CHARTING THE FUTURE OF LIFE SCIENCES

The roadmap for a collaborative research model between Academia and Industry in Italy

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Associazione nazionale per lo sviluppo delle biotecnologie

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Executive summary

This Report aims to provide key players in Italy's Life Sciences research and industry sectors with a high-level document for developing strategic insights and guiding entrepreneurial, industrial, and investment actions in collaborative research models. It seeks to promote effective mechanisms for technology transfer and foster collaboration between academia and industry.

This Report was conceived and strongly promoted by Fondazione Human Technopole, which commissioned TEHA Group to coordinate its drafting, with the valuable collaboration of Federchimica Assobiotec. It was developed through the joint efforts of Fabio Terragni (*Member of the Management Committee delegate for technology transfer*), Fabrizio Martino (*Licensing Officer*), and Alessia De Meo (*Junior Stakeholder Engagement Officer*) for Fondazione Human Technopole; Corrado Panzeri (*Partner & Head of InnoTech Hub*), Davide Skenderi (*Consultant & Project Leader*), and Lodovica Galbiati (*Analyst*) for TEHA Group; Marica Nobile (*Director*) and Elvira Marchianò (*Scientific and Technical Affairs, SMEs & Start-ups, and Training Officer*) for Federchimica Assobiotec.

The working group shared and validated the findings of this Report with the leadership of each organization during a meeting held on 7 March 2025, attended by and enriched with contributions from Valerio De Molli (*Managing Partner & CEO, TEHA Group*), Fabrizio Greco (*President, Federchimica Assobiotec*), Gianmario Verona (*President, Fondazione Human Technopole*), and Marino Zerial (*Director, Fondazione Human Technopole*).

The following chapters offer an analysis of the performance of Life Sciences research and industry in Italy, a mapping of leading European collaborative research models and international best practices, and concrete proposals to support a national collaborative research model that can improve technology transfer performance in Italy.

The Report is organized into three chapters, outlined as follows:

Chapter 1. Life Sciences in Italy: a comparative analysis of research, industry, and technology transfer with EU benchmarks

This chapter analyzes the current state of the Life Sciences sector in Italy, focusing on its strengths, challenges, and opportunities. It examines key indicators such as scientific research outcomes, industry performance, R&D investments, and the effectiveness of technology transfer mechanisms. The chapter highlights Italy's solid production capabilities and research excellence while addressing the persistent gap between academia and industry, limited venture capital attraction, and regional resource disparities. By providing an overview of these dynamics, the chapter sets the stage for identifying collaborative research models that could bridge this gap and enhance the sector's global competitiveness.

Chapter 2. The results of the proprietary mapping of European collaborative research models

This chapter presents the findings of an initiative led by the Centre for Innovation and Technology Transfer (CITT) of the Fondazione Human Technopole, within the Life Science Community of TEHA Group, and in collaboration with Federchimica Assobiotec. The initiative aimed to map and

analyze collaborative research models between academia and industry across Europe, to inform the development of a tailored Italian model. The study involved hosting a dedicated event, conducting confidential interviews with industry leaders, and mapping 16 collaborative research models across 15 European countries. These models were categorized within four analytical layers: stage of collaboration, type of collaboration, organizational structure, and funding scheme. The analysis provided key insights, including the prevalence of mixed public-private funding as the dominant model, the strategic importance of resource and expertise sharing, and the critical role of flexible governance structures. The chapter concludes with actionable recommendations for the Italian context, emphasizing the need for efficient technology transfer mechanisms, enhanced collaboration frameworks, and public-private partnerships to foster innovation and bridge the gap between research and market application.

The perimeter of the analysis was intentionally limited to European countries, where collaborative models are generally more comparable to and replicable within the Italian ecosystem. In contrast, the structural, legal, and institutional frameworks of countries like the United States and China, while rich in valuable practices, present significant contextual differences. Moreover, the current geopolitical landscape reinforces the strategic relevance of a European-focused reflection for building resilient and sustainable models of collaboration.

Chapter 3. Proposals to academia and industry for an Italian collaborative research model

This chapter outlines proposals for developing collaborative research models tailored to the Italian Life Sciences ecosystem. It draws from stakeholder engagement activities, including interviews with industry leaders and insights from an event on collaborative research. Key challenges are identified, such as the lack of a national strategic plan, cultural and structural limitations, and barriers between academia and industry. The chapter also highlights best practices and successful international models. Four potential models are proposed: embedding industry scientists within academic laboratories, establishing consortia, creating a national shared technological facility, and developing integrated innovation campuses. These models aim to bridge the gap between research and industry, fostering innovation and enhancing Italy's competitiveness in the global Life Sciences sector.

1. Life Sciences in Italy: a comparative analysis of research, industry, and technology transfer with EU benchmarks

1.1 The performance of the Italian scientific research

This section aims to analyze the state of research in Italy by examining key indicators such as the number of scientific publications, talent attraction, and the presence of research centers.

Scientific research outcomes

Italy stands out positively in terms of research outcomes, particularly in the Life Sciences sector. The country ranks **second among EU member states in the number of scientific publications** in this field, with a total of **79,700 publications**, placing it just behind Germany, which leads with 95,200[1].

Specifically, Italy ranks 2nd in the number of publications in medicine, pharmacology, and neuroscience, surpassed only by Germany in 1st place. Instead, Italy holds 3rd place in the number of publications in biochemistry and immunology.

Italy also achieves remarkable results regarding the visibility and impact of its research: indeed, Italian publications in Life Sciences have received a total of 120,100 citations, once again positioning the country second in Europe, right after Germany, which has 127,600 citations. This figure reflects the productivity of Italian researchers and the appreciation of the international scientific community for Italy's contributions to the field, underscoring the high quality of the publications produced.

Scientific publications are crucial for disseminating and advancing knowledge: many publications not only indicate an active research community but also reflect the vitality of a scientific ecosystem capable of continuously driving progress.

[1] Source: TEHA Group elaboration on Scimago data, 2024

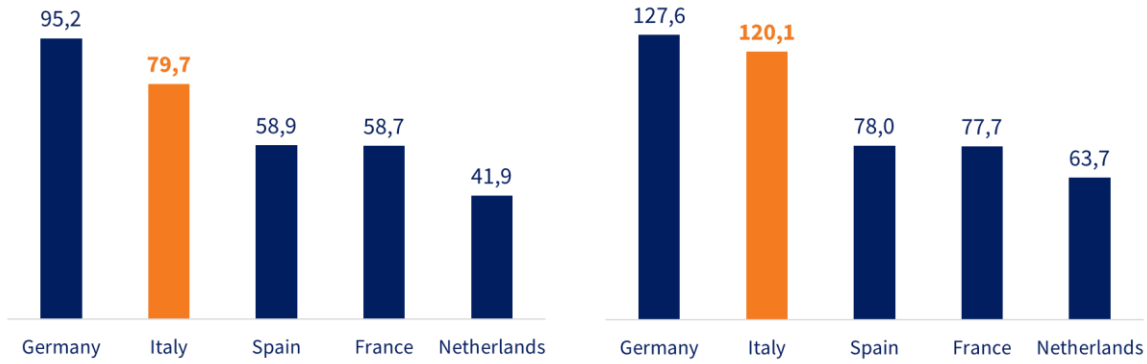

Figure 1: Right: scientific publications in Life Sciences, EU top-5 (in thousands), 2023. Left: citations of scientific publications in Life Sciences, EU top-5 (in thousands), 2023. Source: TEHA Group elaboration on Scimago data, 2024

About Life Sciences research in Italy

Another factor to consider when evaluating the performance of Italian scientific research is its capacity to train and attract talents in Life Sciences, with a particular focus on young professionals who can contribute significantly to the country's innovation. Regarding **graduates, with 15.9% of the total number of graduates belonging to Life Sciences, Italy ranks 17th in the EU,** outperforming Germany (10.5%) and coming close to France (16.8%), while Belgium leads with 28.2%.

In Italy, **PhD graduates in Life Sciences represent 22.1% of the total**, slightly above the European average of 21.9%[2], but far behind top European performers such as Germany (41.0%), Sweden, and Denmark (both at 34.5%), indicating a weaker ability to retain and train high-level researchers.

Another concerning statistic is the low percentage of international students who choose Italy for their PhDs in Life Sciences, only 6.7%, compared to Germany's 19.1%. This points to the limited attractiveness of the Italian system for foreign graduates, a gap that reduces the diversity and richness of Italy's research talent pool.

Nationally, Italy has a total of **208 active research centers, of which 57 are fully dedicated to Life Sciences**, making it the leading sector in terms of specialized facilities[3]. In addition to centers exclusively focused on Life Sciences, there is also the contribution of numerous multidisciplinary research institutes that include Life Sciences among their areas of study, further expanding the scope of research in this field. However, the distribution of these centers is heavily concentrated,

[2] Source: TEHA Group elaboration on Eurostat data, 2024
[3] Source: TEHA Group elaboration on MUR data, 2024

with Lombardy and Lazio hosting 23 and 10 specialized centers, respectively, while all other Italian regions have fewer than 4 each. This geographic imbalance suggests a high concentration of scientific and infrastructure resources in specific areas of the country, potentially limiting access to advanced research environments in less equipped regions. The concentration in Lombardy and Lazio also reflects the prominent role of these regions in attracting public and private R&D investments and fostering well-established academic and industrial networks.

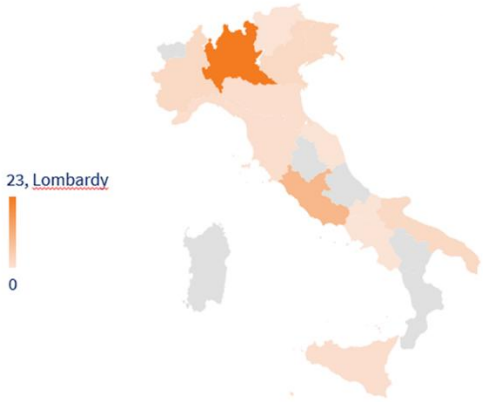

Figure 3: Number of active research centers in Life Sciences in each Italian region (absolute values), 2024. Source: TEHA Group elaboration on MUR data, 2024

However, to fully capitalize on Italy's research potential and foster a more balanced scientific ecosystem, initiatives that encourage the creation and strengthening of research centers in underrepresented areas could be valuable. Such measures would promote a more widespread dissemination of innovation and support greater territorial inclusiveness.

1.2 The state of the art of the Italian Life Sciences industry

The Italian Life Sciences industry represents a diversified ecosystem encompassing **pharmaceutical, biotechnological, and medical device companies**. To understand its state of the art, we will analyze its three main segments: pharmaceuticals, biotechnology, and medical devices. While these sectors are distinct in their characteristics and dynamics, they often overlap and interact, and should not be regarded as isolated silos.

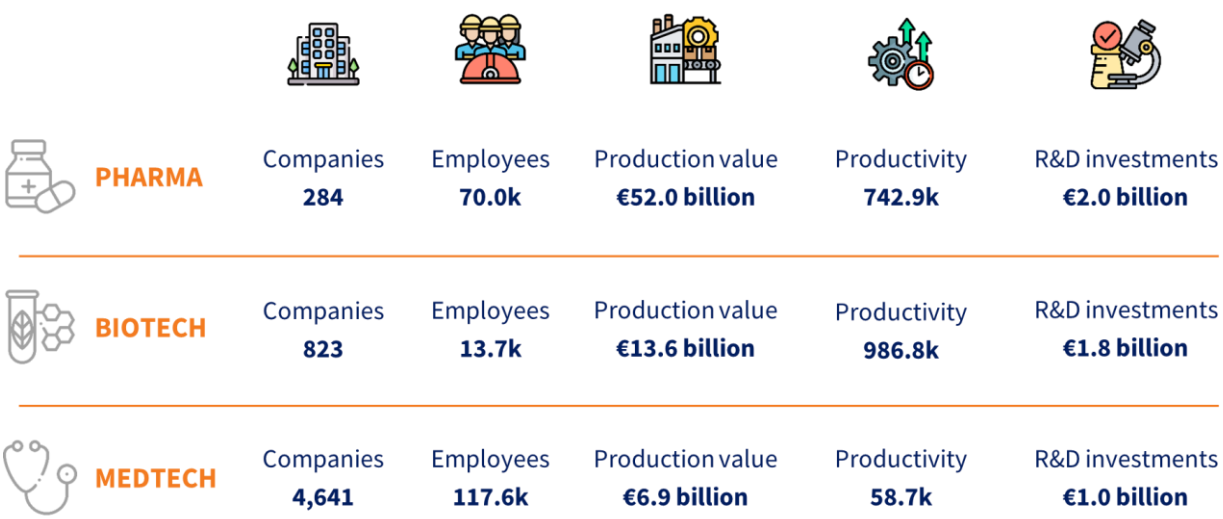

Figure 4: The state of the art of the Italian Life Sciences industry, 2023[4]. Source: TEHA Group elaboration on Farmindustria, Assobiotec and Farmindustria Dispositivi Medici data, 2024

The pharmaceutical sector

At the European level, Italy stands out as a leader in pharmaceutical production. In 2022, the country ranked **first among the major EU producers**, surpassing Germany (€37.4 billion) and France (€32.8 billion)[5].

Globally, the pharmaceutical market reached approximately $1.6 trillion in 2023. North America accounts for 53% of the market, followed by Europe (23%) and China (8%). Italy is the 7th largest pharmaceutical market globally, representing 3% of worldwide revenue. Projections for 2028 place Italy in 6th position, further strengthening the country's strategic role in the international pharmaceutical industry[6].

Although the sector generates high revenues from production, the investments in R&D in Italy represent only 3.8% of the sector's total production value, suggesting a limited reinvestment in

[4] or latest available year
[5] Source: TEHA Group elaboration on EFPIA data, 2024
[6] Source: TEHA Group elaboration on Farmindustria data, 2024

innovation compared to peers like Germany (25.1%) and France (13.5%)[7].

The biotechnology sector

The biotechnology sector in Italy, despite some fluctuations, achieved a **production value of €13.6 billion** in 2022 (the latest year available). Excluding a slight contraction during the pandemic years, the sector experienced overall growth of +5.0% between 2018 and 2022[8].

The industry is divided into four main operational areas:

- Red Biotech: companies specializing in human health, developing innovative therapies and diagnostic systems (403 companies).
- White Biotech: companies focusing on industrial and environmental solutions (82 companies).
- Green Biotech: firms engaged in agricultural and livestock applications (239 companies).
- GPTA (Genomics, Proteomics, and Advanced Technologies): organizations dedicated to basic research and developing advanced technologies, including bioinformatics and Big Data analysis (99 companies).

With 403 companies, representing 49% of the total, the Biotech segment focused on human health is by far the most significant, both in terms of the number of firms and its contribution to turnover, which exceeds €10 billion (74% of the total)[9].

However, the sector is predominantly composed of small enterprises: over 77% of Red Biotech companies are micro (fewer than 10 employees) or small firms (10-49 employees). Only 10% of firms are large enterprises with over 250 employees. Despite their limited number, medium and large companies drive the sector, accounting for 95% of turnover and 84% of in-house R&D expenditure.

However, Italy's numbers are far from those of Europe's top performers. In 2022, Germany had over 750 biotech companies—fewer than Italy—but generated €25 billion in revenue and employed 47,000 people.

Despite these promising figures, the Italian biotech sector suffers from a chronic lack of venture capital (VC) investments compared to major European benchmarks. In 2022, Italy attracted only **€62 million in VC funding for biotech**, 14 times lower than France (€884 million) and 11 times lower than Germany (€720 million). Even Spain, with €162 million, outperformed Italy, highlighting the country's difficulty in securing private capital to support innovation and growth[10].

Furthermore, the sector's limited innovative capacity is also reflected in the number of patents registered annually with the European Patent Office (EPO) in the biotechnology sector. Despite its strong economic performance, Italy continues to lag behind major European benchmarks such as Germany, the United Kingdom, and France, and only slightly trails Spain in this regard. In 2023, **Italy filed 29 patents**, compared to 182 by Germany, 97 by the United Kingdom, and 88 by France,

[7] Source: TEHA Group elaboration on EFPIA and Eurostat data, 2024
[8] Source: TEHA Group elaboration on Assobiotec data, 2024
[9] Source: TEHA Group elaboration on Assobiotec data, 2024
[10] Source: TEHA Group elaboration on Pitchbook data, 2024

highlighting a structural gap in the ability to convert research and development efforts into patented innovation.

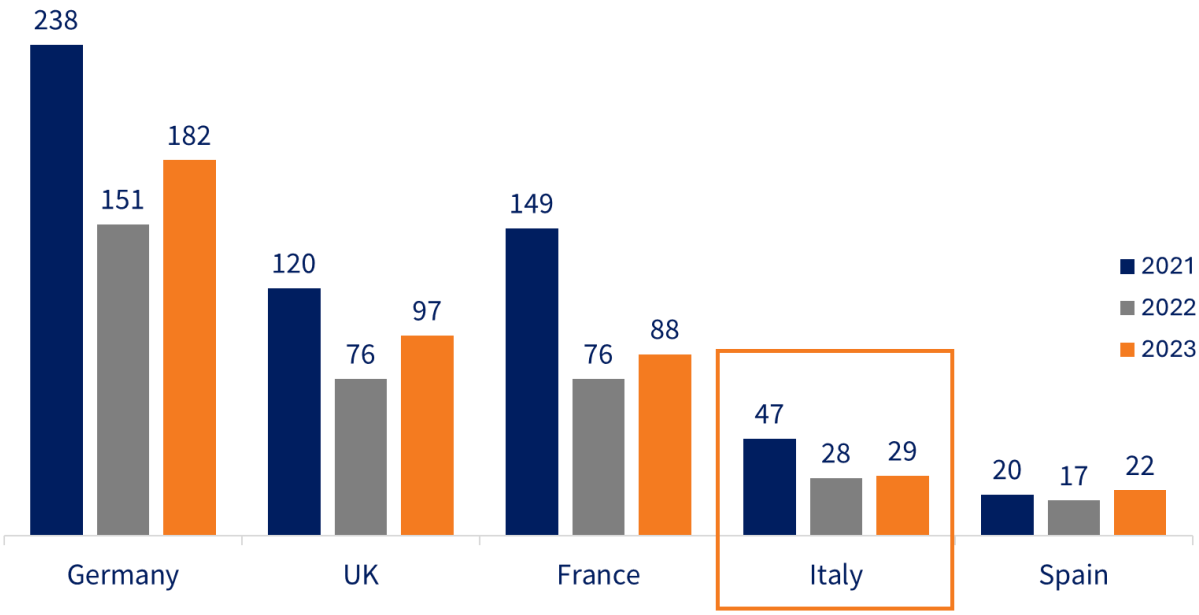

Figure 5: Number of biotechnology patents granted by the EPO in benchmark EU countries (absolute values), 2021-2023. Source: TEHA Group elaboration on EPO data, 2024

The medical devices sector

The Medical devices industry comprises a total of **4,641 companies**, divided into:

- 2,749 manufacturing companies, representing the primary component of the sector;
- 1,531 distribution firms, focused on device commercialization;
- 361 service providers, specializing in support activities and consultancy.

Nearly 94% of companies are classified as small and medium-sized enterprises (SMEs), while large firms account for only a small fraction. This fragmentation makes the sector highly dynamic and limits the economies of scale required to compete in international markets.

The sector includes 108 startups and 201 innovative SMEs, and it is distinguished by a highly skilled workforce and a strong focus on R&D investments.

However, the analysis of patents obtained in the medtech sector highlights the limited innovative capacity of Italian companies compared to major European benchmarks. In 2023, **Italy filed 196 patents** with the European Patent Office (EPO) in the medtech sector, significantly trailing Germany (856 patents), France (338 patents), and the United Kingdom (280 patents). These figures emphasize a competitive gap that hinders the country's ability to establish itself as a leader in technological innovation within the sector.

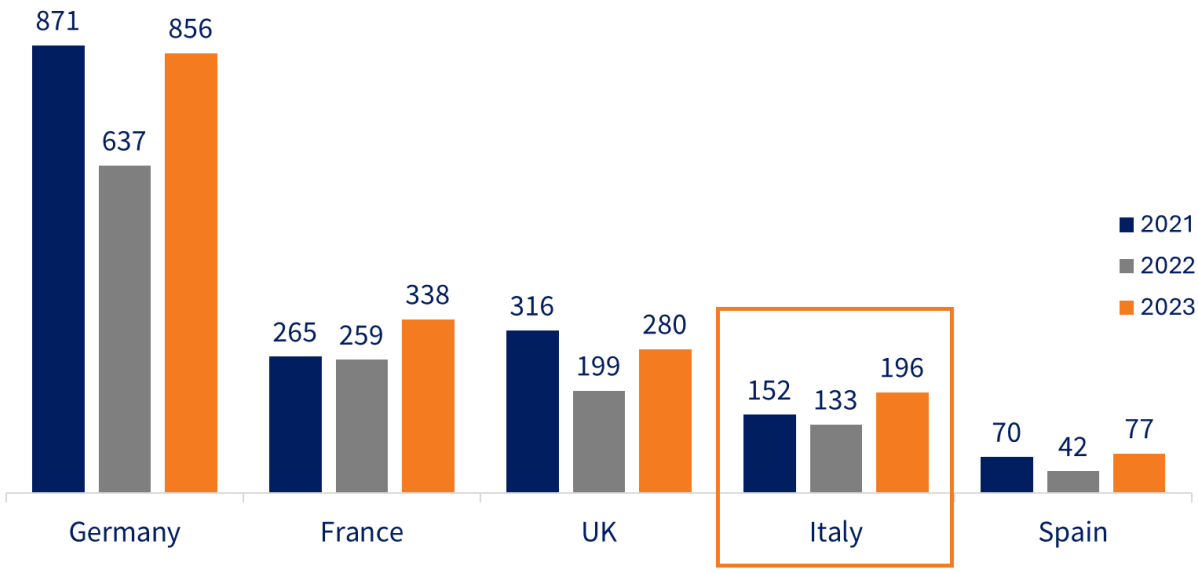

Figure 6: Number of Medtech patents granted by the EPO in benchmark EU countries (absolute values), 2021-2023. Source: TEHA Group elaboration on EPO data, 2024.

Conclusions

In conclusion, while the Italian Life Sciences industry demonstrates strong economic potential and occupies a prominent position in Europe, it faces significant challenges that hinder its ability to capitalize on its strengths fully. The pharmaceutical sector leads in production but requires a greater reinvestment of revenues into R&D and innovation to sustain long-term growth. The biotechnology industry, despite its entrepreneurial dynamism, suffers from underfunding and limited patent output compared to European leaders. Similarly, the medical devices sector is marked by high fragmentation and a competitive gap in technological innovation. Addressing these issues through targeted investments, enhanced innovation capacity, and more substantial support for scaling up businesses is essential to position Italy as a global leader in Life Sciences.

1.3 Resources dedicated to research and development

Although the Life Sciences sector in Italy boasts a significant number of companies and serves as a key pillar of the national economy, it lags behind its European peers in innovation. This gap is evident in R&D spending, M&A activity, and venture capital investments, limiting the sector's full competitive potential.

Public and corporate R&D spending

For a more accurate comparison at the European level, it is useful to consider R&D spending per capita. Public investments in R&D for the Life Sciences sector in Italy amount to €14 per capita, placing Italy in 8th position in Europe. Here too, the Country is outpaced by Germany (€24 per capita) and Spain (€21.1 per capita), which hold 3rd and 4th positions, respectively. Sweden leads the rankings, with €45.8 per capita invested in R&D in the sector[11].

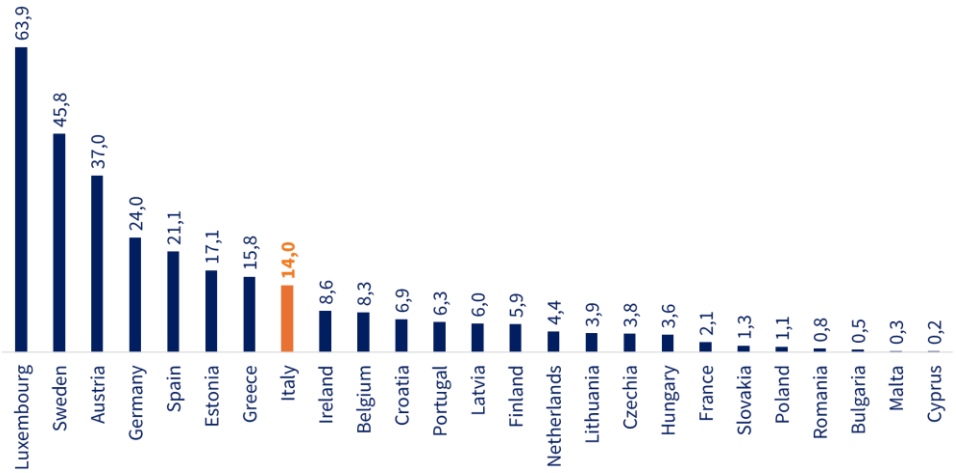

Figure 8: Government Expenditure in Research and Development in Life Sciences in EU countries (Euro per inhabitant), 2021. Source: TEHA Group elaboration on Eurostat data, 2024

Private sector R&D spending in Life Sciences in Italy is even more critical, standing at €13.1 per capita and placing Italy in 11th place in Europe. Here again, Germany (5th with €66.5 per capita), France (8th with €32.3 per capita), and Spain (9th with €17.1 per capita) show a significantly higher level of commitment. European leaders, such as Belgium, which invests approximately €261.2 per capita, outpace Italy by nearly twentyfold[12]. Private investment is essential for developing new technologies, treatments, and innovative solutions capable of enhancing public health and stimulating economic growth. Italy's low level of private R&D spending reflects a structural weakness in the private sector's commitment to fostering innovation and maintaining a competitive position in the global market.

[11] Source: TEHA Group elaboration on Eurostat data, 2024
[12] Source: TEHA Group elaboration on Eurostat data, 2024

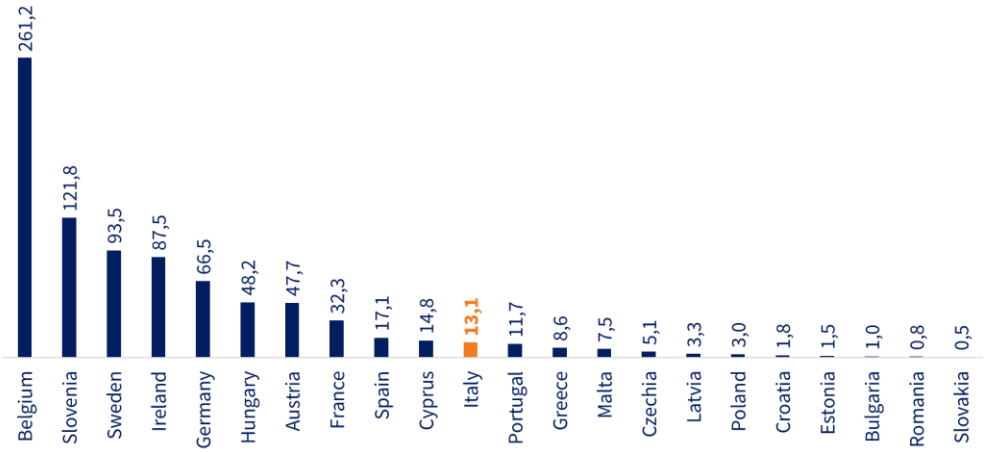

Figure 9: Business Expenditure in Research and Development in Life Sciences in EU countries (Euro per inhabitant), 2021. Source: TEHA Group elaboration on Eurostat data, 2024

When measured **as a percentage of production value**, Italy's total R&D spending in Life Sciences, at **3.8%**, falls well below the EU average of 6.4%, lagging Germany (14.8%) and France (7.1%) while only slightly outperforming Spain (3.7%)[13].

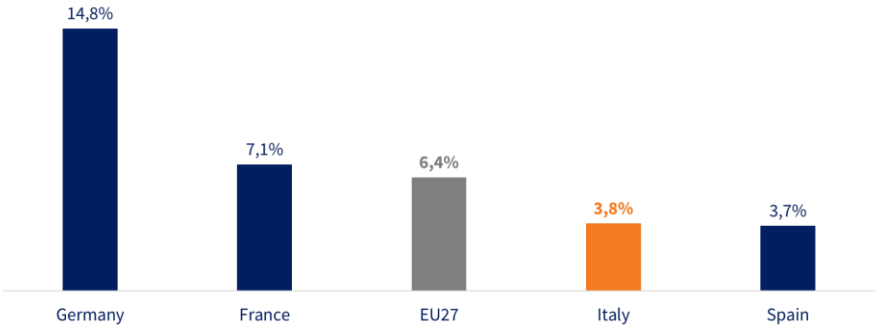

Figure 10: R&D expenditure in pharma as a percentage of pharma production (percentage values), 2022. Source TEHA Group elaboration on EFPIA and Eurostat data

Venture Capital investments and M&A activities

In 2023, **venture capital (VC)** investments in Italy reached **EUR 1.35 billion**[14]. Of this, **243.6 million went to companies in the Life Sciences sector, accounting for 18.1% of the total**. Although investments in the Life Sciences sector decreased by -24.6% year-on-year, they grew at a CAGR of +33.8% compared to 2021. The Life Sciences sector ranks second in Italy in terms of the amount of VC investments, surpassed by the ICT sector with EUR 391.6 million in investments, and followed by the financial services sector with EUR 188.0 million in investments. However, both sectors recorded a negative CAGR growth rate over the last three years of -27.0% and -43.5%, thus testifying to the Life Sciences sector's growth.

[13] Source: TEHA Group elaboration on EFPIA and Eurostat data, 2024
[14] Source: TEHA Group elaboration on AIFI data, 2024

In 2023, 3 out of the 10 largest Venture Capital deals in Italy were made by companies operating in the Life Sciences sector:

- Nouscom: a private company founded in 2015 that develops immunotherapies for the treatment of cancer, has obtained a Late-Stage financing worth EUR 67.5 million;
- AAVantgarde Bio: a spin-off of the Telethon Institute of Genetics and Medicine (TIGEM), founded in 2021, that develops innovative therapies for the treatment of the retina, was awarded an Early Stage grant worth EUR 61.0 million;
- Allotex: a start-up company founded in 2014 that develops solutions for the treatment of presbyopia and farsightedness, was awarded EUR 27.4 million in Early-Stage financing.

The geographical distribution of investments is extremely disproportionate. Foreign-based start-ups attracted EUR 110.1 million, equivalent to 45.2% of the total investment in 2023: these 6 target companies were either born in Italy or belong to entrepreneurs who are mostly Italian. Regarding start-ups based in Italy, Lombardy ranks first in venture capital investments in Life Sciences, amounting to EUR 95.9 million, 39.4% of the total sector. The rest of the investments are distributed among the other Italian regions, but none takes a share of more than 4%.

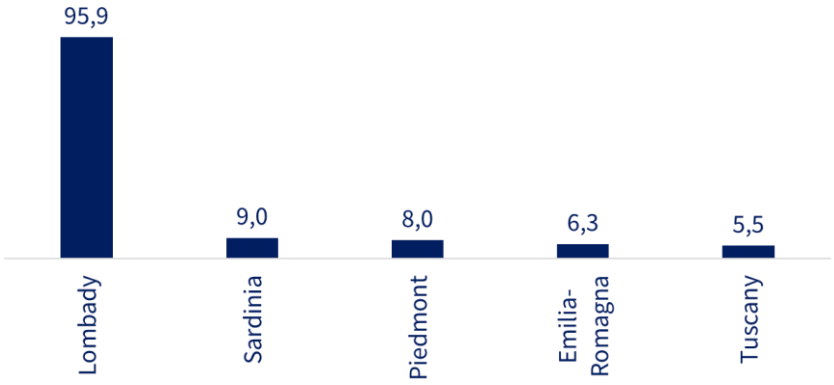

Figure 12: Geographical distribution of VC investments in Life Sciences companies in Italy (in millions €), 2023. Source: TEHA Group elaboration on AIFI data 2024.

However, venture capital investments provide yet another indicator of Italy's limited innovation drive compared with EU benchmark countries. The **€0.24 billion** attracted in 2023 by the Italian Life Sciences sector is significantly lower than the €3.00 billion attracted by the United Kingdom, €1.13 billion by France, and €1.08 billion by Germany. This highlights the country's challenges in attracting private capital to foster startup growth and innovation in the sector,[15] and highlights the need to create more favorable conditions to attract venture capital and further stimulate

[15] Source: TEHA Group elaboration on AIFI, BIO Deutschland, AseBio and Small Business Finance Markets data, 2024

investment in the Life Sciences sector in Italy.

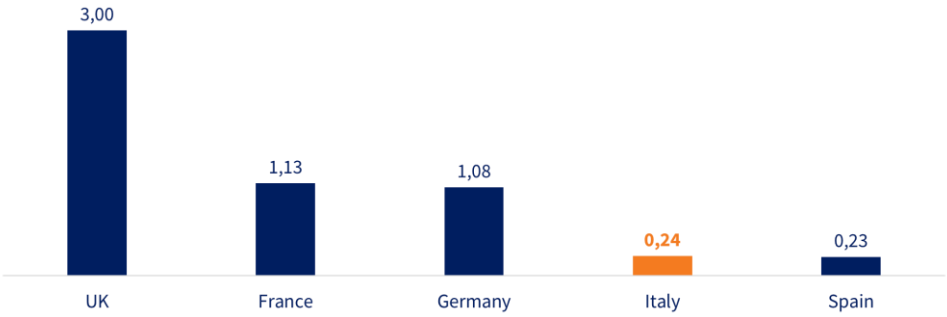

Figure 13: Amount of Venture Capital investments in the Life Sciences sector (billion €), 2023[16]. Source: TEHA Group elaboration on AIFI, BIO Deutschland, AseBio and Small Business Finance Markets data, 2024

Conclusions

Public support is crucial for advancing basic and applied research, supporting researcher training, and building essential infrastructure to drive scientific progress. Additionally, public investments play a key role in de-risking innovation by generating knowledge and increasing the Technology Readiness Level (TRL) of new technologies, thereby reducing the risks associated with early-stage development. This creates a framework for risk-sharing between the public and private sectors, fostering collaboration and encouraging private sector contributions to innovation.

Examples of such initiatives include EU programs like the EIC (European Innovation Council) and EIT (European Institute of Innovation and Technology), which strategically fund R&D to bridge the gap between research and market-ready solutions. Conversely, limited public spending risks undermining competitiveness and scientific advancement, reducing the country's ability to compete on the international stage.

Regional disparities in resource distribution further underscore the challenges faced by the Italian Life Sciences sector. Investments are heavily concentrated in regions like Lombardy, which accounts for nearly 40% of venture capital investments in the sector, leaving other regions with significantly lower shares. Addressing this imbalance is essential to ensure equitable growth and harness the potential of underserved regions.

To bridge the innovation gap, Italy must significantly increase R&D investments and strengthen policies to attract international capital. Only through strategic intervention can the country position itself not just as a production leader but also as a hub of innovation, solidifying its competitive role on a global scale.

[16] Or latest available year

1.4 Technology transfer as a bridge between research and industry

Technology transfer is defined as the "set of activities carried out by universities and research centers aimed at the evaluation, protection, marketing, and commercialization of technologies and, more generally, the management of intellectual property"[17]. At the core of technology transfer is the management of intellectual property, developed within the framework of academic research and development projects.

In the context of technology transfer modalities, it is essential to pay special attention to the forms of collaboration between academia and industry, given their importance in facilitating the matching of demand for innovation and technology development. The synergy between academia and business is a key element for the success of the process, regardless of the mode of technology transfer used.

Given the variety of ways in which technology transfer takes place, it is complex to assess its effectiveness. To do so, it is necessary to analyze the various stages that constitute it to build a general picture highlighting the strengths and weaknesses of the Italian ecosystem. The analysis must begin with producing knowledge, i.e., scientific publications in the sector. Next, it is essential to examine the availability of human capital with specific skills and the presence of structures dedicated to technology transfer. For the commercialization of new technologies, it is essential to have the ability to attract venture capital investments, since they are the most widely used mode for innovative and often risky projects. Finally, to assess the effectiveness of the process, its results need to be quantified, for example by analyzing the number of patents filed in the Life Sciences sector in Italy compared to European competitors.

In recent years, there has been an increasing global presence of so-called Technology Transfer Offices (TTOs), structures entirely dedicated to the technology transfer process that aim to foster the commercialization of innovations born in universities and research centers. Currently, there is no database collecting data on the presence of TTOs in Europe or worldwide. We can only mention the report provided by Netval[18] on the activity of the TTOs in Italy, from which valuable information can be obtained.

In Italy, as of the last available update in 2021, there were **122 Technology Transfer Offices (TTOs)**[19]. These offices often take on different names but generally refer to entities with specific competencies for protecting and exploiting scientific research results.

TTOs started to be introduced in Italy in the early 2000s, mainly in universities. Since 2010, they have also increased in Public Research Institutions[20] (EPRs) and Scientific Hospitalization and Treatment Institutes[21] (IRCCS), where they have grown the most. At the date of the last update, they were distributed as follows:

- 67 TTOs in universities
- 9 TTOs in Public Research Organisations (EPR)

[17] Source: Treccani
[18] Netval is the Italian Network for Research Valorization
[19] Source: TEHA Group elaboration on Netval data, 2024
[20] In italian: Enti Pubblici di Ricerca
[21] In italian: Istituti di Ricovero e di Cura a Carattere Scientifico

- 46 TTOs in Scientific Hospitalization and Treatment Institutes (IRCCS)

The average number of personnel employed in TTOs in Italy almost doubled from 2004 to 2021, from an average of 3.0 employees to an average of 5.6. However, the numbers are still low and have remained constant over the last five years. In fact, **over two-thirds (69.0%) of Italian TTOs have fewer than 5 employees,** and those with at least 10 employees are only 13.5%.

The size of Italian TTOs is far removed from the best-in-class at the European level. Cambridge Enterprise, for instance, has a 'Technology and Knowledge Transfer' team of 33 people, 16 of whom are specifically dedicated to Life Sciences[22]. The staff is also very heterogeneous, with people dedicated to different activities (commercialization, intellectual property management, etc.). The Karolinska Institutet Innovations team, devoted explicitly to technology transfer in Life Sciences, consists of 11 people, including business coaches, project managers, and staff dedicated to communication and assistance to incubated start-ups[23]. The Institut Curie in Paris employs 28 staff for technology transfer in Life Sciences[24].

One of the main issues underlying the limited size of TTOs in Italy is the lack of personnel with specific expertise. Technology transfer requires a broad and complementary set of skills. First, proficiency in scientific language and the ability to identify discoveries with commercial potential must be present. Furthermore, it is essential to communicate this potential in language accessible to those outside the academic sphere, such as investors. Finally, legal skills are indispensable for managing licensing contracts, patents, and the commercialization of innovations.

Currently, training courses on technology transfer for students and professionals in Italy are extremely limited. Most are short courses organized by private institutions, while the few courses offered within universities often provide minimal or no academic credit. Encouraging the creation of training programs that integrate all these skills into a professional pathway is crucial to enhancing Italian scientific research and supporting the country's international competitiveness.

Technology transfer output

As previously mentioned, measuring its success uniformly is challenging due to the complexity of the technology transfer process and the various ways it can be carried out. To address this issue, proxies can be used to indicate the process's impact on the national economy. The most widely used proxy is the number of patents obtained, in our case, specifically in the Life Sciences sector.

The sectors representing Life Sciences (Medical Technology, Biotechnologies, and Pharmaceuticals) account for 13.0% of the total number of applications filed with EPO and **9.8% of the total number of patents obtained in Italy**.

The Italian company that filed the most applications among those in the Life Sciences sector is Chiesi Farmaceutici, which alone filed 43 patent applications in 2023.

Comparing Italy with other EU countries, we find that Italy ranks 4th in the EU for the number of patent applications filed with the EPO in the Life Sciences sector, totaling 655 applications in 2023, with a CAGR of +5.6% from 2018 to 2023. However, this number falls significantly behind

[22] Source: Cambridge Enterprise
[23] Source: Karolinska Institutet
[24] Source: Institut Curie

European competitors such as Germany and France, which filed 2,871 and 1,707 applications in 2023.

In terms of patents obtained, the European picture is remarkably similar: **Italy ranks 4th, with 329 patents granted by the EPO in Life Sciences in 2023**, behind Germany (1,210), France (537), and the Netherlands (449), all of which have significantly higher numbers than Italy. All four countries show a negative CAGR from 2018 to 2023.

Another indicator for measuring the ability to bring academic discoveries to market, and thus the quality of technology transfer, is the growth rate of companies. The growth rate of companies in this sector, calculated as a 3-year CAGR average, was relatively low for Italy, which ranks 13th with a growth rate of 2.5%. This rate is slightly below that of Spain, in 12th place with 2.7%, but better than that of France (0.0%) and Germany (-0.7%), which rank 17th and 21st, respectively. Finland leads with a start-up growth rate of 20.5%.

Final considerations

The Life Sciences sector in Italy stands out for its solid and competitive production capabilities at the European level, but faces significant challenges in translating academic research results into industrial innovations. Despite the high number of scientific publications and an increasing focus on valorizing research outcomes, the gap between academia and industry remains one of the main barriers to the sector's development. This gap results in a limited ability to attract venture capital and a lack of strategic dialogue between universities, research centers, and companies.

Therefore, it is evident that collaborative research models tailored to the Italian context, capable of combining academic excellence with market demands, are needed. Such models should foster synergies between the public and private sectors, promote greater professionalization of technology transfer offices, and encourage the creation of shared infrastructures to support applied research and technological development. These elements are essential for ensuring sustainable growth in the sector and enhancing Italy's competitiveness on the global stage.

The following chapters present the results of an initiative led by the Centre for Innovation and Technology Transfer (CITT) of the Fondazione Human Technopole, within the Life Sciences Community of TEHA Group, and in collaboration with Federchimica Assobiotec. The initiative involves mapping the primary European collaborative research models and obtaining insights through confidential interviews with experts in the Life Sciences industry. These analyses aim to identify effective and replicable approaches that can be adapted to the specificities of the Italian context. The ultimate goal is to detail innovative and sustainable collaboration models capable of overcoming the current barriers between academia and industry and revitalizing Italy's Life Sciences ecosystem.

2. THE RESULTS OF THE PROPRIETARY MAPPING OF EUROPEAN COLLABORATIVE RESEARCH MODELS

We identified several models of Collaborative research in Europe. These have been analysed and studied in detail to identify their key characteristics, including the collaborations' objectives, duration, geographic location, funding models, and more.

Once these elements were identified, the collaborations were clustered into four matrices summarizing their main features. A total of **16 collaborative research models** between academia and industry in the Life Sciences sector were analyzed, spanning **15 European countries**, including Austria, Belgium, Denmark, Estonia, Finland, France, Germany, Ireland, Italy, Norway, the Netherlands, Poland, Portugal, the Czech Republic, Switzerland, Sweden, Spain, and the UK.

Figure 1: Collaborative research models between academia and industry in the Life Sciences sector analysed across Europe

2.1 Clustering into matrices

The analysis and clustering of the 16 collaborative research models provided a representation across **4 layers,** summarizing the main characteristics of these collaborations. These four layers are:

- **Stage of collaboration**: identifies the temporal and strategic phase at which the collaboration is established within the innovation lifecycle. This layer is critical for understanding how and when partnerships are formed to maximize their impact.

- **Type of collaboration**: describes the nature of the partnership and the primary purpose of the collaboration, highlighting shared strategic goals and operational dynamics.
- **Organizational structure**: analyzes the governance and management methods of the partnerships, focusing on organizational tools and coordination mechanisms.
- **Funding scheme**: examines the sources and methods of funding for the collaborations, outlining how these are structured to ensure short- and long-term sustainability. Particular attention was given to models involving venture capital funds as a source of financing.

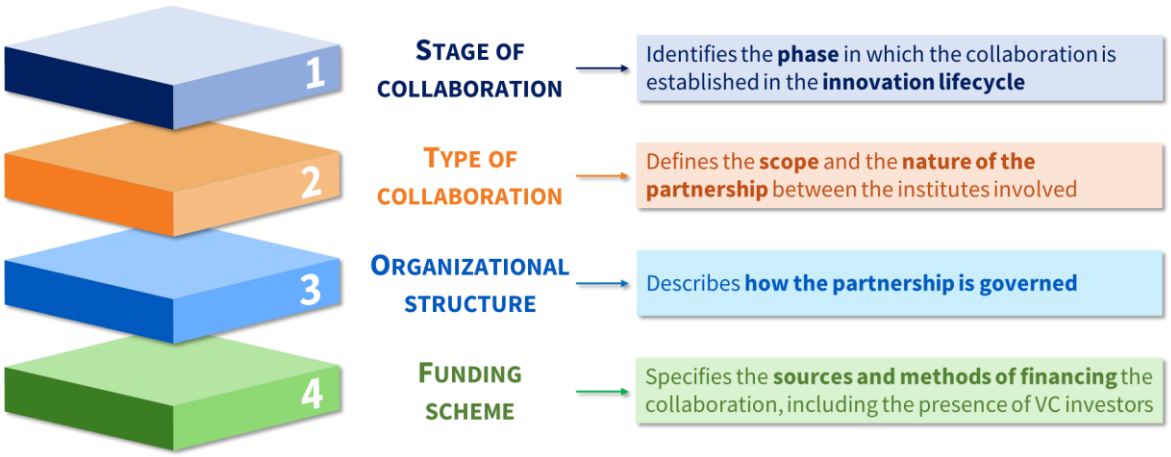

Figure 2: The four layers of analysis of collaborative research models in Life Sciences

Below, the 4 layers are analyzed along with the distribution of collaborative research models within them.

Stage of collaboration

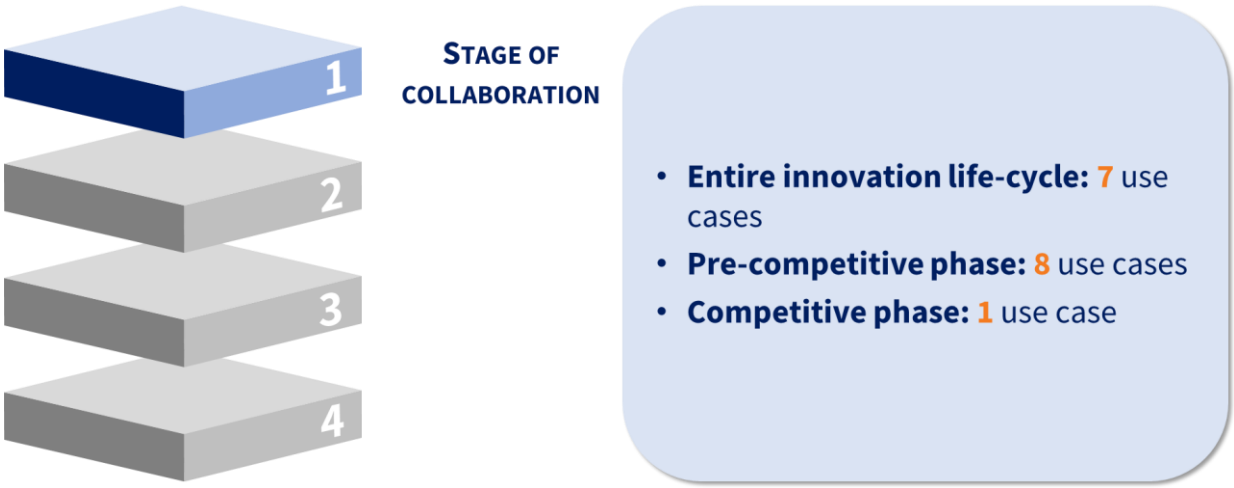

Figure 3: Analysis of the layer "stage of collaboration"

The first layer analyzes the specific **phase of the innovation lifecycle** during which the collaboration is established. This aspect is particularly relevant as it helps identify the strategic timing of partnerships and their potential impact on the creation and diffusion of innovations. Analyzing this dimension allows for understanding how different actors position themselves along the innovation chain and what objectives they aim to achieve.

The collaborations are distributed across three main types:

- **Entire innovation cycle**: in this configuration, the collaboration covers the entire innovation cycle, including basic research, applied research, prototyping, development, and commercialization. It may also involve the creation of spin-off companies or startups. These collaborations are often the most complex and ambitious, requiring strong synergy among academic, industrial, and institutional partners to address the full spectrum of activities. Among the analyzed cases, **7 models** of this type were identified, representing virtuous examples of vertical integration throughout the innovation chain.

  An example of this model is **beLAB2122**, a multi-year partnership between some of the leading academic institutions of the Rhine-Main-Neckar region, Evotec, and BMS to identify exciting and novel disease-modifying therapeutic targets and platforms with the goal of developing these into new spinout companies.

- **Pre-competitive phase**: this type of collaboration focuses exclusively on the pre-competitive phase of the innovation cycle, involving activities that precede the introduction of products or services into the market or healthcare system without immediate commercial objectives. **8 models** of this type were identified in the analysis.

  Some examples of this model are **Open Targets**, a public/private partnership on pre-competitive research that uses human genetics and genomics data for systematic drug target identification and prioritisation, and **Blue Sky Collaboration**, a research fund set up between the MRC Laboratory of Molecular Biology (LMB) and AstraZeneca to support a range of pre-clinical research projects.

- **Competitive phase**: this configuration involves collaborations positioned in the competitive phase of the innovation cycle, where the primary goal is to bring products or services to market and maximise their commercial value. These partnerships are highly results-oriented and require careful management of intellectual property and strategies for know-how protection. However, they are less frequent for several possible reasons.

  The study identified only **1 model** of this type: the **Functional Genomic Centre**, a competitive collaboration between AstraZeneca and Cancer Research UK's (CRUK) drug discovery engine, Cancer Research Horizons.

STAGE OF COLLABORATION	Entire innovation lifecycle	Pre-competitive phase	Competitive phase
beLAB2122			
Blue sky			
Catapult UK			
CD3			
CEMM & Angelini			
EMBL & BII			
Enlight-ten +			
ELF			
FGC			
IHI			
LDC			
Manic			
Open Targets			
Oslo Cancer Cluster			
Persit Seq			
SGC			

Figure 4: Detailed analysis of the layer "stage of collaboration"

Type of collaboration

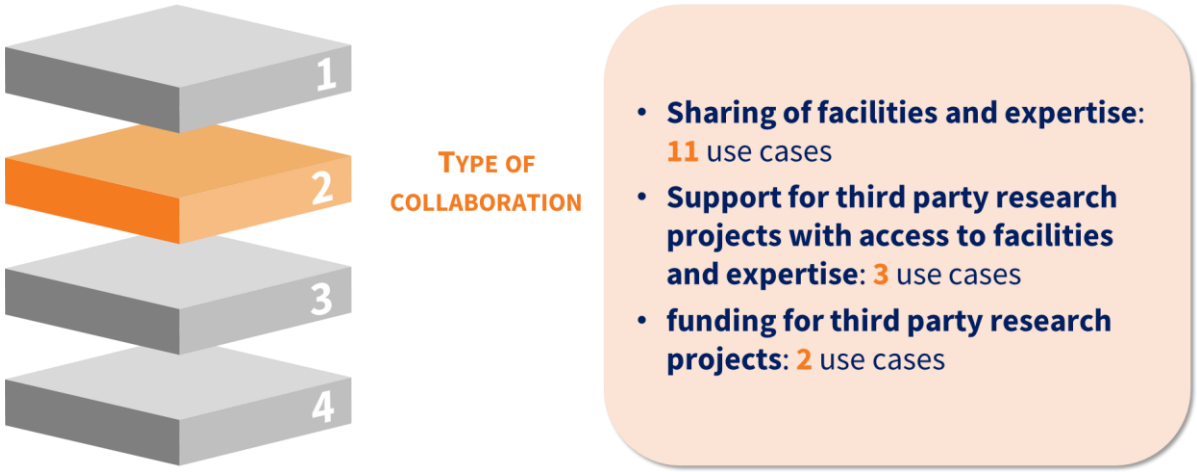

Figure 5: Analysis of the layer "type of collaboration"

The second layer examines the **strategic purpose** and **nature of the partnerships** among the institutions involved, highlighting the level of resource integration and the type of support provided. This layer is particularly useful for understanding how collaborations are structured and which models emerge as most effective for fostering innovation.

The analysed models fall into three main types:

- **Sharing of facilities and expertise**: this involves pooling key resources among the participating parties, such as infrastructure and laboratories, expertise, know-how, and financial resources. These models are characterised by a high degree of operational integration, enabling synergistic management of activities and greater resource efficiency. **11 models** of this type were identified, making it the predominant model.

  Some examples are:

  - The collaboration between **EMBL and BII**: a strategic partnership aimed at accelerating healthcare breakthroughs and developing innovative scientific solutions to address some of the world's most pressing challenges. Through this agreement, both institutions gain enhanced access to each other's expertise in advancing science and fostering innovation, creating a powerful synergy to drive impactful progress in research and healthcare;
  - The **Blue Sky Collaboration**: projects involve scientists from the two organisations working side by side, either within the LMB building on the Cambridge Biomedical Campus, or in AstraZeneca research facilities. A Joint Steering Committee (JSC) of LMB and AstraZeneca staff decides which projects will receive support from the Fund.

- **Support for third-party research projects with access to facilities and expertise**: this type focuses on supporting external research projects by providing regulated access to infrastructure and tools, expertise sharing, and financial support. These collaborations are often governed by structured evaluation mechanisms, such as calls for proposals or

selection committees, ensuring that external projects meet quality and strategic relevance criteria. **3 models** of this type were identified.

An example is the **Innovate UK Catapult Network**, a consortium of nine world-class technology and innovation centres spread across more than 65 locations nationwide. These Catapults are physical hubs equipped with state-of-the-art R&D infrastructure, including laboratories, testbeds, factories, and offices, supported by technical experts dedicated to validating and advancing breakthrough products, processes, services, and technologies. The Innovate UK Catapult Network provides access to cutting-edge research and development facilities and innovation ecosystems to support businesses with new innovations, from concept through to adoption in the marketplace.

- **Funding for third-party research projects**: In this configuration, the parties involved contribute exclusively to financial support for research projects without providing additional resources such as infrastructure or expertise. These collaborations are less common, with **2 models** identified.

  An example is the **Innovative Health Initiative (IHI)**, an EU public-private partnership funding health research and innovation. Its core goals are to translate health research and innovation into tangible benefits for patients and society and ensure that Europe remains at the cutting edge of interdisciplinary, sustainable, patient-centric health research. Its primary objectives are to transform health research into tangible benefits for patients and society while maintaining Europe's leadership in interdisciplinary, sustainable, and patient-centred health research. This is achieved by funding a wide range of organizations, including universities, research institutions, patient associations, small and medium-sized enterprises (SMEs), and mid-sized companies, to support their groundbreaking research projects.

TYPE OF COLLABORATION	Share facilities and expertise	Support third party research	Fund third party research
beLAB2122			
Blue sky			
Catapult UK			
CD3			
CEMM & Angelini			
EMBL & BII			
Enlight-ten +			
ELF			
FGC			
IHI			
LDC			
Manic			
Open Targets			
Oslo Cancer Cluster			
Persit Seq			
SGC			

Figure 6: Detailed analysis of the layer "type of collaboration"

Organizational structure

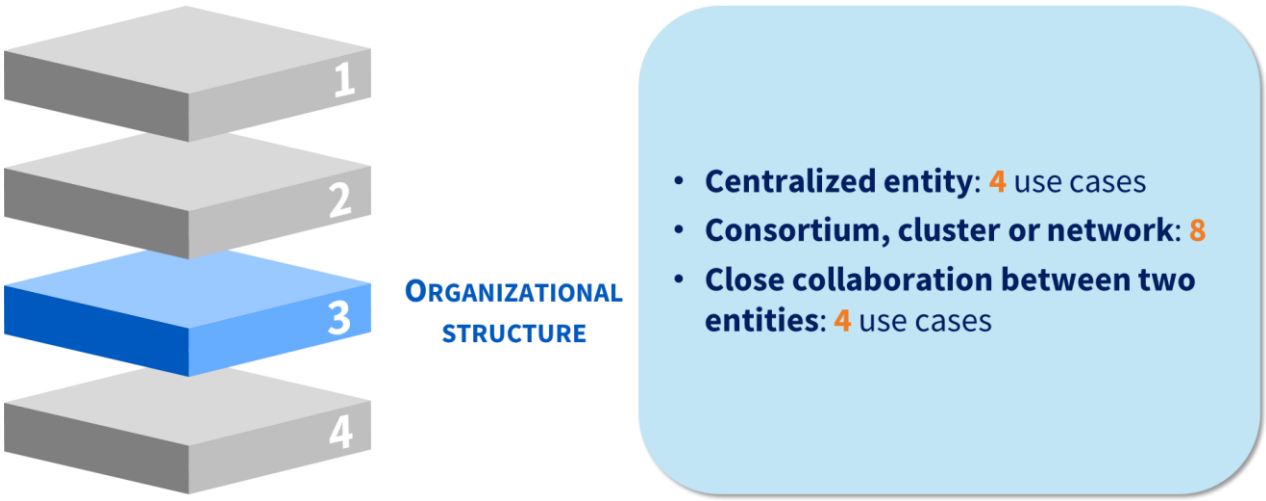

Figure 7: Analysis of the layer "organizational structure"

The third layer analyzes the **governance model** characterizing the collaboration, focusing on how the parties involved structure and manage their activities. This aspect is crucial for understanding the levels of integration and coordination and the degree of formalization of the partnership.

Three main organizational models emerged from the analysis:

- **Centralized entity**: this type of collaboration involves creating a new legal and operational entity, typically resulting from an agreement between public and private parties. The new entity usually has a dedicated structure, shared governance among the parties, and a focus on long-term projects. These collaborations are highly formalized and represent an ideal model for projects requiring strong resource integration and continuous coordination. **4 models** of this type were identified.

  An example is the **Centre for Drug Design and Discovery (CD3)**, based in Leuven (Belgium). It is a drug discovery centre and investment fund created to drive the translation of innovative basic research to the clinic. As an investment fund, CD3 can invest in drug discovery projects as well as in spin-off companies and biotechs, while as a drug discovery centre, it complements investments with an experienced drug discovery team and state-of-the-art infrastructure. The cornerstone of CD3's activities is hand-in-hand collaborations with academic research groups and biotech or pharma partners, always aimed at discovering and developing new medicines. Successful collaborations lead to partnering with biotech or pharma, or the creation of spin-off companies.

- **Consortium, cluster, or partner network**: this model is characterized by the participation of more than two entities collaborating in a coordinated manner without creating a new legal entity. These collaborations are versatile, well-suited to addressing multidisciplinary challenges or promoting large-scale innovation. Consortia and clusters also encourage resource sharing and synergies across different sectors. **8 models** of this type were identified.

Some examples are:

- **The Structural Genomic Consortium**: a global public-private partnership committed to open science principles that fast-tracks new medical discoveries by fostering and organizing collaboration among a vast network of scientists from academia and industry and making all its research output freely accessible. SGC is currently one of the largest and longest-running biomedical research consortia in the world, with current contributions from nine Pharma industry members.
- **Oslo Cancer Cluster**: a non-profit member organisation dedicated to improving the lives of cancer patients by accelerating the development of new cancer diagnostics and treatments. The Cluster's member base comprises university hospitals, research centres, patient associations, start-ups and biotech companies, global pharma and technology companies, investors, financial institutions, as well as service providers – all working in the cancer field.

- **Close collaboration between two entities**: this partnership is based on a close bilateral collaboration between two main actors, typically a research institution and an industrial partner, without the creation of a new entity. **4 models** of this type were identified.

  An example is the collaboration between the **Research Center for Molecular Medicine of the Austrian Academy of Sciences (CEMM) and Angelini Venture** to accelerate lifespan expansion research and venture creation. The collaboration will combine the venture creation capabilities of Angelini Venture with the breakthrough research from CEMM.

ORGANIZATIONAL STRUCTURE	Centralized entity	Consortium/ cluster/ network	Collab. Between 2 entities
beLAB2122		■	
Blue sky			■
Catapult UK	■		
CD3	■		
CEMM & Angelini			■
EMBL & BII			■
Enlight-ten +		■	
ELF	■		
FGC			■
IHI	■		
LDC		■	
Manic		■	
Open Target		■	
Oslo Cancer Cluster		■	
Persit Seq		■	
SGC		■	

Figure 8: Detailed analysis of the layer "organizational structure"

Funding scheme

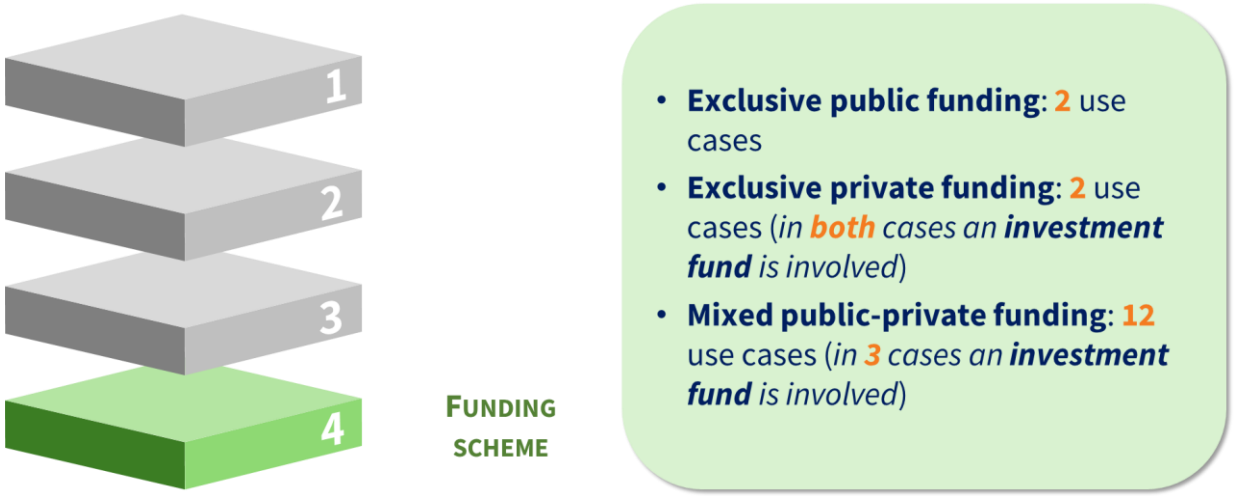

Figure 9: Analysis of the layer "funding scheme"

The fourth and final layer covers the **financing methods** of the collaborations, analysing the sources and methods adopted. This aspect is critical for understanding how the partnerships are economically sustained and what mechanisms are used to ensure their short- and long-term sustainability. Particular attention was given to the involvement of **venture capital** funds, which represent an important element for fostering innovation and accelerating technology transfer.

The analyzed collaborations can be grouped into three main types of financing:

- **Exclusive public funding**: these collaborations are entirely supported by public funds, with no financial contributions from private actors. In most cases, the funds come from governmental or European programs (e.g., Horizon 2020). This model is particularly useful for supporting projects requiring significant initial investments or presenting a high level of scientific risk. **2 models** of this type were identified, both funded through the Horizon 2020 program.

  An example is **Enlight-ten+**, a structured research & training network of European immunologists and bioinformaticians from academia and industry focused on the in-depth characterisation and tailored targeting of tissue-resident T cells. This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant.

- **Exclusive private funding**: these collaborations are exclusively supported by financial resources from private entities, such as companies or investment funds. This model is particularly suitable for projects with a clear market perspective, where private investors see high potential for economic returns. **2 models** of this type were identified, **both** involving a **venture capital fund**.

  An example is the collaboration between **CEMM and Angelini Venture**, which is financially supported by Angelini Venture, the venture capital firm of Angelini Industries.

- **Mixed public-private funding**: this configuration represents the most common model, with funding provided by both public and private actors, often with varying modalities and proportions. This model is particularly valued for its flexibility and ability to attract additional resources, making it the most prevalent among those analysed: **12 models** of this type were identified, demonstrating its effectiveness in balancing public and private objectives. In **3** of these collaborations, a **venture capital fund** participated, providing additional resources and expertise to accelerate the innovation process.

  Some examples are:

  - The **Innovative Health initiative (IHI)**: the IHI is jointly funded by the European Union (represented by the European Commission) and the Life Sciences industries (represented by COCIR, EFPIA/Vaccines Europe, EuropaBio, MedTech Europe).
  - The **Lead Discovery Centre**: funding can come from a variety of sources, including grants, potential industry partners, or early-stage investors. The LDC also sustains a long-term partnership with the Max-Planck Society and the KHAN Technology Transfer Fund I GmbH & Co KG (KHAN-I).

FUNDING SCHEME	Exclusive private	Exclusive public	Mixed private-public
beLAB2122			
Blue sky			
Catapult UK			
CD3			
CEMM & Angelini			
EMBL & BII			
Enlight-ten +			
ELF			
FGC			
IHI			
LDC			
Manic			
Open Target			
Oslo Cancer Cluster			
Persit Seq			
SGC			

 : presence of an investment fund

Figure 10: Detailed analysis of the layer "funding scheme"

Conclusions

The analysis of collaborative research models between academia and industry in Europe allowed the identification and characterization of the main configurations adopted in the Life Sciences sector. The study aimed to provide a detailed overview of existing practices and extract insights useful for building an Italian collaborative research model tailored to the specific needs of the national ecosystem.

The following table summarizes the classifications of the models analysed within the four layers of the matrix. This representation provides valuable insights into the most employed collaboration methods between academia and industry.

	Stage of collab.	Type of collab.	Organiz. structure	Funding scheme
beLAB2122	Entire cycle	Facilities and expertise	Consortium/ cluster/ network	Public-private
Blue sky	Pre-competitive	Facilities and expertise	Collab. between 2 entities	Public-private
Catapult UK	Entire cycle	Support third party research	Centralized entity	Public-private
CD3	Entire cycle	Support third party research	Centralized entity	Public-private
CEMM & Angelini	Entire cycle	Facilities and expertise	Collab. between 2 entities	Private
EMBL & BII	Entire cycle	Facilities and expertise	Collab. between 2 entities	Private
Enlight-ten +	Pre-competitive	Facilities and expertise	Consortium/ cluster/ network	Public
ELF	Pre-competitive	Facilities and expertise	Centralized entity	Public-private
FGC	Competitive	Facilities and expertise	Collab. between 2 entities	Public-private
IHI	Pre-competitive	Fund third party research	Centralized entity	Public-private
LDC	Entire cycle	Support third party research	Consortium/ cluster/ network	Public-private
Manic	Pre-competitive	Fund third party research	Consortium/ cluster/ network	Public
Open Target	Pre-competitive	Facilities and expertise	Consortium/ cluster/ network	Public-private
Oslo Cancer Cluster	Entire cycle	Facilities and expertise	Consortium/ cluster/ network	Public-private
Persit Seq	Pre-competitive	Facilities and expertise	Consortium/ cluster/ network	Public-private
SGC	Pre-competitive	Facilities and expertise	Consortium/ cluster/ network	Public-private

Figure 11: Summary table of the 16 analyzed models' classification across the 4 layers

The analysis highlights the following key insights:

1. **The most prevalent model: mixed public-private funding**

   Among the 16 analyzed models, **mixed public-private funding** emerged as the most common, with **12 collaborations** adopting this configuration. This model combines public sector support, often aimed at risk reduction and pre-competitive innovation promotion, with private sector contributions, which bring additional resources, management expertise, and a focus on commercial valorization. The involvement of venture capital funds in some cases further underscores the importance of specialized financial actors in accelerating innovation and facilitating market transfer.

2. **The centrality of resource and expertise sharing**

   Collaboration models based on **sharing facilities and expertise** were the most widely adopted within the "type of collaboration" dimension, with **11 examples**. This demonstrates the strategic importance of pooling physical and intellectual resources to increase efficiency and maximize the impact of collaborations.

3. **The need for flexible and diversified models**

   Collaboration models span the entire innovation lifecycle, reflecting the diversity of approaches needed to address different stages of development. **Partnerships covering the entire innovation cycle** - encompassing basic and applied research, prototyping, development, and commercialization - are ambitious and relatively common, with **7 examples** identified. Similarly, **collaborations in the pre-competitive phase** are widespread, with **8 models** focusing on research activities that precede market introduction, emphasizing shared goals without immediate commercial objectives.

4. **Governance as a strategic lever**

   The choice of an appropriate governance structure is a critical success factor for collaborations. Governance models based on **consortia or partner networks** (**8 cases**) offer high flexibility and the ability to aggregate diverse actors. However, **centralized entities** (**4 collaborations**) are better suited for managing complex, long-term initiatives due to their greater formalization and centralized coordination.

5. **Challenges and opportunities for the Italian model**

   The Italian context presents specific challenges, such as the need to improve technology transfer and bridge the gap between research and the market. However, the analysis of European models provides a series of best practices and replicable approaches. In particular, mixed public-private funding and resource sharing are key elements for developing an Italian model that is both **efficient** and **sustainable**.

3. Proposals to academia and industry for an Italian collaborative research model

The results of the analysis and mapping presented in the previous chapter have been enriched by valuable insights gathered through stakeholder engagement activities. These activities included an event held on October 8, 2024, titled "Unlocking potential in Life Sciences: collaborative research between academia and industry in Europe," as well as a series of confidential interviews with senior executives from leading pharma and biotech companies in Italy. Overall, the stakeholder engagement activities involved 24 executives:

- Daniela Bellomo – *Director Business Development and Technology Transfer Division, Ospedale San Raffaele*
- Elisabetta Confalonieri – *General Manager DG University, Research, Innovation, Lombardy Region*
- Fabrizio Conicella – *Head of Open Innovation & Competence, Chiesi Farmaceutici*
- Alessandro Curioni – *IBM fellow, VP Europe and Africa and Director, IBM Research Zurich*
- Andrea D'Alessandro – *Executive President OpenZone, Zambon*
- Sabrina De Camillis - *Head of Government Affairs & Communications, GSK*
- Silvia Di Tollo – *Head of R&D Strategic Leadership & Pipeline Management Dept, Alfasigma*
- Sergio Dompé – *Presidente, Dompé Farmaceutici*
- Peter Fenici – *Head of Medical Innovation, AstraZeneca*
- Giorgio Ghigoni - *Vice President Corporate Scientific Affairs, Diasorin*
- Fabrizio Grillo – *Director General Affairs & International Relations, Bracco Group*
- David Hulcoop – *CEO, Open Targets*
- Bert Klebl – *Managing Director and Chief Scientific Officer, Lead Discovery Center*
- Matteo Liguori – *CEO, IRBM*
- Alessandro Maiocchi – *Innovation Hub Director, Bracco*
- Salvo Mizzi - *Director, Innovation, Omnichannel & Customer Engagement, Recordati*
- Marica Nobile – *Director, Federchimica Assobiotec*
- Francesca Pasinelli – *Board Member, Fondazione Telethon*
- Maria Cristina Porta – *General Manager, ENEA Tech e Biomedical*
- Riccardo Pietrabissa – *Rettore, IUSS Pavia*
- Francesco Pontorno - *Innovation & omnichannel PMO, Recordati*
- Fabio Terragni - *Member of the Management Committee delegate for tech transfer, Fondazione Human Tehnopole*
- Gianmario Verona – *President, Fondazione Human Technopole*
- Marino Zerial – *Director, Fondazione Human Technopole*

3.1 Takeaways from interviews

During the stakeholder engagement activities, several key points emerged regarding the state of technology transfer in Italy and Europe, as well as the potential of collaborative research models to revitalize innovation and research within the Italian Life Sciences ecosystem. These reflections form the foundation for a broader analysis of challenges and opportunities:

1. **Lack of a national strategic plan**

   The absence of a long-term national strategic vision undermines the technology transfer process in Italy. For example, the UK set a strategic goal to become a “Life Sciences superpower”. While Italy excels in the initial stages of research, the lack of a coherent national plan leads to fragmentation and isolated efforts, with initiatives often characterized by overly short time horizons. This contributes to the "death valley" phenomenon, where innovative technologies fail to bridge the critical gap between academic research and commercialization. Strategic planning should integrate research, industry, and financial management, fostering stronger connections between public and private entities.

2. **Barriers to collaboration between academia and industry**

   Relations between academia and industry in Italy are often fragmented and ineffective. Industry is highly selective when evaluating research outputs, focusing on solutions with clear commercial and therapeutic potential that fit their therapeutic areas. But academia often approaches industry as if it would approach a scientific journal’s editor, not a potential client. Academia should learn what therapeutic area or medical needs, and what stage of maturation each company is interested in. For this reason, to attract corporate interest, collaborations must begin in the early stages of research and development. Companies often demand co-development plans with clearly defined milestones, alongside patent acquisitions, to ensure alignment with market needs.

   The Italian bureaucratic complexity discourages public-private hybridization, making the system less competitive compared to contexts like the United States, where processes are more streamlined.

3. **Cultural and structural limitations**

   The Italian academic culture resists adopting an entrepreneurial approach. Researchers tend to prioritize publishing over patent protection, sacrificing market potential for academic visibility. Additionally, Technology Transfer Offices (TTOs) lack professionalization and specific expertise linked to business and industry, widening the gap with international models. Limited international exposure and the inability to attract foreign talent further reduce the competitiveness of Italy’s innovation ecosystem.

4. **Entrepreneurial mindset and cultural innovation**

   To make technology transfer more effective, it is essential to foster an entrepreneurial culture among researchers, encouraging them to consider the practical applications of their discoveries. Research centers must adopt a client-oriented approach, conducting proactive scouting activities to identify market needs and companies interested in their work, as well as analyzing market potential and geographic reach before approaching companies and investors. These elements, along with training and awareness campaigns,

can help build trust among academia, industry, and the public, overcoming skepticism about collaborations and fostering a more dynamic and integrated ecosystem.

5. **Technology Transfer and Business Development Offices**

   Academic institutions should develop professional offices with resources experienced in science, industry, business creation, and development.

6. **Successful models and best practices**

   Examples of successful pre-competitive collaborations include shared laboratories and scientific resources, fostering synergies and cultural exchanges between academia and industry. These approaches allow the two sectors to work side by side but require predefined frameworks to ensure transparent management of intellectual property.

   The introduction of industrial advisory boards helps align academic research with market needs, identifying strategic priorities and steering projects toward practical applications. International models, such as the UK's Catapult program, highlight the value of shared resources and structured governance, providing valuable insights for adapting these approaches to the Italian context.

7. **The role of public support in the Italian ecosystem**

   The public sector must play a central role in supporting innovation by funding projects in critical phases to overcome the "death valley" and ensure adequate infrastructure. It should also foster the training of highly skilled personnel and create a regulatory environment conducive to attracting private investments. Public entities could act as catalysts to accelerate technology transfer by supporting open innovation initiatives and simplifying bureaucracy to make public-private partnerships more efficient.

8. **Focus on strategic fields and diversification**

   Italy has established expertise in areas such as rare diseases, gene therapies, and diagnostics, representing fields of excellence to focus on for maximizing economic and scientific impact. However, it is equally important to avoid limiting innovation solely to biotechnology. Research should expand to include medical devices, innovative production processes, and incremental innovations, such as repurposing existing drugs. These areas, characterized by shorter development cycles and lower risks, offer quicker returns and can strengthen Italy's international competitiveness.

3.2 Proposed collaborative models for Italy

As emerged from the mapping activity, the direct scientific collaboration between academia and industry, on a specific project, is the most common and widely used collaborative model present in Europe. In such collaborations, industry often employs the know-how and laboratories of academic institutions in exchange for financial support for their laboratories. In Italy, we can find such examples, among others, at Politecnico di Milano, with PoliHub, Politecnico di Torino, and University of Milano, Modena e Reggio Emilia, Torino, and Verona.

A first, more structured example of collaborative research bringing together academia, industry capabilities, and public-private funding and covering the entire innovation cycle is represented by the EXTEND initiative. EXTEND, launched in 2022 by CDP Venture Capital in collaboration with Evotec and Angelini Ventures, is an incubator that connects leading universities, research centers, venture partners, pharmaceutical companies, and venture capital funds. Its goal is to leverage academic research and drive the development of the biotech sector by creating new startups focused on innovative therapeutic targets and approaches.

Less frequent is the scenario where industry collaborates with specific research groups on defined projects and together, they drive a discovery to a stage suited for acquisition. In Europe, examples of such collaborations are established between large multinational corporates and institutes that have a strong track record in scientific achievements (scientific articles, prestigious grants, Nobel laureates) such as: Blue sky collaboration between AstraZeneca and the LMB, the Functional Genomic Centre between AstraZeneca and Cancer research Horizons, and the collaboration between EMBL and Denmark's BioInnovation Institute Foundation (BII).

Such examples are one-to-one interactions that will not have a strong impact on the Italian innovation ecosystem. Indeed, to have a real change, we need to look at models that will involve the whole system to promote not only collaborations and development of projects and therefore technologies, but also the maturation of the culture of technology transfer among the academic scientists and inventors, and therefore the strengthening of the innovation ecosystem in Italy.

In light of this analysis, four potential models emerge as suitable for the Italian ecosystem of research and innovation in Life Sciences:

A. **Embedding scientists and personnel** from industry within academic laboratories and vice versa. This model fosters a bidirectional exchange of resources, technologies, know-how, and culture. Industry participants can experience academia's creativity and "blue-sky" research approach, while academics can learn strategic planning and risk assessment methodologies necessary to bring discoveries to market.

   A unique benefit of this model is the informal "coffee break interactions", which often drive breakthrough scientific discoveries. These unscheduled, daily exchanges encourage creativity and innovation, creating a fertile environment for prolific scientific research. Typically operating in the pre-competitive domain, this model ensures that intellectual property (IP) stays with the academic institution, with the industry partner having an exclusive acquisition option. Transitioning to competitive domains requires clear, detailed agreements on IP ownership and commercialization pathways before interactions begin. Examples include collaborations such as Chiesi and Karolinska, Crick Institute and AstraZeneca, and the Laboratory of Molecular Biology and AstraZeneca.

For Italy, implementing this model would require overcoming significant challenges. Firstly, strict public-private partnership regulations demand careful navigation by highly specialized teams. Additionally, IP and profit-sharing agreements should be standardized nationally to avoid case-by-case inconsistencies. Furthermore, fostering mutual trust among academia, industry, and the public is vital: training programs, transparency campaigns, and public communication efforts should emphasize the societal benefits of these collaborations, ensuring broad acceptance and understanding.

B. **Consortia** that could be either in the pre-competitive or in the competitive domains.

Consortia can operate in pre-competitive or competitive domains, typically addressing specific medical needs or scientific challenges. They are often formed around a shared goal and have a predefined lifespan.

Consortia acting in the pre-competitive domain can be large and include many players from different sectors and countries. In the competitive domain, negotiating a proper agreement for the sharing of future IP is a bottleneck, and for this reason, these consortia are usually quite small.

These consortia often generate from public calls from large institutions, such as national governments or agencies linked to the European Commission. They often arise from present medical needs, such as epidemics and pandemics, or from diffuse pathologies such as cancer.

Examples: Open-Targets, Structural Genomics Consortium, Enlightten+, European Lead Factory.

To apply such a model in Italy, it is necessary to identify a medical need that is recognized as a priority by academia, industry, and the health system, as well as to identify the know-how offered by academia and the interests of industry. Alternatively, it could be based on a particular domain where Italy is particularly strong, for instance, diagnostics, ATMPS, clinical trials, or production of radio-conjugated therapies. In the absence of a strong indication from the Italian government (as mentioned above, the UK set the goal of becoming a Life Sciences superpower), we would need that one player from industry and one from academia act as catalyzers of the consortium, identify the domain of activity, the goals, rules of interaction, legal framework and then identify other partners. Considering the extraordinary genomic variety present in the Italian population, such a consortium could focus on the sequencing and analysis of Italian genomes. Examples such as the UK and the Scandinavian countries have demonstrated the amazing power of such analysis in improving people's health. Some examples of small projects run by regions like Molise and Valle D'Aosta could be taken as a model for a nationwide scale up. Italy already has all the know-how needed, embedded in research institutes, pharma, and private companies focused on technology, and finally, hospitals.

C. **A national shared technological facility.**

Academic basic research has a very different procedure from R&D in industry. Also, how projects are designed and developed is very different. This is because academia aims at producing knowledge by unraveling the mechanisms of functioning of complex systems (living organisms). Because of its own nature of investigating the unknown, the process is often based on trial-and-error, and it requires continuous generation and updating of

protocols and approaches. Also, academic scientists are totally free to follow the path of discovery mainly based on their curiosity. Moreover, academic research is sustainable because of strong funding from public bodies. Industry, on the contrary, aims at delivering a product that not only must be commercialized, but must be suited to human usage. For this reason, the R&D approach of industry must have a different strategic drive and focus on reproducibility, scalability, risk assessment, and the possibility of recovering the investments.

The proposed facility aims to provide an environment conducive to reducing the risks associated with projects from discovery to proof of concept and pre-clinical investigations. It will also support academic scientists and their projects in aligning with industry strategic goals. Additionally, this facility could serve as a platform for companies to explore opportunities available in academia. A shared facility could synchronize the objectives of both sectors and guide strategic decisions. At present, the only case of competitive collaboration (sharing of infrastructure only) is the Functional Genomic Centre. There are examples of such facilities, but not in sharing/collaboration, such as the Lead Discovery Centre in Dortmund, the CD3 in Leuven, and Catapult UK.

The Italian academic research would benefit from such a facility. In such a model, pharma companies would play the role of final clients because they would be able to buy a product that already fits their standards and strategic plans. In this case, the interaction between academia and pharma is based on choosing the projects that are more appealing to Italian companies and guiding those projects in the right direction. Collaboration could instead be established with private companies that develop and commercialise high-tech equipment, such as DNA sequencers, automation, and, in general, instruments for analysis.

D. **Integrated innovation campuses/districts.**

An integrated campus or district could serve as a hub for fusing the models outlined above, creating a seamless environment for collaboration among hospitals, research centers, and industry. Such a district would allow the co-location of resources, infrastructure, and expertise, facilitating interactions and fostering synergies.

A well-designed campus would include shared laboratories, clinical trial facilities, innovation accelerators, and training centers. It would provide space for pre-competitive collaborations while also supporting competitive R&D projects with clear commercialization pathways. Furthermore, the campus could house a governance body to manage partnerships, allocate resources, and ensure alignment with national innovation strategies.

Italy's MIND (Milano Innovation District) provides a promising example of such a campus, offering a foundation for scaling this model. Beyond infrastructure, this model could catalyze cultural change by encouraging interdisciplinary collaborations, nurturing entrepreneurial mindsets, and aligning stakeholders around shared goals.

For this model to succeed, it is essential to ensure sustained funding, attract diverse stakeholders, and foster international collaboration. It would also benefit from public awareness campaigns to demonstrate how such a district contributes to societal well-being, economic growth, and Italy's global standing in the Life Sciences.

3.3 Next steps: strategic and enabling activities for academia-industry collaboration in Life Sciences

The findings of this Report were shared and validated by the working group with the leadership of each organization during a meeting held on 7 March 2025, attended by and enriched with contributions from Valerio De Molli (Managing Partner & CEO, TEHA Group), Fabrizio Greco (President, Federchimica Assobiotec), Gianmario Verona (President, Fondazione Human Technopole), and Marino Zerial (Director, Fondazione Human Technopole).

The discussion confirmed the strategic relevance of the analysis and opened the door to a potential second phase of work aimed at refining the methodology and translating the proposed models into concrete collaborative initiatives.

Several key priorities emerged from the debate. First, the importance of **adopting clear quantitative criteria and measurable KPIs** to guide the future selection and prioritization of collaborative models to be analyzed was emphasized, with the aim of making benchmarking efforts more targeted and aligned with the specific needs and goals of the Italian ecosystem. Second, participants highlighted the value of **expanding the benchmarking exercise to include extra-European models** - especially from the **United States and China**, with specific reference to the Boston biotech cluster – as a source of inspiration for the Italian context. Third, **the active involvement of venture capital**, both national and international, was identified as a critical factor in bridging the innovation funding gap and strengthening the link between academic research and market application.

The discussion also delved into the cultural and structural factors that currently limit the effectiveness of collaboration between academia and industry. Participants stressed the importance of **preserving academic freedom and scientific excellence**, especially in curiosity-driven research, **as a foundation for breakthrough discoveries**. At the same time, they highlighted the need to complement this with **stronger institutional mechanisms** that can identify, support, and guide those research outcomes that show potential for real-world application. Fostering an entrepreneurial mindset does not mean transforming every researcher into an entrepreneur, but rather building an ecosystem where academic excellence and value creation can coexist through targeted training, professional support structures, and clearer pathways from discovery to innovation. In this context, rethinking academic careers also emerged as a key issue: today's research and innovation ecosystem requires new models that can offer young scientists not only scientific development, but also professional prospects that are attractive, sustainable, and compatible with a broader innovation-driven mission.

Building on these shared insights, a possible next step could involve a broader desk analysis from extra-EU ecosystems, the co-design of pilot programs such as scholarship schemes, and targeted grants and VC-backed initiatives. This potential second phase would aim to test scalable solutions capable of generating measurable results and fostering long-term collaboration between academia and industry.

Beyond the possible development of specific collaborative models, participants agreed on the

importance of identifying a set of strategic and enabling activities that could serve as foundational building blocks for any future academia-industry partnership, designed to function for any configuration ultimately adopted. These cross-cutting actions are intended to strengthen the structural conditions for collaboration, support long-term alignment between stakeholders, and foster a more dynamic and innovation-oriented ecosystem. Together, these initiatives aim to lower operational barriers, enhance mutual understanding, and create fertile ground for scalable and sustainable partnerships in the Life Sciences sector.

The strategic and enabling activities for academia-industry collaboration in Life Sciences identified are the following:

1. **Strategic agenda alignment**
    - Co-create a national agenda on research and innovation in Life Sciences aligned with medical needs, industrial strategies, and academic capabilities.
    - Identify high-potential scientific areas, therapeutic needs, and technological trends relevant to both academia and industry.
    - Set up innovation brokerage mechanisms (e.g., digital platforms, dedicated intermediaries, national collaboration forums) to facilitate early-stage partner matching.

    Aligned with these goals, CITT[25] has established, through its executive Fabio Terragni, a close interaction with industry by coordinating the Federchimica-Assobiotec Industrial Development Working Group. CITT has also organized networking activities with the players of the Italian innovation ecosystem, such as technology transfer officers from academic research institutes, research hospitals, and universities, investors and venture builders, law firms, and industry.

    To align with European practices and models of technology transfer, CITT has studied European models of technology transfer, both through “desk analysis” and study tours in the most important academic institutes in Germany, Switzerland, Austria, Belgium, and the United Kingdom. These studies were instrumental in the writing of this report and also contributed to establishing interactions with the most important technology transfer offices in Europe.

    As a key tool to strengthen bonds with European strategic life science players of innovation, a working group between Italian and Swiss public research institutes and industry has been established to present a project to the INTERREG program.

2. **Shared talent programs**
    - Develop co-funded PhD and Postdoc programs with mixed academic-industry supervision.
    - Promote mobility schemes (e.g., fellowships, sabbaticals, and internships) that allow scientists, engineers, and project managers to spend time in both sectors.

[25] For more details about the activities performed by the HT Centre for Innovation and Technology Transfer, see Appendix.

- Launch "visiting industry scientists" and "entrepreneur-in-residence" programs within universities and research institutes.

To reduce the gap between academia and industry, CITT is committed to training young scientists in the fundamental aspects of technology transfer, providing them with the tools they need to transform the knowledge generated by scientific research into technologies that impact society and improve people's lives. This is done by offering theoretical lectures from experts in the field and inviting startup founders and investors to share their experiences with the audience. Later this year, CITT will promote a workshop to put Italian scientists in contact with the best European experiences of startup creation and spinoff.

Finally, we are developing an entrepreneurship course in collaboration with a major European business school to prepare scientists who want to become startup founders.

To give researchers an overview of the hottest topics in medicine, CITT has established the "Future Trends in Translational Medicine" conference, with the support of Nature Italy. After a successful first edition held in Milan in 2023, the second edition will be held on the 30th and 31st of October 2025 in Naples.

3. **Funding mechanisms & incentives**

- Design blended financing schemes combining public grants, venture capital, and corporate investments to support early-stage collaborative R&D.
- Offer tax incentives for companies investing in shared projects or infrastructure with academia.
- Create competitive seed funds or proof-of-concept grants reserved for academia-industry collaborations.

In this regard, CITT will soon launch an Innovation Program to act as a bridge between academia and industry by funding and supporting the research needed to transform one or more scientific discoveries into disruptive and highly innovative medical technologies, e.g., therapies and devices, capable of solving unmet medical needs, improving human health, and creating new markets. A special focus will be given to precision and personalized medicine.

4. **Shared research infrastructures and technology platforms**

- Facilitate mapping and public cataloguing of existing research infrastructures and capabilities open to collaboration.
- Establish open-access platforms for joint use of advanced equipment, labs, and digital infrastructure.

Within this context, the National Facilities of Human Technopole, with their advanced technologies and know-how, could offer a unique and valuable resource for the R&D and innovation of Italian startups and industry. However, the right mechanisms of public-private partnership must be found to regulate the private sector's access to the NFs.

5. **Pre-collaboration frameworks and templates**

- Co-develop shared frameworks to define value creation for both academia (e.g., publications, impact) and industry (e.g., IP, scalability, market access).
- Design modular, nationally recognized templates for IP management, confidentiality, and benefit-sharing to streamline negotiation.

Appendix

European examples of collaborative research between academia and industry

beLAB2122

beLAB2122 is a collaborative initiative based in Heidelberg, **Germany**, uniting academic **institutions in the Rhine-Main-Neckar region** with **Evotec** and **Bristol Myers Squibb (BMS)** to identify and develop innovative therapeutic targets and platforms. The partnership combines the strengths of cutting-edge academic biomedical research, Evotec's expertise in drug discovery and development, and BMS's industry-leading capabilities.

The initiative provides funding of up to $1.5 million per project, along with access to advanced technological platforms and mentoring, to achieve preclinical proof of concept. A dedicated Evotec drug discovery expert works closely with academic partners to select promising projects and create commercialization strategies. At the end of the funding period, the consortium supports the development of business cases and the creation of spin-offs to bring the research outcomes to market.

Blue Sky collaboration

The **Blue Sky Collaboration** is a groundbreaking partnership established in the UK in 2014 between the **MRC Laboratory of Molecular Biology (LMB)** and **AstraZeneca**. This initiative aims to advance the understanding of fundamental biology and disease while fostering innovative scientific approaches through shared expertise and technologies.

Backed by a combined investment of approximately £18 million ($30 million) — with £12 million ($20 million) contributed by AstraZeneca and £6 million ($10 million) by LMB alongside in-kind scientific support — the collaboration funds preclinical research projects that transcend traditional boundaries.

Scientists from both organizations work closely together, either within the state-of-the-art LMB facilities on the Cambridge Biomedical Campus or in AstraZeneca's research centers. While not explicitly focused on drug development, the projects enrich the broader research and development efforts of both partners, with findings frequently published in peer-reviewed journals.

The initiative is guided by a Joint Steering Committee (JSC) composed of representatives from LMB and AstraZeneca, which selects projects for funding based on their potential for scientific innovation.

Innovate UK Catapult Network

The **Innovate UK Catapult Network** comprises nine cutting-edge technology and innovation centres designed to bridge the gap between research and industry. These independent, not-for-profit organisations operate across more than 50 locations, offering state-of-the-art R&D infrastructure, including laboratories, testbeds, and factories, alongside technical expertise. The **Cell and Gene Therapy Catapult (CGT)** in London focuses on Advanced Therapy Medicinal Products (ATMPs), supporting activities from early R&D to commercialisation. The **Medicines Discovery Catapult (MD)** in Cheshire specialises in drug discovery, particularly in neuroscience, oncology, and infectious diseases, providing experimental planning and data critical for decision-making. Public partners include universities and government entities, while private collaborators include AstraZeneca, Biogen, and GE Healthcare. The network has supported thousands of companies, facilitated clinical trials, and attracted significant investment, such as £525 million raised by CGT collaborators and £600 million leveraged by MD partners. Catapults engage businesses and academia through tailored collaborations, accelerator programmes, and real-world deployment of innovations, fostering systemic impact and scaling up capabilities across sectors.

CD3 Centre for Drug Discovery and Design

The **Centre for Drug Design and Discovery (CD3)**, based in Leuven, Belgium, is a drug discovery centre and investment fund aimed at translating innovative basic research into clinical applications. It operates as both an investment fund, financing drug discovery projects, spin-offs, and biotech companies, and a drug discovery centre, offering state-of-the-art infrastructure and expertise in fields such as medicinal chemistry, organic synthesis, ADME-Tox evaluations, and antibody discovery. CD3 collaborates closely with academic research groups and biotech/pharma partners, with projects ranging from novel biology insights to preclinical candidates. Supported by **KU Leuven** and the **European Investment Fund (EIF)** with an €84 million investment, CD3 has contributed to over 30 projects targeting various disorders. Its flexible structure within KU Leuven Research & Development enables seamless collaboration with internal and external entities. CD3 employs a rigorous project evaluation process involving a Scientific Advisory Board and an

Investment Committee to ensure scientific and financial viability, fostering impactful partnerships that bridge academia and industry.

CEMM and Angelini Ventures

CeMM and **Angelini Ventures** have partnered to support CEMM's Principal Investigators in advancing healthy lifespan expansion initiatives through an innovative academic/entrepreneurial dual-track program. Based in Vienna, Austria, the program combines groundbreaking scientific research at CeMM, an interdisciplinary institute of the Austrian Academy of Sciences, with venture creation driven by Angelini Ventures, the venture capital firm of Angelini Industries. This collaboration integrates scientific and business insights to develop new start-ups and foster impactful innovation. The dual-track approach is designed to create virtuous feedback loops between research and business development, driving progress in understanding aging and promoting healthy lifespan expansion. CeMM provides access to its scientific advisory board, leadership, and spinoff ecosystem, while Angelini Ventures offers expertise in venture creation and connections to an international network of investors and healthcare innovators. This partnership demonstrates a strong commitment to translating research into societal and commercial impact.

EMBL and BII

The collaboration between the **European Molecular Biology Laboratory (EMBL)** and the **Bio Innovation Institute (BII)** of the **Novo Nordisk Foundation** aims to enhance the translation of fundamental research into transformative Life Science innovations. Established through a memorandum of understanding in 2022, the partnership facilitates resource sharing and mutual access to expertise, enabling a stronger innovation ecosystem.

BII's Bio Studio program, designed to stimulate early-stage Life Science start-ups, is a cornerstone of this collaboration, supporting the progression of promising research into innovative products and solutions. EMBL's technology transfer arm, EMBLEM, coordinates these efforts and provides access to EMBL Ventures, a dedicated venture capital fund. The partnership, based in Heidelberg, Germany, and Copenhagen, Denmark, highlights the shared commitment to advancing therapeutic and diagnostic innovations in areas such as cancer, aging-related diseases, diabetes, and liver conditions. Supported by the Novo Nordisk Foundation, this collaboration exemplifies a strategic approach to fostering innovation through co-development and startup creation.

Enlight-ten +

ENLIGHT-TEN+ is a European network that bridges cellular immunology and bioinformatics, aiming to train researchers with expertise in T cell biology and the skills to analyze and interpret large datasets using cutting-edge tools such as artificial intelligence and preclinical models. Supported by Horizon 2020 under the Marie Skłodowska-Curie grant, the consortium includes 15 beneficiaries and 8 partner organizations from 10 European countries. It combines academic excellence with industrial expertise, featuring partners like Bayer AG, CRISPR Therapeutics, and IBM Research. ENLIGHT-TEN+ addresses immune-mediated diseases by identifying novel biomarkers and therapeutic targets, fostering collaboration between academia, industry, and nonscientific entities to create innovative solutions. Through this cross-disciplinary effort, the network bridges the gap between fundamental research and its translational applications.

European Lead Factory

The **European Lead Factory (ELF)**, a public-private partnership funded by the **Innovative Medicines Initiative (IMI)**, operated from 2013 to 2023 to advance early-stage drug discovery in Europe. Bringing together 37 partners, including 13 academic institutions, 10 EFPIA members, and 10 SMEs, ELF created a vast compound library of over 535,000 high-quality chemical compounds, combining contributions from pharmaceutical companies and newly synthesized compounds by SMEs and academics. The European Screening Centre facilitated high-throughput screening of various therapeutic targets across diverse disease areas, leading to over 200 drug discovery programs, 100 publications, nine patent applications, and two candidate drugs now in Phase 1 clinical trials. ELF's legacy includes a robust infrastructure for collaborative research, two spin-offs (Scandicure and Keapstone Therapeutics), and innovations such as a potential solution to reverse antibiotic resistance. The initiative fostered pre-competitive collaboration through co-development and resource sharing, making its advanced resources accessible to researchers across Europe.

Functional Genomic Centre

The **Functional Genomics Centre (FGC)**, established in 2019, is a collaborative initiative between **AstraZeneca** and **Cancer Research UK's (CRUK) Cancer Research Horizons**, focusing on CRISPR and functional genomics to advance cancer research. Based at the Milner Therapeutics Institute in Cambridge, FGC supports independent projects by AstraZeneca and CRUK while jointly developing advanced genomic technologies. The Centre aims to deepen understanding of cancer biology, identify therapeutic targets, and investigate drug resistance. Open to academic collaborations, FGC allows researchers to access its cutting-edge facilities, with CRUK subsidizing costs for its grant recipients. Despite shared infrastructure, data and results from AstraZeneca and CRUK projects remain independent.

Innovative Health Initiative (IHI)

The **Innovative Health Initiative (IHI)**, established in 2021, is a public-private partnership between the European Union and Life Sciences industry leaders, expanding on the scope of its predecessors, IMI1 and IMI2. IHI integrates the pharmaceutical, medical technology, biotechnology, digital health, and vaccine sectors to address unmet public health needs. It supports pre-competitive research spanning prevention, diagnosis, and treatment, fostering innovation in molecules, technologies, regulatory science, and in silico trials.

Based in Brussels, Belgium, IHI operates on a substantial budget of €2.4 billion for 2021-2027, funded jointly by Horizon Europe (€1.2 billion) and contributions from industry partners (€1 billion) and other contributors (€200 million). Its projects have driven nearly 600 scientific advancements, over 50 regulatory contributions, and thousands of publications, enhancing Europe's global health competitiveness.

Lead Discovery Centre

The **Lead Discovery Center (LDC)**, established in 2008 by **Max Planck Innovation**, serves as a premier hub for translating basic research into commercially viable pharmaceutical discoveries. With a highly professional and flexible structure, the LDC acts as a bridge between academia and industry, catalyzing technology transfer and fostering innovation.

A pivotal element of the LDC's success is the **KHAN Technology Transfer Fund**, which has committed €70 million since 2019 to support research projects from academic institutions and European spin-offs. This funding enables the LDC to drive projects from target discovery to preclinical proof of concept, promote the creation of startups and spin-offs, and accelerate the transformation of academic findings into market-ready technologies. With a team of around 120 experts—85% of whom hold PhDs and possess extensive experience in the pharmaceutical and biotech sectors—the LDC manages a portfolio of over 20 active projects across various therapeutic areas. Its strong network of collaborations with leading academic institutions and global companies further enhances its impact.

Manic (IBM)

The **MANiC project (Materials for Neuromorphic Circuits)** is a multidisciplinary research initiative funded by the European Commission through the Horizon 2020 Marie Skłodowska-Curie ITN Programme. Launched in 2020, MANiC aims to advance neuromorphic computing by developing innovative materials and architectures inspired by the human brain's efficiency and adaptability.

This ambitious project brings together leading academic and industry partners across Europe, including **IBM Research (Switzerland)**, the **University of Cambridge (UK)**, the **Ecole Polytechnique Fédérale de Lausanne (Switzerland)**, and **Forschungszentrum Jülich (Germany)**. MANiC provides advanced multidisciplinary training to 15 Early Stage Researchers, equipping them with expertise at the intersection of materials science, physics, computer science, and engineering. The program also includes industrial placements, fostering a deeper understanding of R&D strategies and business applications.

Open Targets

Open Targets is an innovative large-scale collaboration between public and private partners, established in 2014 with the aim of improving the identification and prioritization of drug targets using human genetic and genomic data. This partnership, positioned within the realm of pre-competitive research, was founded by **EMBL-EBI**, the **Wellcome Sanger Institute**, and **GSK**, and later expanded to include industry leaders such as Pfizer, Sanofi, MSD, and Genentech.

Open Targets stands out for its collaborative and integrated approach, bringing together high-level expertise from academic and industrial institutions to address the challenges of biomedical innovation. Its organizational structure is designed to support interdisciplinary, multi-year research, guided by a strategic and scientific leadership team that sets the consortium's priorities and selects projects.

Open Targets goes beyond generating new knowledge by creating tools and platforms that facilitate data sharing and improve biomedical research. The Open Targets Platform and Open Targets Genetics are concrete examples of how this collaboration has built accessible and high-value resources for the scientific and industrial sectors.

Oslo Cancer Cluster

Oslo Cancer Cluster (OCC) is a non-profit industrial and research cluster based in Oslo, Norway, dedicated to advancing cancer research and treatment by fostering collaboration among over 90 members spanning academia, biotech, global pharma, and investors. Focused on precision medicine, digitalization, and public-private partnerships, OCC supports start-ups, innovation parks, and incubators, aiming to position Norway as a leader in cancer treatments like cell therapy and radiopharmacology. Members benefit from access to international networks, R&D support, and skill development programs, contributing to a dynamic ecosystem for oncology innovation.

Persist-Seq

PERSIST-SEQ is a European consortium dedicated to improving the understanding of therapeutic resistance in cancer and developing strategies to enhance treatments and prevent drug resistance. Funded by the **Innovative Medicines Initiative (IMI)** under Horizon 2020 with a €14 million budget, the project involves 14 partners, including AstraZeneca, Bayer, and the Wellcome Sanger Institute. PERSIST-SEQ focuses on advancing single-cell sequencing workflows and promoting an open-access model for data sharing and benchmarking. Its outcomes aim to reduce clinical trial costs, integrate single-cell technologies into cancer research, and improve long-term cancer treatment outcomes, enhancing Europe's global competitiveness in oncology innovation.

Structural Genomic Consortium

The **Structural Genomics Consortium (SGC)** is a global public-private partnership dedicated to advancing early drug discovery through open science principles. Bringing together over 250 researchers and nine leading pharmaceutical companies, including Bayer, Pfizer, and Takeda, the SGC has secured more than $400 million in R&D funding since its inception. With laboratories at institutions such as Karolinska Institutet and the University of Toronto, the SGC collaborates across academia and industry to develop high-quality protein structures and chemical probes. Its achievements include determining over 4,000 protein structures, creating more than 200 chemical probes, and distributing 50,000 samples globally, which have inspired over 85 clinical trials. The SGC also leads Target 2035, an initiative to develop chemical probes for every human protein, aiming to revolutionize computational drug discovery using artificial intelligence and machine learning. Governed by a Board of Directors and supported by major funders, the SGC is a cornerstone of open innovation, accelerating research while making its outputs freely accessible.

The Italian Life Sciences Ecosystem

Italy boasts a broad and diverse Life Sciences ecosystem, distinguished by the presence of top-tier universities, cutting-edge research centers, technology parks, and innovative networks, as well as a leading pharmaceutical and biotechnology industry.

To outline a reference framework for a collaborative research model that aligns with Italy's unique characteristics, it is essential to first understand the current structure of the Life Sciences landscape in the country, analyzing its key players and their interconnections.

The ecosystem is structured around four fundamental pillars:

- **Universities (Academia)**: universities play a crucial role in talent development and the advancement of both basic and applied research. Many actively participate in European projects and collaborate with companies and research institutes to enhance technology transfer.
- **Research centers**: public and private organizations dedicated to scientific research and technological innovation in the biomedical, pharmaceutical, and biotechnological fields. Some of them are recognized as Scientific Institutes for Research, Hospitalization, and Healthcare (IRCCS), with a strong focus on translational research.
- **Technology parks and networks**: these structures serve as hubs for innovation, facilitating collaboration between businesses, researchers, and startups, while promoting technology transfer activities and the development of new solutions in the Life Sciences field.
- **Companies (Industry)**: the industrial sector comprises large pharmaceutical, biotechnological, and diagnostic groups, as well as a network of highly specialized SMEs. These companies represent the productive backbone of the sector and play a key role in valorizing scientific research outcomes.

The mapping presented in the following sections is not exhaustive but provides a representative overview of the key players operating in Italy's Life Sciences sector. The aim is to offer a reference point for understanding the context in which collaborations between research and industry develop, analyzing both potential and critical aspects. This analysis serves as the starting point for defining an innovation model based on cooperation between academia and industry, one that can leverage Italian excellence while bridging the gap with more structured European ecosystems.

UNIVERSITIES

Name	Location	EU Horizon Europe contribution in LS
Università degli Studi di Padova	Padova	€32,482,994
Politecnico di Milano	Milano	€27,178,483
Alma Mater Studiorum – Università di Bologna	Bologna	€20,696,356
Università degli Studi di Milano	Milano	€19,400,777
Università degli Studi di Torino	Torino	€13,938,525

Università degli Studi di Trento	Trento	€9,923,088
Università degli Studi di Pavia	Pavia	€9,841,843
Università Vita-Salute San Raffaele	Milano	€9,444,574
Università degli Studi di Napoli Federico II	Napoli	€8,894,645
Università degli Studi di Verona	Verona	€8,215,538

RESEARCH CENTERS

Name	Description	Location
Fondazione Telethon	Foundation focused on research and treatment of rare genetic diseases	Milano
IRCCS Monzino	IRCCS entirely dedicated to research, treatment, and prevention of cardiovascular diseases	Milano
Istituto Europeo di Oncologia - IEO	Non-profit institute engaged in clinical practice, research, and education, with a focus on cancer	Milano
Istituto Italiano di Tecnologia	Research institute in four main domains: Computational Sciences, Life Sciences Technologies (Life Tech), Nanomaterials, and Robotics. Life Tech focuses on developing tools for advanced molecular genetics, electrophysiology, computational analysis, and imaging to analyze the microscopic neural processes underlying brain function	Genova
TIGEM	Multidisciplinary research institute dedicated to studying the mechanisms of rare genetic diseases and developing innovative therapies. Supported by Fondazione Telethon, the European Community, and various funding agencies	Napoli

TECHNOLOGY PARKS / NETWORKS

Name	Description	Location
AREA Science Park	National Research Institution supervised by the Ministry of University and Research (MUR), managing a science park focused on Life Sciences, advanced materials, and data engineering	Trieste
Bioindustry Park Silvano Fumero	Science and Technology Park designed to foster the creation and growth of innovative companies and to connect businesses with research centers and universities	Torino
Cluster Scienze della Vita FVG	Regional system of businesses and public and private entities focused on health, quality of life, agri-food, and bioeconomy	Pordenone
Netval	Network di Università, Enti Pubblici di Ricerca, IRCCS ed alri enti che operano nel settore della promozione dell'innovazione e del trasferimento tecnologico	Pavia
Parco Tecnologico Padano – Science Park	Spin-off of the Fondazione Parco Tecnologico Padano, with a mission to promote scientific research and technology transfer in agri-food, Life Sciences, and bioeconomy sectors	Lodi
Toscana Life Sciences	Foundation supporting the startup process of biotech companies focused on human health, orphan diseases research, biomedical technology transfer, and national and international networking	Siena
Trentino Sviluppo	Organization of the Autonomous Province of Trento supporting businesses, innovation, and territorial marketing	Rovereto

COMPANIES

Nome	Focus	Sede	Fatturato
Alfasigma	Gastroenterology, vascular medicine, orthopedics and rheumatology, metabolic diseases, pulmonology, gynecology and urology, self-medication	Bologna	€1,4 bln
Angelini	Mental health, pain management, antibiotic therapy, fever and cold-related diseases, disinfection, dietary supplements, and personal care	Roma	€2,1 bln
Bracco	Cardiology, imaging diagnostics	Milano	€1,7 bln
Chiesi	Respiratory health, rare diseases, neonatology, consumer healthcare	Parma	€3 bln
Diasorin	Infectious diseases, gastrointestinal diseases, hepatitis, endocrinology, metabolic disorders, oncology diagnostics	Vercelli	€446 bln
Dompé	Ophthalmology, primary care, pulmonary hypertension	Milano	€972 bln
Menarini	Pharmaceuticals, consumer healthcare, oncology, dermatology & aesthetics, diagnostics	Firenze	€4,4 bln
Recordati	Cardiovascular diseases, urological diseases, digestive system disorders, respiratory diseases, endocrine diseases, oncology, metabolic diseases	Milano	€557,4 mln
Zambon	Severe respiratory diseases, pain management, neurological disorders, respiratory system diseases, and urological system	Bresso	€899 mln

The Fondazione Human Technopole Centre for Innovation and Technology Transfer's activities

The Centre for Innovation and Technology Transfer (CITT) of Human Technopole undertakes initiatives aimed at supporting the technology transfer system in Italy, following a strategic approach based on three pillars: training, networking, and international relations, including the study of foreign models of technology transfer. In addition, an intensive research effort has been carried out, through desk analysis and study tours, focusing on forms of collaborative research between academic and industrial actors in the life sciences sector at the European level.

CITT organizes initiatives on technology transfer and related topics to support Italian universities and research institutions in training students and scientists on the mechanisms for valorizing their discoveries. These activities are delivered through in-person courses, motivational workshops, and online seminars.

Our partners and collaborators have so far included Netval (Network for Research Valorisation) and IUSS Pavia (School for Advanced Studies), the Business Development and Technology Transfer Division of the San Raffaele Hospital in Milan, the University of Milan, the CDP Extend hub, Italian Tech Alliance, Chelonia SA, and Exscalate.

In October 2025, we will organize a school entitled "European Success Stories in Translational Medicine", in partnership with relevant research institutions from Germany, Austria, and the UK, such as Max Planck Innovation, xista, and the MRC. The initiative aims to connect Italian researchers with the best European practices in startup creation strategies by presenting case studies and sharing experiences. In the spirit of scientific retreats, the event will be held in a scenic lakeside location in Northern Italy.

Complementary to the training activity is the networking activity. CITT has contributed to strengthening the network of professionals in the Italian technology transfer sector through meetings and discussions on topics of mutual interest, such as the reform of the industrial property code in Italy, the Golden Power discipline, the interaction with investors, and how companies organize their open innovation programs. Recently, we contributed to the EU Startup and Scaleup Strategy debate with a workshop held in the MIND District during its flagship innovation week, focusing on Europe's endeavors to make its innovation ecosystem more attractive. The event provided an overview of European tools and opportunities supporting research, knowledge valorization, and innovation, focusing on policies, national perspectives, and future strategies. We also visited the OpenZone Science Campus in Bresso, Lombardy, and met some Zoners, including GCA Biologics and Sibylla Biotech, and learned about Zambon's effort to bridge science and innovation.

CITT organised a conference titled "Future Trends in Translational Medicine," in collaboration with Nature Italy and Nature Conferences, to encourage researchers in the early stages of their careers to pursue pathways for enhancing the value of their research for the benefit of

society. The conference serves as a context to discuss new frontiers of research in the life sciences, stimulating debate on the social impact of innovation and how society's needs can help guide research.

The first edition was successfully held in Milan, featuring panels on Gene Therapy and RNA, Data Science and Genomics, AI for Life Sciences, and Organoids for drug discovery and personalised medicine. Each day opened with a keynote speech delivered by Open Targets' CEO, David Hulcoop, and Humanitas' Scientific Director, Alberto Mantovani. The second edition will be held in Naples on 30 and 31 October 2025, covering Metabolism, Cancer, Rare Genetic Disorders, Gene Therapy and RNA Therapeutics.

International relations and the study of foreign models of technology transfer have been carried out in the form of study tours, aimed at fostering interaction between the Italian technology transfer system and those of other European countries. The goal is to explore models potentially applicable to the Italian context, learn about funding opportunities at the European level, and attract researchers and capital toward the innovation produced in Italy.

In 2024, we organized three missions to the United Kingdom, Germany, and Belgium.

In the UK, the mission aimed to delve into the public-private collaborative research model managed by Open Targets and discover how LifeArc handles technology transfer for the Laboratory of Molecular Biology of the MRC, one of the world's leading institutes in molecular biology. Discoveries from this institute have led to 13 Nobel Prizes and therapies and technologies that have revolutionized medicine.

In Germany, CITT visited the Lead Discovery Center in Dortmund and Max Planck Innovation in Munich, accompanied by Professor Marino Zerial, Director of the Human Technopole Foundation. The Max Planck Society is one of the most prominent institutions in basic research in Germany – and globally.

In Belgium, we visited the Brussels South Charleroi Biopark (ULB) and KU Leuven's LRD, a leading example in technology transfer. Indeed, the latter generates approximately EUR 400 million annually from its technology transfer activities – funding nearly one-third of the university's overall payroll.

This year, our well-established relations with some Swiss institutions have led to applying to the KTTH-Alps project as part of the INTERREG program, supporting trans-border collaborations. The project KTTH-Alps aims to enhance economic growth and technological advancement in the border regions between Italy and Switzerland through a collaborative open innovation program in Life Sciences. By fostering a long-term network for Knowledge and Technology Transfer (KTT), the project seeks to establish a shared identity between the two countries in these fields. A matchmaking platform will support the network to help identify common interests and develop innovative projects between the two regions. The initiative will promote knowledge dissemination and entrepreneurial culture among students, scientists, and academics. Strengthening interactions between academia, start-ups, SMEs, and industry will be a key strategy to drive innovation and business development. The project proposal has been submitted in collaboration

with Chelonia, a Swiss company focused on drug repurposing, Politecnico di Milano, Università del Piemonte Orientale, and SUPSI – Scuola Universitaria Professionale della Svizzera Italiana.

As this report highlights, Italian research institutions are less effective than other European countries in transferring the knowledge they produce into technologies that benefit society. Access to funds is one reason for this gap. Indeed, the amount of funds available to support innovation in Italy is five to ten times lower than in other countries.

Italy does not have a network of startup accelerators and incubators in the USA or other European countries. Moreover, the offer of scientific and strategic management services to support startup maturation is not as rich as abroad. As a result, most inventions cannot leave laboratories and mature in an appropriate industrial environment.

Entrepreneurship culture and training among Italian scientists and researchers are another reason for the innovation gap in Italy compared to other countries. Italian students from STEM disciplines rarely receive formal training on startup creation, business administration, finance, marketing, strategic management, and communication. Such studies are often limited to economic disciplines, and there is rarely any contamination between economic and STEM faculties.

The Centre for Innovation and Technology Transfer would like to contribute to reducing the innovation gap described in this report in several ways. Besides proposing the setting of a collaborative research model between academia and industry, CITT will soon present a program to support the industrial maturation of biomedical technologies from academic research institutes in the Lombardy region.

The CITT Innovation Program will offer financial support to run proof of concept experiments in relevant environments, analyse the IP and market landscape, and define a business model and business plan. On top of the financial support, the Program will offer the selected projects an environment suited to the maturation of their business idea, including equipped laboratories, startups, technologies, and business nursery support. The program will offer mentorship and a school of entrepreneurship to provide the program winners with training and tools to create their startups.

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