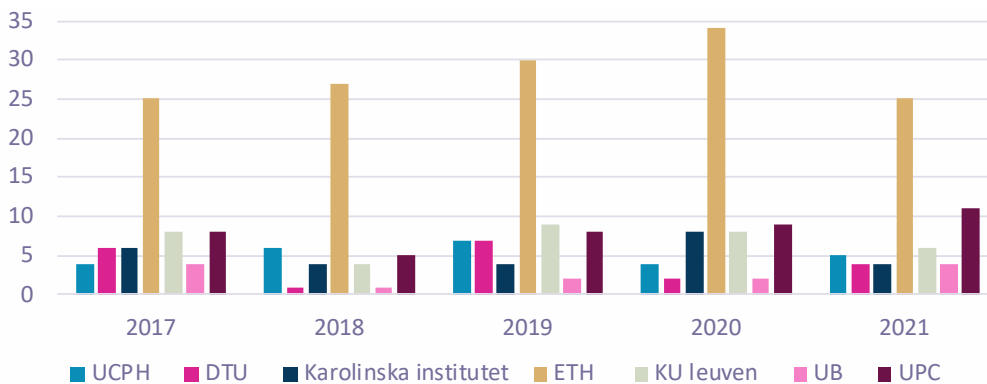
Source: Dealroom (28/06/2023) & EY analyses.

### 5.3.2. INDICATORS OF INNOVATION GENERATION

Below is a comparison between the universities mentioned in the report and the leading academic institutions in Catalonia. This comparison will be based on key indicators related to the generation of innovation over the past years. The evaluation of these indicators will allow us to analyse the performance and contribution of these institutions to the advancement of innovation in their respective regions.

Firstly, the number of spin-off companies established annually by the universities indicated in *Figure 60* is presented. It is observed that the Swiss Federal Institute of Technology Zürich (ETH) is the university that creates the highest number of spin-offs per year. Additionally, the Universitat Politècnica de Catalunya (UPC) stands out as the second university in terms of spin-offs created in 2021 and 2020. On the other hand, the University of Barcelona (UB) consistently lags behind the others with an average of 2.6 spin-offs established per year.

**The Polytechnic University of Catalonia (UPC), with an average of 8.2 spin-offs created annually, ranks as the second academic institution with the highest number of spin-offs within the group of universities studied, despite the relatively low investment in research in the Catalonia region in terms of GDP.**



**Figure 60.** Number of Spin-offs companies established by universities per year.

Source: Annual reports of each university.

The number of scientific publications produced by different universities over the past years is presented. The quantity of scientific publications from a university reflects its contribution to the advancement of knowledge, innovation generation, and its reputation within the academic community, thereby attracting talent, funding, and recognition. Furthermore, it promotes the dissemination of research that can have an impact on society. In *Figure 61*, it can be observed that the University of

Copenhagen (UCPH) is the university that generates the highest number of publications with an average of 11,120.6 scientific publications per year, followed by ETH with an average of 9,808.4 publications per year. The University of Barcelona (UB) and the Universitat Politècnica de Catalunya (UPC) produce an average of 6,542.8 and 4,691.8 publications per year, respectively, surpassing Karolinska Institutet (3,740.8).

Finally, the number of patents applied for by the universities in recent years is shown. A patent is understood as the title that recognizes the exclusive right to exploit the patented invention, preventing others from manufactu-

ring, selling, or using it without the consent of the owner. In comparison to the others, Catalan universities exhibit a lower number of granted patents, indicating reduced activity in intellectual property generation and protection.

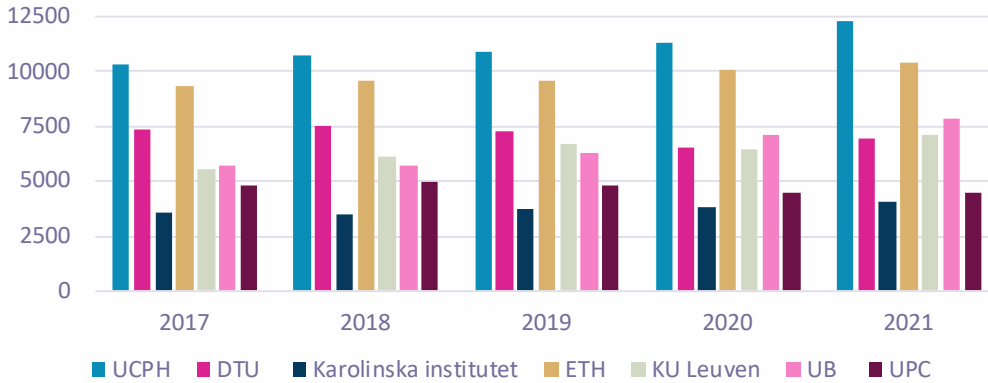


Figure 61. Number of scientific publications by university per year.

Source: Annual reports of each university.

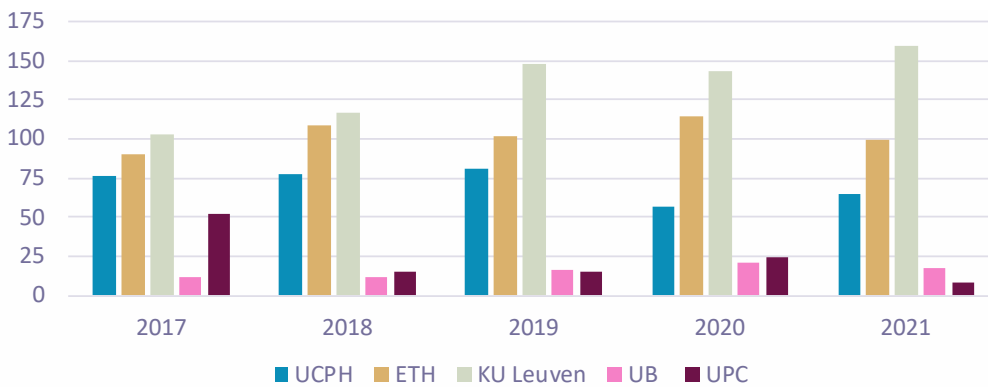


Figure 62. Number of patents by university per year.

Source: Annual reports of each university.

## 5.4. Access to the HealthTech innovation market in Catalonia

### 5.4.1. COMPARISON BETWEEN PRIVATE AND PUBLIC INVESTMENT

Access to the HealthTech innovation market in Catalonia is a relevant topic in both the private and public sectors. The HealthTech technology industry has experienced significant growth in recent years, and Catalonia has positioned itself as one of the innovation hubs in this field. A comparative analysis will be conducted between the private market and the public market regarding access to this industry.

Between 2017 and 2023 HealthTech start-ups in Catalonia secured a total capital investment of 1.095 €M. As seen in Figure 63, represented by 89%, totaling 974 million euros, was funded by private investors. In contrast, the remaining 11%, equivalent to 121 million euros, was derived from public funds.

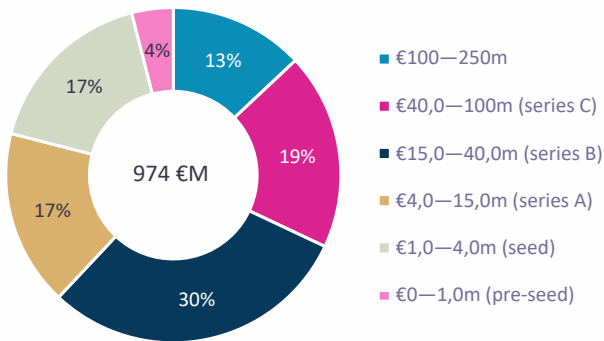


Figure 63. Private Capital invested.

Source: Dealroom (28/06/2023) & EY analyses.

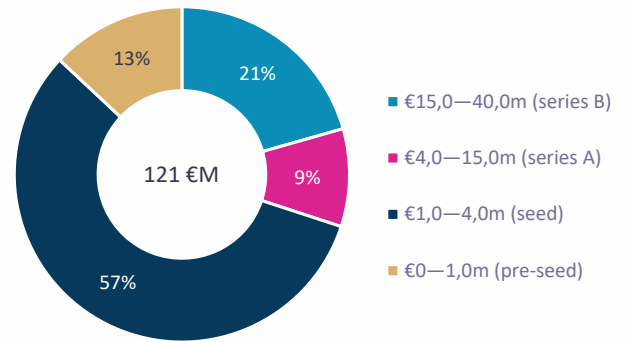


Figure 64. Public capital (Grant) invested.

Source: Dealroom (28/06/2023) & EY analyses.

### 5.4.2. PUBLIC PROCUREMENT OF INNOVATION

Public procurement of innovation opens up new opportunities to explore different approaches and facilitates the creation of collaborations with suppliers. This practice fosters a culture of innovation by involving a variety of profiles in all processes related to the adoption of innovation, including healthcare professionals and procurement experts, making them essential allies. Ultimately, innovation procurement aligns procurement processes with healthcare organisations' strategies, emerging as a pivotal strategic element.

On the flip side, the main challenges associated with innovation procurement include, firstly, deficiencies in information systems, which are primarily focused on healthcare activities and lack the capacity to provide more complex indicators and metrics, considered a limitation in information systems.

Secondly, the weaknesses in evaluation schemes, as they did not have an adequate evaluation methodology at the outset and developed it as they progressed. This sometimes leads to a too project-focused approach rather than a system-wide one, highlighting the need to strengthen their methodological framework.

The third relevant element is the lack of alignment between payment systems and innovation procurement processes, especially within the public insurer and healthcare service providers. These payment systems do not match, making it challenging to implement outcome-based payment models in agreements with companies. It is important to align these payment systems to facilitate innovation procurement more effectively, **according to Ramón Maspons, Chief Health Innovation Strategist at Catalan Ministry of Health.**

### 5.4.3. ACCESS TO THE INNOVATION MARKET FOR THE FOUR ACTORS

Once a product is ready to be commercialised, it is necessary to ensure compliance with all regulations and legal requirements for its marketing and use in Catalonia and the European Union. Firstly, it must be approved by the Spanish Agency of Medicines and Medical Devices, which is responsible for granting authorization for the marketing of industrially manufactured medi-

cines, as well as reviewing and adjusting those already on the market. Depending on the product, specific certification of the CE marking may also be required. This declaration states, under the manufacturer's responsibility, that the product being marketed has fulfilled the essential requirements of safety and health outlined in the corresponding regulations for the product.



To obtain the CE marking, an evaluation procedure must be carried out to ensure compliance with these essential requirements. It is important to note that compliance with these regulations and legal requirements is crucial to guarantee the safety and efficacy of the product, as well as to comply with current regulations regarding the marketing of medical devices in Catalonia and the European Union. The process of obtaining the necessary approvals and certifications may involve submitting detailed technical documentation, test reports, and conformity assessments, among other requirements established by the competent authorities.

Once the necessary certifications have been obtained, the product is eligible to access both the public and private markets.

The term "public market" refers to the sector of purchasing and procurement of products or services carried out by governmental entities or public sector institutions, such as public hospitals in Catalonia.

To access the public market, it is essential to follow certain procedures. Firstly, it is crucial to register as a supplier in the corresponding contracting profile. In the case of Catalonia, the Public Procurement Platform of Catalonia is used as the designated platform for this purpose. This registration enables suppliers to submit their proposals and participate in bidding processes.

Secondly, hospitals and other public sector institutions request innovative solutions through public tenders or bidding processes. These competitions are organised to obtain products or services that meet the established requirements, and they allow suppliers to compete on equal terms to submit their proposals. In this way, transparency and fairness are ensured in the selection process.

On the other hand, the term "private market" refers to the purchasing and procurement of products or services by private entities, such as private clinics, patients or companies in the health sector.

The acquisition process in the private market stands out for its enhanced flexibility compared to the public sector. Private entities have more freedom to design and implement their procurement processes according to their specific needs and requirements. This flexibility allows them to make decisions swiftly and directly when it comes to purchasing products and services.

In the private market, hospitals and healthcare facilities have greater autonomy in managing their finances. They are not bound by the same budgetary constraints as public institutions and can allocate funds more freely. This financial independence enables them to make investments in innovative and cutting-edge medical products and technologies. Private entities can quickly adapt to changing market dynamics and emerging healthcare trends. They have the agility to respond promptly to evolving patient demands and incorporate new solutions into their operations. This ability to stay at the forefront of medical advancements gives them a competitive edge in providing high-quality healthcare services.

The commercialization of healthcare products and services in the private sector follows a structured process. Small companies typically approach individual hospitals directly, engaging in activities such as sales, customer service, and medical direction, as well as research collaborations. These interactions allow them to showcase their offerings and establish partnerships with healthcare institutions.

When a hospital decides to purchase a product or service, it incorporates it into its operations. This applies to both public and private hospitals. Hospitals often have departments dedicated to evidence-based practice, responsible for validating proposed clinical practices or technologies. They generate expert opinions or reports, assessing the cost-effectiveness of the proposed interventions. These evaluations are presented to the hospital's service provider, who ultimately decides whether to incorporate the product or service into the hospital's service portfolio as a clinical trial or treatment option.

# 6. Innovation opportunities and Challenges of the Future

## 6.1. Sustainability of the innovation model for the four actors

In 2021, the Departmental Commission on Innovation and Transformation of the Healthcare System was established to drive growth in innovation in health and its consequent applications in the healthcare system. Its main goal is to establish a clear, sustainable, and consensual model for promoting HealthTech innovation while facilitating highly complex public-private collaboration projects and innovation partnerships geared towards creating value.

Moreover, it aims to foster the roll-out of innovations in processes and services generated by the healthcare system to ensure its commercialization and impact on society. All this must be achieved through ensuring proper coordination of the four agents to promote and adopt innovations, by defining strategies, scheduling, and executing projects through various instruments for public and private procurement and bringing about transformation in the healthcare system. To ensure the model's sustainability, it is key to foster collaboration and know-how transfer between these stakeholders. Additionally, securing funding from both public and private sources while implementing effective intellectual property management strategies is essential.

Innovation is a key aspect of business excellence in Catalonia, and it is indispensable to guarantee access to innovation for start-ups and scale-ups as a strategy for competitiveness, in clear connection with internationalisation. It is reported that 84.6% of Catalan companies that innovate foresee a growth in turnover, while 71.3% expect to increase productivity and 36.8% expect to create new jobs. Catalonia receives 60% of foreign investment in R&D in Spain, leads in attracting European funds and in the ranking of patent applications. Nonetheless, the Catalan ecosystem seeks to intensify and extend innovation and increase the volume of investment in R&D&I, especially in the later stages of the process. To achieve this, it is necessary to stimulate demand and have a robust, coherent offer that can compete internationally.

The attractiveness and availability of talent, as well as its retention, are crucial elements for innovation and that is the main reason why relationships with universities should be a top priority, as the availability of talent with exceptional value is perceived as critical to sustaining expected growth rates.

## 6.2. Equity of access to innovation

The Catalan start-up scene has gained recognition as one of the most emergent and dynamic in Europe, and Barcelona has emerged as a hub for innovation and entrepreneurship, attracting start-ups from several industries, with the HealthTech sector accounting for the highest share according to Catalonia Trade & Investment. The ecosystem benefits from a combination of factors, including a favourable business environment, access to a skilled workforce, and a strong network of support institutions and resources.

Catalonia seeks to promote HealthTech innovation based on a transformation to democratise healthcare by making it more accessible and personalised yet also more flexible and efficient. Nevertheless, the system is facing some difficulties when transferring knowledge to society. Despite Catalonia being at the cutting edge of research, there is not an equivalent impact in terms of development, innovation, and the ability to bring research results to patients. Start-up companies often must navigate several challenges and a complex journey to deliver innovative solutions to the point of care. When compared to other regions in Europe, the innovation indicators such as investments, innovations activities and impact, are above the average, meaning that its performance is 105.9% of the EU average according to the Regional Innovation Scoreboard 2023.

One of the main problems in Catalonia is the uptake of technological innovation in the public health system due to budgetary constraints and the increasingly difficult evaluation of healthcare products. The efforts to develop a definition of equity in innovation are still far from achieving a degree of consensus, and this is the next challenge that the healthcare system must tackle.

The principle of equity has been recognised as one of the guiding values of the Catalan health systems meaning that, ideally, everyone should have a fair chance to reach their full health potential and, more pragmatically, that no one should be at a disadvantage in healthcare if it can be avoided.

Due to the scarcity and divergence of the objectives of public funding for health (equity) and private funding for innovation (market returns), the challenges would range from achieving excellence in either direction. This yields to different motivations on the part of the state and industry. According to this, the issue of healthcare versus sustainability of the health system has to be clarified, according to a "progressive" parameter of realisation of the principle of equality in the protection of the health of the population. This approach simultaneously seeks to provide care that incorporates the latest advances in medical science. The prevailing scarcity, accentuated by the pandemic crisis, is what imposes a declaration of the discrepancy between the objective of equality in health provision and access to the most innovative advances in HealthTech research, the incentive for which is the profit in a competitive market.

The fact that "sustainability" and "innovation" go in different directions does not imply that they are incompatible. The Catalan government has an obligation to protect, promote and fulfil the right to health of its citizens through legal mechanisms; sometimes through protective legislation or consensus, including various forms of national or international aid and cooperation. Although applied innovation in health is a hopeful prospect, at the same time it is seen as a cost-increasing and inflationary factor, rather than as an instrument for interventions to create new solutions to reduce unfair and avoidable inequality.

HealthTech solutions assessment is a systematic multidisciplinary process that must aim to examine the benefits and risks associated with its use, including medical, social, economic and ethical impacts. It should be used to inform health plans, policy decisions and optimise decision-making, coverage, access and quality. The potential impact requires ongoing evaluation and the participation of the main stakeholders to be synergistic, networked and nominalized and hence, promote equity in the health sector.

Some of the HealthTech innovations that are available in the Catalan ecosystem and contribute to equity are vaccines, digital health, telemedicine, data storage, those applications that increase diagnostic accuracy, devices for parametric information of chronic patients, management technologies that increase productivity and efficiency in the health sector, as well as collaborative artificial intelligence systems.

Equity, along with accessibility, is one of the cornerstones of the Catalan health system and also one of the values that guide the actions of the professionals of the *Institut Català de Salut*. Economic models that consider social determinants and public health would make inequitable coverage decisions less likely. Technology can build a truly egalitarian and equitable healthcare system but its assessment, coverage and costs should be improved.

### 6.3. Consolidation of Catalonia as a hub

Catalonia is an important centre of attraction for large companies. After years of a constant trickle of companies establishing in Catalonia, there are now 96 development centres and 82% are located in Barcelona, including centres of large companies with a longer track record.

Currently, companies continue to show interest in Catalonia. This year (2023), AstraZeneca announced that it is about to invest €800 million in the next 5 years to launch its own biomedical investigation hub in Barcelona, aiming to become a global reference.

The study highlights that, although the territory has been attracting this type of foreign investment since 1985 when HP installed its centre in Sant Cugat del Vallès, it has been in the last decade when it became a priority destination for these companies, since 88% of the hubs were created after 2012. The last five years have been particularly active, as the number of hubs has increased. In 2018, there were 46 hubs, and as of the current year ('23), the number has nearly doubled to 96. Two-thirds of the hubs belong to European companies, but it is worth noting that those coming from the United States account for 23% of the total.

At present, these are Catalonia's strengths to position the region as a leading health hub:

Catalonia has a robust and rapidly evolving digital health technology ecosystem which positions it ideally for consolidating a health tech hub that harnesses start-ups and foster an encouraging ecosystem for advancements in this field. Major companies in the health tech sector such as Teladoc Health, Sanofi, Novartis, and others have already established their digital hubs in Barcelona. Additionally, in recent years, leading pharmaceutical and medical devices companies have also set up their presence, enhancing the potential for health tech hubs and creating a profitable network. For example, companies like Roche and Grifols Diagnostics serve as notable instances of this trend.

- **Medical Expertise:** Catalonia boasts world-class healthcare facilities and a highly skilled medical workforce. It is home to renowned hospitals, research institutions, and medical universities, making it an ideal destination for medical innovation and expertise. In fact, according to Forbes, eight of the twenty-five reference hospitals in Spain are based in Barcelona.
- **Innovation Ecosystem:** The region fosters an innovation-friendly environment, with a focus on technology and healthcare innovation. This includes support for start-ups, investment in research, and collaboration between academia and industry. Organisations like Biocat, CataloniaBio & HealthTech, Barcelona Health Hub, Tech Barcelona, and others advocate for health techs and promote innovative health solutions.
- **Engagement with Europe:** According to the External Action and Open Government of the Generalitat of Catalonia, the Catalan region participated in more than half of all interregional Mediterranean projects, one-fifth of which were coordinated by Catalan public and private entities. Catalan visibility within initiati-

ves increased by 15-20% between 2014 and 2020, compared to the previous period (2007-2013). Regarding cooperation within the Mediterranean basin, of the 79 ongoing projects, 34 have a Catalan presence, 13 of which are coordinated from Catalonia.

- **Biotechnology and Research:** Catalonia has a strong presence in biotechnology and life sciences. Its research centres and biotech companies are at the forefront of medical advancements, making it an attractive hub for research and development in the healthcare sector. Catalonia is in the top 6 European regions and top 9 worldwide contributing to clinical trials and research, which means that powerful knowledge, and what's more, initiatives are concentrated in the territory, specially Barcelona (Informe de la BioRegió 2022, Biocat).

The healthcare sector ranks as the 4<sup>th</sup> most relevant field in the Catalan region, representing 13% of the companies with a technological hub. Moreover, 89% of the technology hubs actively collaborates with other Catalan companies (27% of them being start-ups) in the innovative and technological ecosystem for technological developments, thus causing a traction effect for the Catalan economy.

Forecasts estimate that by 2025 the turnover of innovation centres will reach 2,000 M euros a year, growing by 40% from 2022 and that 20,000 people will be employed in this sector, a relative workforce increase of 32% compared to 2022.

Catalonia's strategic location and international connectivity are important deciding factors, followed by a rich and diverse business and industrial ecosystem, cost competitiveness (wages are lower than in other European cities) and tax benefits are aspects that make the difference in the decision and opting for Catalonia.

Day to day, technological projects are increasing with the number of foreign tech companies setting up in Catalonia growing by 21% in 2019, mainly with projects from the United States, Germany, France, and the United Kingdom. In addition, Catalonia is the region that received the most R&D investment projects in all of Europe in 2021, as innovation activities benefit from efficient tax deduction schemes, as well as from lower corporate tax rates than those in neighbouring countries, making it a key innovation hub in the continent.

Catalonia has a rich start-ups and spin-offs scene, a strong innovation culture and the ability to attract investment. Nonetheless, a critical political factor is missing to coordinate and align the agents of the ecosystem, by prioritising engagement and resources, bearing risk and adopting fast track initiatives to build a solid strategic roadmap. Moreover, a multidisciplinary intradepartmental leadership should be a key requirement to ensure the flow scalability of the system. The consolidation of the hub is at a turning point, but middle phases of development need support from the public administration and the political forces, to achieve the adoption of innovations. The active interaction and coordination of the operations transversally with the different agents of the ecosystem, emphasising the contact with other emerging companies in the sector, universities, and different public entities, should also be given high priority.

Together with a consolidated industrial economy, the access to skilled talent and a growing number of dynamic start-ups, Catalonia has the potential to stand out as a significant location for developing projects in the industry 4.0 sector, a revolution in the fast-evolving digital ecosystem and an inspiring place for global corporations to invest in. Despite the major development experienced in the last decade, there is still room for improvement to catch up with the leading-edge European players, and work in the same line to not be left behind.

# 7. Areas for Improvement and Proposed Actions

## 7.1. In what areas of innovation can we improve as the Catalan Ecosystem

The present study has undertaken an analysis of the HealthTech ecosystem in Catalonia and its needs, with a focus on three primary aspects. Firstly, it has been observed that there is a pressing need for close collaboration between the public and private sectors to foster the growth of this ecosystem. Secondly, a limited perception of innovation has been identified, where innovation is only acknowledged in its early stages, and there is a lack of necessary support during the market access phases. Lastly, the absence of structured mechanisms facilitating market access for highly innovative products in the HealthTech sector has been highlighted.

Regarding the first point, the involvement of the public sector in the HealthTech ecosystem in Catalonia has been brought to the forefront. However, it is acknowledged that without the participation and collaboration of the private sector, the growth of this ecosystem is constrained. Currently, in Catalonia, 88.16% of capital is derived from the private sector, while 11.84% comes from the public sector, based on capital distribution data from 2013 to 2023 sourced from the Dealroom database.

In Catalonia public and private entities and companies are supporting initiatives to boost innovation and to accelerate HealthTech start-ups, such as the BCN Health Booster —a programme created by the Barcelona City Council and the Barcelona Science Park (PCB) with the collaboration of Biocat to scale-up biotech companies—,

CaixaImpulse —for the development and valorisation of biomedical research projects—, Ferrer4Future —an initiative of the biopharmaceutical company Ferrer to identify and support new digital health projects for prevalent diseases—, and Barcelona Health Hub —an association that supports digital health start-ups—, among others. HealthTech start-ups have also an extensive participation in transversal innovation boosting initiatives as The Collider, and its increase has motivated that the digital cluster TechBarcelona have enlarged its premises with the Pier07, particularly dedicated to HealthTech companies.

It is crucial to establish strategic partnerships between both sectors to leverage knowledge, experience, and available resources to drive innovation and competitiveness to enhance healthcare in the region. This collaboration is particularly important during the early stages of development when risks are higher, and the private sector may hesitate to invest. Raising awareness and promoting collaborative environments, along with the promotion of joint research and development programs, are key actions to encourage this cooperation.

In second place, a restricted perception of innovation has been identified, where only early-stage innovation is recognized, and the market access phases lack the necessary support. To address this issue, it is imperative to broaden the understanding of innovation within the HealthTech ecosystem in Catalonia. It is essential to provide

support for innovative projects in their early stages, as demonstrated by KU Leuven University (which holds the most patents from 2017 to 2021). They offer assistance in acquiring and managing funds, in addition to participating in national translational programs. These programs include collaboration projects with companies in Flanders, aiming to secure co-financing for joint ventures with research groups associated with KU Leuven. It is equally vital to acknowledge and support innovation in later stages, especially during the market access phases (currently Catalonia has one of the lowest survival rates, along with Denmark, at 44% in the first year). A notable example can be found at the ETH Swiss Federal Institute of Technology Zurich (which created the most spin-offs between 2017 and 2021), offering support to students, alumni, and entrepreneurs at all stages of their journey, from experimenting with creative ideas to establishing spin-off companies. This includes programs like the Pioneer Fellowship Deep-Tech Acceleration, which allows ETH students and researchers with entrepreneurial spirit to transform their research-based technologies into marketable products and services, thereby launching ETH spin-off companies.

In the Catalan ecosystem, this requires the implementation of policies and programs that facilitate the adoption and dissemination of proven and cross-cutting HealthTech technologies and solutions, ultimately contributing to tangible improvements in the quality of healthcare and the efficiency of the system.

## 7.2. What internationally recognized mechanisms could be implemented/enhanced at the local level?

Based on the performed analysis where the four key actors from different international regions were compared, a few actions have been identified as good practices and are listed below.

It has emerged evident that numerous regions emphasise internationalisation as a core strategy, boasting open economies tailored for global markets. These forward-thinking regions have wholeheartedly embraced

the opportunities afforded by globalisation, actively nurturing connections and partnerships across borders. Consequently, they've enjoyed remarkable success in expanding their influence and globalising their ground-breaking innovations.

Finally the absence of structured mechanisms for the entry of highly innovative HealthTech products into the market has been emphasised. The emergence of new technologies and solutions in the healthcare sector presents unique challenges due to complex regulations and healthcare sector intricacies. To overcome this, it is essential to establish a transparent regulatory framework and a well-organised ecosystem to enhance efficiency in the evaluation, approval, and commercialization of such products. Furthermore, promoting adequate funding mechanisms and specialised support programs is vital to facilitate widespread adoption and commercialization of these innovations.

Considering all the above, the HealthTech ecosystem in Catalonia requires a comprehensive and coordinated approach that fosters innovation, improves healthcare, and positions Catalonia as a leading player in the HealthTech sector. This approach should involve close collaboration between the public and private sectors, a broader understanding of innovation, and the implementation of appropriate market access mechanisms for innovative products, leveraging the strengths of each sector. Additionally, the growing importance of impact investments aligned with the Sustainable Development Goals is an important trend that should be considered in advancing the ecosystem.

In stark contrast, Catalonia, despite its vibrant research ecosystem and innovation potential, struggles to efficiently transition innovations to the market. When compared

pared to regions of similar population sizes, Catalonia's universities fall behind in converting their research endeavours into tangible market impacts. This glaring discrepancy underscores the urgency of establishing a more effective framework for knowledge transfer and commercialization within Catalonia.

To bridge this gap and align with the achievements seen in other regions, it's imperative for Catalonia's public entities to allocate more substantial resources to research and innovation. Increased investment can catalyse the development of cutting-edge technologies, bolster research collaborations, and facilitate the seamless transfer of knowledge and technology from academia to industry. By providing greater financial support, improving infrastructure, implementing policies to stimulate large companies investments in research and development activities and fostering stronger ties between academia, industry, and government, Catalonia can unlock its full potential and position itself as a formidable contender in the global innovation arena.

### 7.3. Recommendations

After analysing the good practices from different regions in this report, and considering the detected areas of improvement of the Catalan Ecosystem some mechanisms have arisen as the most impactful ones, that have helped to draft some recommendations.

The Catalan ecosystem boasts a strong position in knowledge transfer and innovation, notably underscored by the quality of knowledge it offers. In this report, while analysing other pioneering countries such as Denmark, Sweden, Switzerland, and Flanders, we have extracted recommendations that, when implemented, could enhance the Catalan ecosystem.

Strengthening social awareness and undertaking educational initiatives to promote an entrepreneurial mindset from the early stages of education would be the first action to showcase the Catalan ecosystem. By fostering a

Furthermore, it's vital for public entities to cultivate a culture of innovation and entrepreneurship. This can be achieved through the implementation of policies and initiatives that promote risk-taking, offer incentives for innovation-driven activities, and simplify access to funding and mentorship for start-ups and emerging businesses. Encouraging collaboration between public and private entities can also fortify these mechanisms. Creating a nurturing and supportive environment for innovation will not only attract and retain talent but also stimulate economic growth and bolster Catalonia's competitiveness on the global stage.

Despite Catalonia sharing a similar healthcare system and public healthcare approach with higher-GDP Scandinavian counterparts, its limited capacity to access population data poses a significant hindrance to advanced clinical research. Nonetheless, with adequate investment, Catalonia can adopt analogous tools and augment its ability to gather population data for advanced clinical research, levelling the playing field.

leadership mentality that values knowledge transfer and the implementation of business programs from a young age, essential skills can be developed within the educational framework, much like the approach taken by the Technical University of Denmark (DTU). The University has bolstered funding for the commercial maturation of ideas and inventions by students and staff through the 'DTU Discovery Scholarships.'

The second recommendation, in line with Denmark's approach, entails that the public sector should develop channels for knowledge transfer to the market through cooperation and support, akin to the approach taken by the Technical University of Denmark with the DTU Skylab funding program for start-ups and researchers affiliated with the university, who are seeking to commercialise their innovations. This effort will streamline the process, making it more accessible and facilitating



successful instances of knowledge reaching the market. This exponential increase in successful cases will reduce the number of ideas that become stagnant along the way.

Furthermore, active collaboration among the four key actors in knowledge transfer is crucial. To this end, it is recommended, as Denmark, Sweden, and Flanders have done, that the public sector establish channels or platforms for Hospitals, Universities, Research Centres, and Start-ups to collaborate. This alignment of knowledge and cooperation among the primary stakeholders, with a shared objective, will create synergies, resulting in a significantly greater impact of joint efforts, all while conserving resources.

Regarding the synergy among the four mentioned actors throughout the report, it is pivotal, as seen in Sweden, to establish collaboration among all ecosystem hospitals by creating a common database platform. This would allow access to specific and localised data, facilitating informed commercial agreements and addressing needs.

Additionally, the creation of public platforms that connect payers, providers, and patients is recommended. This would increase awareness of needs and boost the survival rate of start-ups, a matter of significance given Catalonia's low survival rate in the initial stages.

Lastly, the establishment of a university network, modelled after the successful initiative in Flanders, holds the potential to significantly enhance collaborative research and innovation among universities. It is recommended that a network of universities, similar to the one implemented in Flanders known as the Tech Transfer Offices, be established. This initiative, jointly undertaken by the

five Flemish universities, including Ghent University, University of Antwerp, KU Leuven, Vrije Universiteit Brussel, and Hasselt University, encompasses technology transfer offices (TTOs) responsible for facilitating the transfer of knowledge and technology from these academic institutions to both public and private partners. These TTOs serve as a unique gateway to knowledge and technology emanating from Flemish universities and colleges, with the primary aim of being a central point of contact for industries seeking research expertise and licensing opportunities. Such an approach seeks to maximise the utilisation of available university knowledge and technology for the benefit of the economy and society.

It is important to mention that although observing it as a successful international mechanism for improvement, a close initiative has been already implemented and addressed by the Generalitat de Catalunya through its program Ajuts per a xarxes d'R+D+I. This framework has allowed to support the creation of different networks focused on prioritised thematic areas, enhancing the streamline of information and interactions among actors and the promotion of technology transfer within the regional ecosystem. This program promoted by AGAUR has set the bar in the provision of support to knowledge generators and has created an ecosystem of value.

The Catalan ecosystem could substantially elevate its quality through the implementation of these measures. By optimising internal efforts, harmonising the synergy among the four key actors, and focusing on knowledge-centric projects with clear objectives and aligned developmental strategies, efficient idea generation can lead to short-term improvements in companies. This transformation has the potential to be a reference in HealthTech.

## ROADMAP

OPPORTUNITIES TO IMPROVE THE CATALAN ECOSYSTEM	PROPOSAL FOR ACTION	REFERENCE COUNTRIES
Improving public-private partnerships.	<ul style="list-style-type: none"> <li>• Adapting the regulatory framework to favour this type of collaboration.</li> <li>• Boost PPP for data collection for advanced clinical research.</li> <li>• Publicising and promoting participation in the different acceleration and innovation initiatives of ecosystem agents.</li> <li>• Showcase successful cases so that stakeholders can see the potential.</li> </ul>	The program being carried out at the European level is the "IHI Innovative Health Initiative.
Broadening the concept of innovation from research stages to market innovation.	<ul style="list-style-type: none"> <li>• Establish programs that encourage funding for innovation development.</li> <li>• Rewarding all stages of innovation.</li> <li>• Implement school programs to encourage innovation and entrepreneurship.</li> <li>• Encourage success stories.</li> </ul>	Denmark DTU programs such as 'DTU Discovery Scholarships' and 'DTU Skylab Funding Programmes.  KU Leuven program "The Odysseus programme of the Research Foundation - Flanders (FWO)".
Enhancing synergies with the 4 actors.	<ul style="list-style-type: none"> <li>• Continue the support to initiatives that allow the creation of knowledge and innovation platforms formed by the universities, hospitals and research centres of Catalonia in order to boost research and technology transfer.</li> <li>• Centralising an innovation and knowledge platform of the universities of Catalonia in order to boost research.</li> <li>• Creating a system where patient information is available and information can be obtained for other agents and to facilitate this type of communication.</li> </ul>	Sweden patient information system.  ETH Zurich programs such as "The Pioneer Fellowship Deep-Tech Acceleration Program" and "Wyss Zurich".

## 8. Interviews

### RAMÓN MASPONS



Chief Health Innovation Strategist at Catalan Government Ministry of Health, Chief Innovation Officer at the Agency for Health Quality and Assessment of Catalonia

Industrial engineer, Polytechnic University of Catalonia (UPC). Master's and postgraduate studies from: ESADE, Institute for the Future, University of Cambridge, and Copenhagen Institute for Future Studies.

Lecturer at High-value Surgical Systems Program in the Harvard T.H. Chan School of Public Health, and ex-associate lecturer in Innovation Management at UPC. Ex-director of different Technology innovation departments in Granollers city council, Ministry of Health (Government of Catalonia), and IALE Technology

*It is evident that the transformation of the healthcare system is based on keeping citizens healthy for as long as possible in the long term. In terms of innovation, this implies seeking opportunities for the healthcare sector in terms of products or services, as well as rethinking the boundaries of healthcare networks.*



## MAITE FIBLA

Co-Founder & Managing Partner at Ship2B



PhD in Economics and dynamic professional, co-founder and managing partner of Ship2B Ventures, as well as co-founder of the Ship2B Foundation. With a keen interest in fostering positive change, he specialises in identifying and nurturing high-impact start-ups through venture capital and impact investing

***Social impact investments are undertaken with the aim of addressing a societal issue, typically within the framework of the Sustainable Development Goals (SDGs). Currently, there is no standardized and universally accepted method for objectively measuring such impacts. Consequently, assessment is often conducted on an ad hoc basis, tailored to the specific problem-solution context.***



# MANUEL PALACIN

Chief Executive Officer at Association TECNIO



The Tecnio Association works to promote a model of excellence in the transfer of research results to business and society.

It brings together 56 university groups and CERCA and CSIC research centres that have the TECNIO accreditation awarded by ACCIÓ, a quality distinction that identifies and gives visibility to technology developers in the Catalan R+D+I system with differential technological capabilities and the potential to transfer them to the business sector, making the Catalan innovation ecosystem internationally attractive.

***Scientists encouraged by publication.  
Innovation is transfer, creation of start-ups and commercialization of patents.  
The transfer part is not currently valued (creation of transfer sessions).  
Promote that the transfer part has the same weight as the research part.***



## FELIP MIRALLES

Executive Director - Health Technologies at  
Eurecat - Centre Tecnològic de Catalunya



Eurecat, Technology Centre of Catalonia (member of Tecnio), promotes, through applied research and innovation, the competitiveness of companies and the welfare of society.

It is the leading technology centre in Catalonia and the second private organisation in Spain in terms of H2020 fundraising. It brings together the experience of more than 670 professionals who generate an annual turnover of 50 million euros and provides services to more than 1,700 companies.

***There is a lack of public-private collaboration along the whole path, more finalist in the innovation phase, the private company has to lead the way but with the help of research centres to continue innovating and carry out the relevant tests and validation.***



## LAIA ARNAL

Director General for Knowledge Transfer  
and the Knowledge Society



She has been Director of Business Development at Vall d'Hebron Institut de Recerca (VHIR), Director of the International Center for Scientific Debate Barcelona (BDEBATE) and Director of Innovation projects in Biocat Bioregion of Catalonia.

*The Catalan health innovation system has, potentially, all the elements to become an international benchmark. We need an additional collective organizational intelligence effort to make this possible.*



## DÍDAC MAURICIO



Director, Department of Endocrinology & Nutrition, Hospital de la Santa Creu i Sant Pau

Professor of Endocrinology, University of Vic & Central University of Catalonia

Predoctoral clinical & research fellow, Hospital de Sant Pau, Autonomous University of Barcelona; Postdoctoral Fellow, Steno Diabetes Center, Copenhagen, Denmark.

Consultant in Endocrinology & Nutrition at different hospitals: Hospital Mutua de Terrassa; Corporació Sanitària Parc Taulí; Hospital de Sant Pau; Head of Department of Endocrinology, Hospital Arnau de Vilanova, Lleida; Chief Physician, University Hospital Germans Trias I Pujol, Badalona.

***Society does not perceive innovation as a differential point. There is a systemic problem.***





## ANTONI TRILLA



Professor at the University of Barcelona, Head of the Epidemiology Service at the Hospital Clinic of Barcelona and researcher at ISGlobal. Dean of the Faculty of Medicine at the University of Barcelona

He is Dean of its Faculty of Medicine and advisor to the Spanish government on the occasion of the 2020 Coronavirus Disease Pandemic in Spain.

***Comparison with Scandinavian countries (Denmark and Sweden): We have our own systems for registering the health of all their citizens. They have well-constructed, well-connected databases, which nowadays, the way in which many of these clinical tests are carried out, allow them to be done very quickly or to be able to collect very consistent data at a much lower cost.***



## FINN BECH ANDERSEN

CEO at PRECURE



CEO at Denmark start-up, this start-up is all about smart wearables that help reduce the risk of work-related strain injuries by providing real-time, cloud-based analysis of body activity.

***Commercially viable platform that does not limit yourself. Strength of Denmark: we are perhaps not the one with the greatest ideas but we are excellent to transform ideas to business and bring them to the market (cooperation and access between the market - start-up - customers)."***



## STEPHEN TOWNSEND

Co-founder and CEO of Havio Health AB



Havio Health is a healthtech start-up building a platform to help physicians provide better behavioural healthcare through digital therapeutics.

Previous experiences include: Co-founder of Paravita Health Inc, Course Manager at Karolinska Institutet, Clinical Analytics Lead at Surgical Safety Technologies.

***Sweden has a super strong start-up culture, inside and outside of healthcare as well. There are many start-ups that became global companies like Spotify, Klarna, and there's a great entrepreneurial spirit in Stockholm. You see a lot of people talking about wanting to start a start-up, and a lot of coworking spaces and accelerator programs***



## PATRICK DÜMMLER

Cluster Manager, Member of the Executive Board, Health Tech Cluster Switzerland



The Health Tech Cluster Switzerland connects the players of the health tech community in Switzerland. It offers its members the leading working and exchange platform for relevant topics and issues within this ecosystem. This results in innovative and sustainable solutions that further develop the health ecosystem and increase the benefits for society.

***From a Swiss perspective - given the relatively small domestic market - exports are key to grow a company. This is especially the case for medical devices and pharmaceutical manufacturers, their export share is usually well above 90%. Thus, market access is important.***



## BART DE GREEF

Innovation Manager at UZ Leuven



As Belgium's largest university hospital, UZ Leuven aims to push boundaries by combining specialised care and innovative treatments with human attention and respect for each patient.

Former positions include: Senior Consultant in Inovigate, Expert public Health- biotechnology & SME in pharma.be, CEO ad interim and VP, IP & Regulatory Affairs in Beta-Cell.

***Not only the financial instruments that the Flemish Government installed which have increased over the past few years in a significant way, really supporting also collaborations between for example hospitals and companies. So that is definitely a good thing”***



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TECHNOLOGY TRANSFER PATHWAY:

# The Catalan HealthTech Ecosystem

PROMOTED BY

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