13. How to engage with business in the field of research and innovation

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INTRODUCTION

Among the ways to build partnerships between business stakeholders and universities, technology transfer, or knowledge and technology transfer (KT), plays a significant role. The Alliance of Technology Transfer Professionals (ATTP 2023a) defines KT as a collaborative endeavour to translate knowledge and research into impact in society and the economy (ATTP 2023b).

These transfers are driven by the need for companies to innovate and universities' obligation to disseminate and valorise their research knowledge. Companies face pressure from the market, customers, competitors, and regulations, leading to more cooperation through open innovation, including research and development (R&D) projects and common creation of intellectual property (IP).

Universities and public research organisations are obligated by law and common sense to make good use of public funding. They are expected to contribute to society by addressing societal and economic challenges through their knowledge and output, in addition to their traditional purposes of research and teaching (Compagnucci and Spigarelli 2023).

Governments, funders, and policymakers expect public research investment to generate value beyond publications in specialised journals and books. Further valorisation requires collaboration with social and commercial stakeholders to transform knowledge into valuable outputs such as new products and services for society. It is important to note that these considerations extend beyond business activities, as the overall expectation is to create a positive impact in terms of environment, social cohesion, well-being, etc.

As stated in the European Commission publication on KT Metrics (Campbell et al. 2020), the various channels for KT involve different stakeholders like companies, start-ups, policymakers, and citizens. Consequently, KT is often a complex, risky, and expensive process. Achieving effective transfer may involve students, researchers, academics, public KT and industry professionals

engaged in training, collaborative research, consultancy, IP protection, licensing, networking, and spin-off creation.

The focus of this discussion will primarily be on research-related activities.

MUTUAL INTEREST

R&D partnerships can arise from academic ideas, business needs, joint discussions, and personal interactions. The opposition between 'pure' fundamental research and applied research has no justification in academia. Excellence is required throughout the continuum of research, from basic mechanisms to solving practical issues. Collaborations with industry can pose additional challenges for researchers compared to their traditional focus on publication. Industry must navigate a different world with specific timelines, vocabulary, and objectives when working with public research. However, once mutual understanding is achieved, the rewards are significant. Industrial expectations often drive high-level scientific knowledge and research, requiring specialised expertise and resources. Industrial problems generate new ideas and research directions, and collaborations offer access to unique infrastructures and resources for field testing. This is particularly relevant in domains such as energy and big data.

Although some multinational companies have developed impressive R&D capacity in areas like artificial intelligence, public research continues to be a unique source of ideas, creativity, and preliminary developments crucial for solving major challenges faced by humanity. This has been evident recently in the field of health and vaccines. Research collaborations offer new knowledge and solutions to industrial problems, often leading to the creation of IP that provides a competitive advantage to private partners.

The academic world benefits from IP, albeit in different ways than industry. Collaborations not only result in scientific publications but also contribute valuable intellectual assets through the production and protection of IP. Additionally, universities gain immediate financial resources from their partners and various public funds dedicated to research, innovation, and growth. This funding supports research collaborative projects, enabling the acquisition of necessary resources and the improvement of facilities in public research laboratories. For many public universities, this income can account for a significant portion of their global budget, although public funding primarily allocated to staff expenses remains the major contributor.

Numerous international associations such as ASTP, AUTM, SARIMA, PraxisAuril, CURIE, NETVAL, and others provide data on industry–academia collaborations and the transfer of IP rights. The financial data indicates that the academic revenue model for joint industry–university innovation relies heavily on research project funding, with a smaller income generated from

IP exploitation through licensing, IP assignment, or spin-off valorisation. For instance, in 24 European countries, research agreements account for €2.7 billion in revenue, while IP brings in €0.75 billion (ASTP survey 2022). Similarly, in France, research contracts amount to €1 billion, while IP exploitation contributes €0.2 billion (CURIE survey 2021).

Although finances are important, universities and public research organisations prioritise making an impact, which should be measured using indicators beyond just income. KT involves monetary aspects, but the primary focus is not solely financial gain.

Furthermore, the collaboration between industry and academia in research and innovation projects is driven by the human factor. Young scientists play a vital role in the operations and growth of public research institutions and provide private companies with skilled professionals who can integrate external discoveries and develop in-house innovative solutions. Collaborations also allow for the recruitment of students, postgraduate, or PhD candidates, who ideally should join local companies during or after the research project, thereby fostering a culture of R&D in small and medium-sized enterprises. France has implemented an interesting funding scheme for industrial PhD projects, leading to the recruitment of PhD candidates by the industrial partner. These candidates are often offered permanent positions in the company after graduation (Plantec et al. 2023). This approach can be a powerful tool, particularly in the development of a local innovative eco-system.

THE FIRST STEPS

R&D and innovation public–private partnerships often arise from personal connections, but various mechanisms have been created to encourage collaboration between companies and universities. These mechanisms involve public funding to support regional, national, and international strategies that aim for growth and sustainability. Dedicated bodies and organisations invest resources in facilitating partnerships, helping design viable projects, selecting the best candidates, and providing funding. However, the evaluation of project outcomes is typically not as robust as the pre-award assessment phase, despite its importance in optimising the use of public funds. Information about these partnerships can be found on the communication channels of ministries for research, industry, and economy.

Many countries have established specialised agencies and organisations (innovation agencies, clusters) to identify skills and needs and facilitate collaborations. Trade and invest offices promote international business and showcase local R&D resources to attract foreign companies. The selection of the right partner should be based on their ability to deliver, with the research partner providing quality science and knowledge and the industrial partner having the

capability to integrate and transform that knowledge into marketable products/services. While the market may not be relevant for pure research projects, the objectives of any project must align with the capabilities and mission of the partners involved to avoid potential failures.

Typical mistakes arise from a lack of understanding of expected outputs, incapacity to grasp industrial requests and constraints, ignorance of research timeframes and risks, insufficient resources (staff, money, equipment, etc.), and underestimation of the effort required to absorb and apply new knowledge.

Before starting a project, it is advisable for both parties to undergo a 'know your partner' process and minimal due diligence to prevent disappointment or disputes.

Once the partners' consortium quality is established and objectives are clear and shared, the focus shifts to financial engineering and funding. Government support for private companies has made it uncommon for innovation or R&D projects to be solely funded by a private partner. Even without seeking direct public funding, companies often benefit from tax incentives (OECD 2022) that indirectly support public–private partnerships.

WHAT TYPES OF LINKS CAN BE ESTABLISHED?

The first stage focuses on R&D and innovation public–private projects or partnerships, including forming notable teams, defining an ambitious research programme, setting objectives, determining required resources, developing a financial plan, and establishing a dissemination and transfer plan. For stakeholders unfamiliar with each other, a more simple and rapid approach like consultancy or service contracts could be used to initiate a testing phase. Engaging in scientific discussions and industrial questioning can help build trust and lead to more structured collaborations. An intermediary phase may require validations and preliminary experiments under a service agreement. Potential collaborations between companies/business and research providers vary widely (OECD 2013) and can be categorised as follows (duration may vary by country and field) (Table 13.1).

Two additional specific mechanisms for interaction with business can be tackled, as follows.

Table 13.1 Range of potential collaborations between business and research providers

Type of Action	Duration and Cost	Comments
Consultancy	Days–weeks x K€	Based on individual skills of permanent academic staff
Service contract	Days–months x–xx K€	Uses specific skills, materials, equipment, existing know-how, methods, data
Research collaboration	Months–years xx K€–x M€	Usually requests additional recruitments (including PhD candidate for 3–4 years, post-doc for 1–2 years)
Chairs	3–10 years x M€	Several types of chairs exist. Often assimilated to donations, with tax incentives but no direct counterpart to the funder
Joint laboratory	3–5 years x M€	Specific to each country

Table 13.2 Intellectual property interest and use

Academia	Industry
Patrimony and assets valorisation, investment protection	
Visibility and basis for new partnerships (competitive advantage)	Market protection, monopoly (competitive advantage)
Licensing out	Licensing out/licensing in Balance in negotiations/cross-licensing
Image, reputation, attractiveness	
Staff recognition and motivation (financial incentives)	
Support to economic growth	
Support to start-up creation (spin-offs)	Spin-outs
Key performance indicators, rankings	
	Support to standards

Intellectual Property Rights Agreements

The university has developed scientific or technical results that have been protected through IP tools such as copyrights, patents, and designs. A partner will be sought using business intelligence, and the IP rights will be offered through a licensing agreement providing international protection. If the IP was obtained through collaboration with a private company, this initial partner is naturally the logical choice for the exploitation of the IP. However, they may not always be the best choice for exploitation due to internal strategy, lack of resources, or inability to reach the market. In this case, the university may search for a more suitable partner or help create a new actor. It should be noted that IP interest and use differ between businesses and universities (Farrell 2009; Ollivier and Winnove 2013; Lallement 2014) (Table 13.2).

Spin-Off Creation

In this case, a new service or product can be envisioned and the value chain analysis indicates potential for a new innovative company. There are numerous conditions to meet for successful spin-off creation and development, extensively covered in academic literature (Odei and Novak 2023), European consortia reports (CHARM-EU 2023), and the experiences of various incubators worldwide (multiple networks exist across all continents; e.g., European Business Network). The key factors for initial success are logically the team, product, and market. Some professionals even consider the three main factors to be the team, the team, and the team.

Start-ups, innovative young companies with high growth potential, often rely on IP to gain a crucial competitive advantage and attract investors (assuming a top-notch team, well-defined product, and suitable market). When the IP is owned by a university, the start-up is referred to as a spin-off and obtains a license from the university under fair and reasonable terms. Since a university's expectations differ from those of investors (including early-stage investors and business angels), the licensing conditions can be more lenient compared to those granted to global players or big pharmaceutical companies. The university's third mission allows us to understand that the main purpose of licensing to spin-offs is not solely profit-driven. However, the creation of the IP supporting the spin-off's existence is a result of public academic investment (including salaries, time, equipment, infrastructure, and IP costs), thus necessitating a fair return for the university, besides the spin-off and other investors' return on investment.

One could argue that the university expects a financial return comparable to a low-yield patient investment, based on a fair share of the created value. This allows to fix licensing conditions avoiding the spin-off unnecessary financial

burden during the first years of its development. Many universities accept a mix of royalties and equities to minimise the initial cash-out for the spin-off. Some economic research suggests that the optimal license should use a triple mix of fixed fee–equity–royalty (Savva and Taneri 2014, for those appreciating maths and Latin).

Regardless of the chosen approach, IP transfer and creation of a minimum viable product or service typically requires an intermediary phase called proof of concept (PoC) or maturation. Specific PoC funding is provided by most countries and the European Commission, and evaluations of these schemes have been published (Denis et al. 2022). PoC projects are generally short to medium term (1–2 years), with a moderate budget and require thorough management to ensure that both scientific developments and the final objective of increasing project maturity are kept in mind. In addition to the well-known technological maturity scale, the Technological Readiness Level, it is recommended to consider the maturity of IP, market access, team quality, etc. The Royal Institute of Technology in Sweden, KTH, has developed a useful tool for assessing innovation readiness levels (https://kthinnovationreadinesslevel.com).

WHO MUST BE INVOLVED ?

A crucial factor in any business–academic relationship is the team involved: their complementary skills, intentions, and responsibilities need to be gathered and clearly expressed. This is especially important in R&D and innovation, where scientific and technical staff must align with non-science-focused colleagues and partners. On the industrial side, multiple departments, such as legal, marketing, and business, may be involved besides production or R&D teams. In smaller companies, the chief executive officer often lacks support for discussing business opportunities or strategy, while larger enterprises may have an innovation office. Regardless of the situation, it is important to identify the decision-maker during project preparation, contract negotiation and signature, project implementation, and follow-up, including the transformation of project results into valuable assets and business. Many negotiations become lengthy and painful because the individuals involved, typically R&D staff, lack the authority to engage legally. The same goes for public scientists, researchers, and professors who are not legal representatives of their university or public research organisation. This highlights the necessity of establishing a team from the beginning, which may include internal and external facilitation and support staff.

On the academic side, research providers have organised themselves and most institutions have dedicated offices for research partnerships and innovation. Keywords such as innovation, partnerships, IP, commercialisation, busi-

ness, valorisation, tech transfer, KT, industrial liaison, and research contracts can help locate the appropriate office within the university or its subsidiaries. The commonly used internationally agreed term is tech transfer office (TTO) or knowledge transfer office.

The TTO collaborates with researchers (principal investigators) to prepare research projects, initiate partner searches, and design research valorisation and KT strategies. External advice from the eco-system can be sought in some cases. A best practice is to involve innovation agencies or business networks in university KT plans and activities. It should be noted that the business world lacks a comparable organisational structure, although some larger companies may have established innovation services, open innovation teams, or positions dedicated to academic partnerships.

The TTO provides advice to researchers, manages partnerships and academic IP portfolio, oversees PoC projects (sometimes hiring additional business advisors for market insights), negotiates research collaboration and licensing agreements (working with other university offices for legal, value-added tax, finance, and data protection), and requires skilled individuals and professional tools for project and IP management. European and national initiatives emphasise capacity building in this area.

CONCLUSION

Joint R&D and innovation involve knowledge creation and transfer. Business and academia contribute different skills and means, and the primary challenge is to identify a meaningful topic that adds value to both partners and society. This includes new scientific results for publication, IP, and pathways to economic, environmental, and social impact. The second challenge is forming the right team from the inception, especially in the case of business creation through a spin-off. Additionally, the relationship must be balanced in terms of resources, project management, and sharing project outputs. This requires a state of mind focused on public–private convergence of interest, mutual understanding, respect, and trust. Thousands of KT professionals are dedicated to these challenges, particularly in supporting scientific staff in universities and public research organisations. They play a crucial role in bringing science and business together to find solutions to the significant challenges faced by humanity.

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