IP EXPERIENCE

Best Practices on IP valorization:

Handbook on Italian and Spanish best practices of Intellectual Property exploitation in an academic context

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COVER IMAGE
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EDITION
Version 1.1 – 21st December 2020.
Freely available on this website https://www.ip-experience.eu/handbook/

This handbook has been developed in the frame of the *IP EXPERIENCE – Intellectual Property Experiential Program* project. The Project has been co-funded by the European Union Intellectual Property Office-EUIPO (GR/001/19, Lot 2: Reaching consumers/citizens and especially young people, Application reference n° 0185, Agreement Number 1320190007). For further information visit www.ip-experience.eu .
Project Partners are:
- Fondazione Politecnico di Milano (project leader), www.fondazionepolitecnico.it;
- Politecnico di Milano - Technology Transfer Office TTO, www.polimi.it;
- PoliHub - Innovation Park & Startup Accelerator, www.polihub.it;
- Universitat Politecnica de Catalunya, https://www.upc.edu/ca.

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1. INTRODUCTION: Why talk about the strategic value of intellectual property rights?

By Filippo Silipigni

Intellectual Property Rights (IPRs) are traditionally linked to the ability to fight counterfeiting and piracy and in the context of the global market, SMEs declare strongly that the main reasons for registering IPRs are to prevent others from copying their products or services and to ensure greater legal certainty (EUIPO IP SME SCOREBOARD 2019).
Besides, another aspect of Intellectual Property has been arising and has some untapped potential to grow further: the strategic value brought by Intellectual Property Rights into business activities.
Today this factor appears to be nevertheless of great importance not only for enterprises and companies that already compete on the market, but also for start-ups and new entrepreneurial activities that need to grow and to achieve a higher level of maturity, and for universities and public research organizations that have recently established the concept of "Third Mission".
However, despite the different and specific reasons that could drive the actions and attitudes of the actors cited above to register IPRs for strategic objectives, the lack of knowledge on Intellectual Property Rights (IPRs) is still the main reason for failing to register IPRs (EUIPO IP SME SCOREBOARD 2019) and wider and deeper diffusion and understanding of IPRs and their impact on the economy needs to be pursued.
In such a context, the IP EXPERIENCE project aims to sensitize and empower university students, researchers, and young entrepreneurs on the strategic value that Intellectual Property Rights bring into their future business activities.
As an output of the project, the present handbook aims to shine a light on the theme of the strategic value of Intellectual Property rights in the context of Universities, focusing on the theme of IP valorisation, sharing the experiences of university-industry collaborations made by Politecnico di Milano, Milan and Universitat Politecnica de Catalunya, Barcelona.

How can Intellectual Property become a valuable asset in the context of Universities? What are the possible approaches to valorise an idea in the context of the university? How to evaluate the patentability and the registration requirements, and how to calculate the value of an intangible asset? What are the possible exploitation strategies for the results coming from scientific and industrial research?

To provide answers to the above questions, the handbook will present:

- A general overview of the importance of IP protection and valorisation processes in universities and the approaches adopted by Politecnico di Milano and Universitat Politecnica de Catalunya;
- A typical path for the creation of value and definition of an exploitation strategy for target ideas and some well-established initiatives currently ongoing in the two universities;
- The processes adopted by the two universities to evaluate the patentability and the registration requirements for a new idea and how to estimate the value of an intellectual property asset;
- The recurrent practices and approaches to proficiently exploit the results coming from academic-industry collaborations;
- The valorisation of IPRs through the creation of a university spin-off.

The learning objectives of the present handbook are:

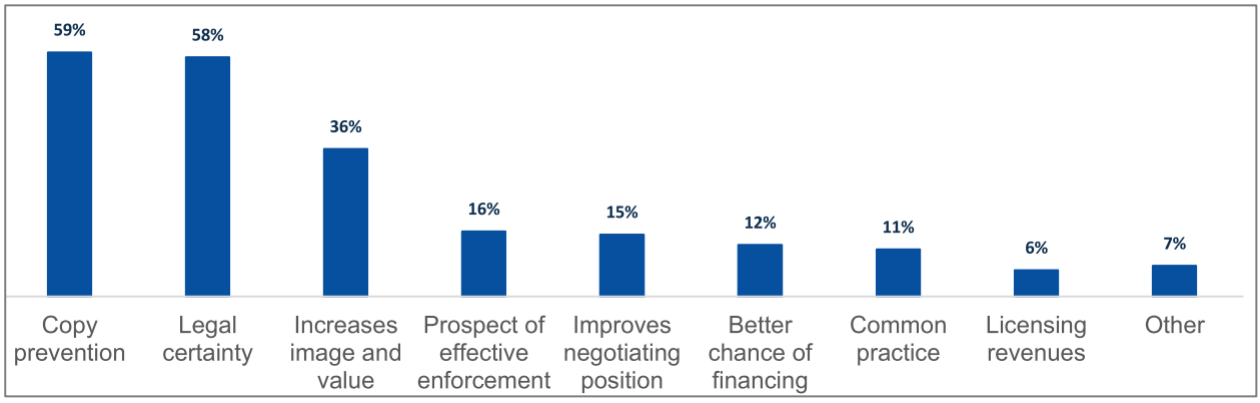
- To achieve a greater sensibility on the strategic impact that Intellectual Property can bring to the entrepreneurial and business in general activities;
- To understand that the exploitation of results emerging from research and development activities can be greatly enhanced if such results are duly protected by Intellectual Property Rights and a well-defined strategy of IP protection needs to be defined and undertaken since from the beginning of the creation of such results;
- To understand the possible actions to be undertaken to carry on a valorization of intellectual property rights within the academic context.

In recent times, notable institutions have published significant studies and reports to strongly highlight the importance of Intellectual Property in the economy and in particular for European Union SMEs. Some of the pieces of evidence arising from such studies are directly or indirectly linked to the theme of IP valorisation.
In the following, some of these reports are cited with the objectives:

- To provide relevant insights into ongoing trends running at the European Union level on the use of IP by universities and enterprises, with particular attention to the topic of IP valorisation;
- To complete and enrich the contents of the following articles in the present handbook in the light of such studies. The evidence cited here can definitively provide grounds for motivation for, or a better understating of, the experiences and practices adopted by Politecnico di Milano and Universitat Politecnica de Catalunya.

Refer to the full studies for deeper analyses and more details.

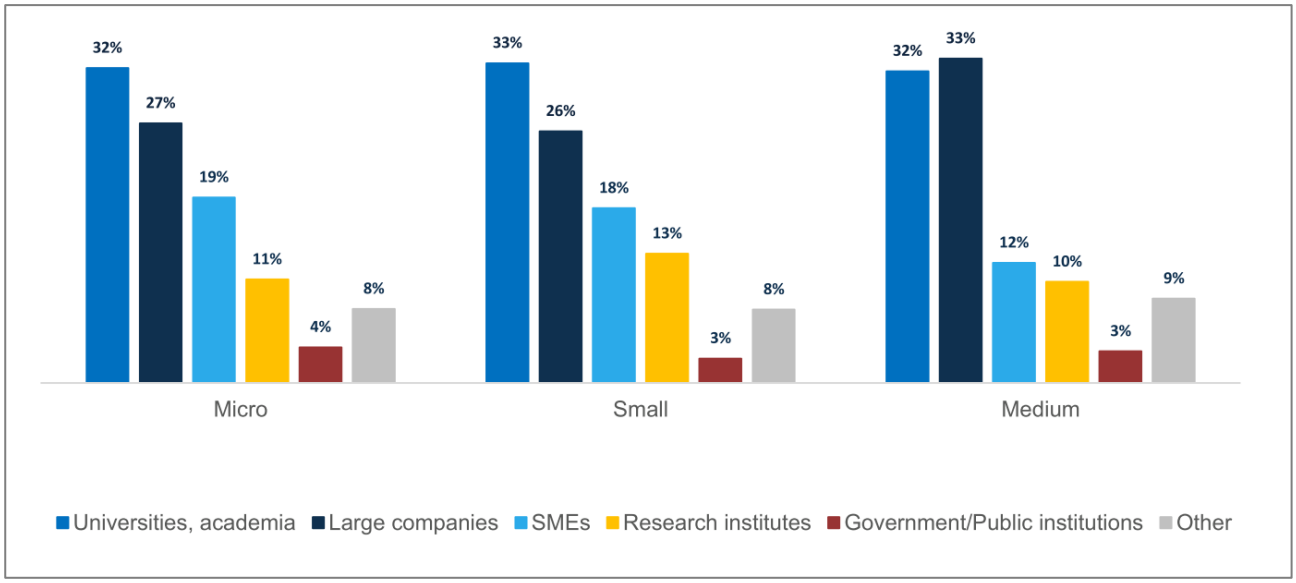
Concerning the attitude of enterprises towards intellectual Property rights in general, the **IP SME Scoreboard 2019 edition** published by the European Union Intellectual Property Office-EUIPO provides insights into why EU-SMEs do or do not register intellectual property rights, and what problems they encounter in doing so. The survey interviewed more than 8300 SMEs in the 28 countries of the EU, operating in 21 different sectors of activity. Half of the firms selected have applied for IP Rights, according to databases of EUIPO and the Worldwide Patent Statistical Database (PATSTAT), provided by the European Patent Office (EPO). Firstly, it is worth citing the main reasons for registering IPRs according to the opinion of EU SMEs.
Among the several reasons, IPR owners agree that the three main ones are: to prevent others from copying their products or services (59 %); to ensure greater legal certainty (58 %); IPR has a positive impact on the company's image and value (36 %). Licensing revenues represent the eighth reason for 8% of surveyed.



*Main reasons for registering IPRs by EU SMEs in 2019 - **EUIPO IP SME Scoreboard 2019 edition (2019)***

Among the different analyses, the ones related to the practices of introducing innovative processes are of interest for the topic of IP valorisation.

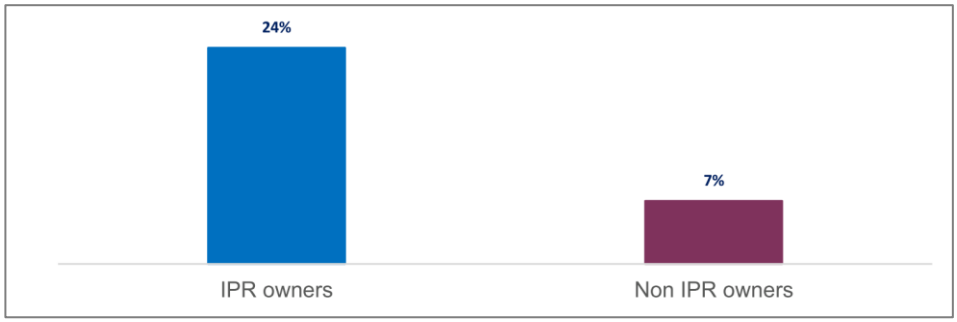
The study reveals that IPR owners are almost twice as likely as non-IP owners to collaborate with other organizations on innovations. Besides, universities and academia are the most recurrent collaboration partners for IPR owners, being involved in almost a third (32 %) of cases. Micro and Small enterprises prefer to collaborate with Universities and academia, while medium companies choose first Large companies (33%).



*Collaboration partners by IPR owners, broken down by company size - **EUIPO IP SME Scoreboard 2019 edition (2019)***

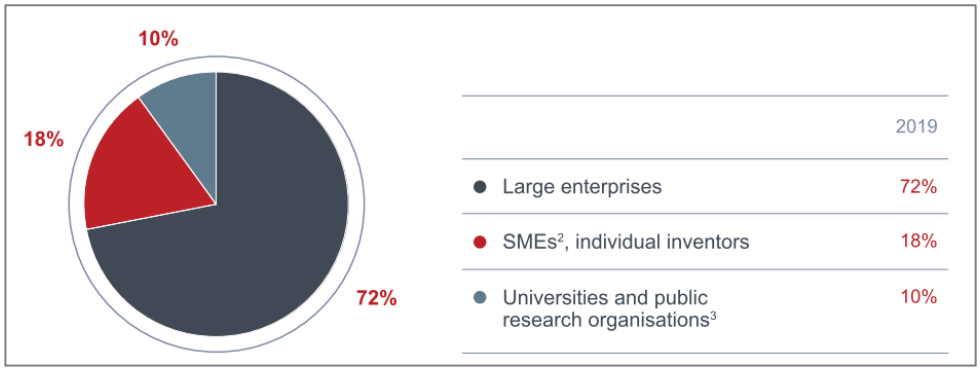
Concerning the topic of monetization of IP rights in general, the same survey can provide an insight into the diffusion of the practice of IP rights licensing among EU SMEs. The survey shows that only 24% of interviewed IPR owners have signed a license involving IPR (including patent, confidential know-how or trade secret, trademark, franchising, copyright, design, and other license agreements, such as those that involve alternative protection measures, etc). Only 71% of those licensed their IPRs to other organisations.

Only 7% of non-IPR owners have signed a license agreement.



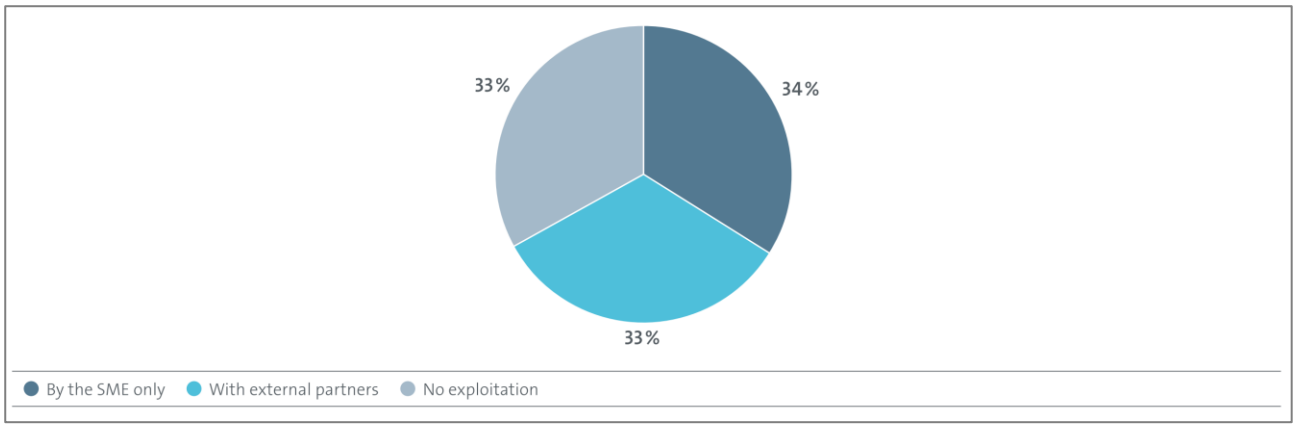
*Companies that have signed a license agreement including IPRs – **EUIPO IP SME Scoreboard 2019 edition (2019)***

Focusing on patent invention IP rights, as documented by different research studies (among the others, OECD 2019), **in recent years patent applications filed by universities and public organizations are growing fast**.
The EPO - Annual Patent Index reports on recent years provide clear evidence about ongoing trends concerning the attitude of Universities and public research organizations to filing patents.
According to the EPO Annual Patent Index reports, in 2015, only 5% of the patent applications originating from European countries were filed by Universities and Public research organizations, in a total amount of 160,022 patent applications.
Growing with an average rate of more than 1% each year, in the Annual Patent Index 2019 published by the EPO in March 2020, the share of patent applications filed by such institutions reached 10% of the total amount of 181,406 patent applications filed in 2019. In other words, in five years the amount of patent applications from European countries filed by Universities and Public organizations has doubled.
Besides, it is worth noting that nearly one in five European patent applications is filed by an SME (or by an individual inventor).



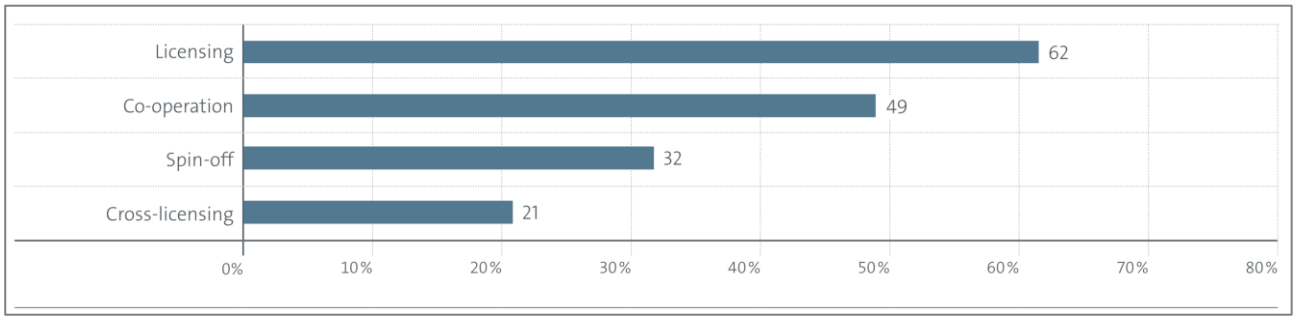
*Shares in European patent applications originating from applicants based in one of the contracting states of the European Patent Convention – **EPO Patent Index 2019** (2020)*

Moving attention to the topic of valorisation of patents, notable evidence comes from the study "Market success for inventions" published by the EPO in 2019 which reveals how European SMEs rely on European patents to protect their high-potential inventions. The survey interviewed 1500 SMEs which filed European patent applications with the EPO between 2009 and 2018.
Among the other results, the study shows that **almost two thirds (34%+33%=67%) of the inventions for which SMEs have filed a patent application with the EPO are exploited for commercial purposes**. One third (34%) of all inventions are exploited exclusively by SMEs, and another third (33%) are commercialized in collaboration with external partners, via technology transfers or co-operation agreements. In other words, half of all patented inventions that reach the market are exploited via a partnership.



*Type of commercial exploitation used by SMEs which have filed a patent application with the EPO – **Market success for inventions, EPO** (2019)*

The survey details also the forms of collaborative exploitation, and **licensing is the most frequent (62%) form of collaborative exploitation undertaken by SMEs**. Almost half of the joint commercialization cases also involve a broader form of co-operation. Nearly one-third of the surveyed SMEs involved in collaborative exploitation create spin-offs based on their patented inventions, while just over 21% co-operate via cross-licensing.

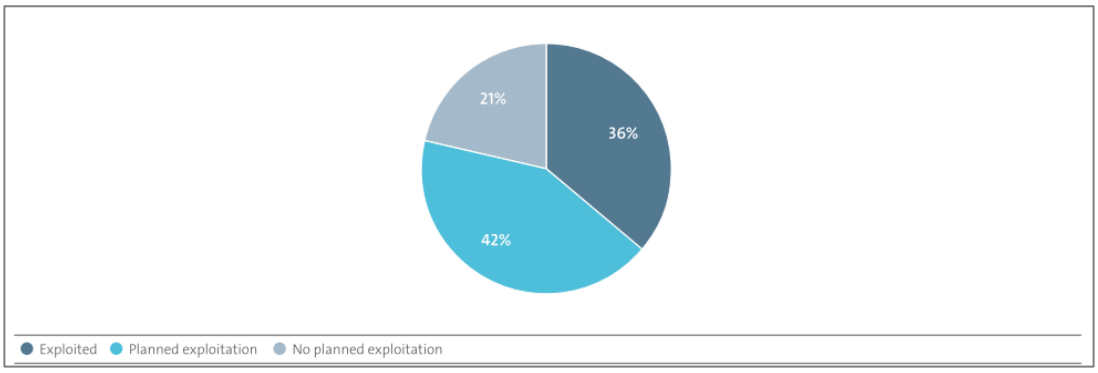


*Forms of collaborative exploitation (if any) used by SMEs which have filed a patent application with the EPO– **Market success for inventions, EPO** (2019)*

Finally, a very recent study gives insights into **how European universities and public research organizations use European patents**.

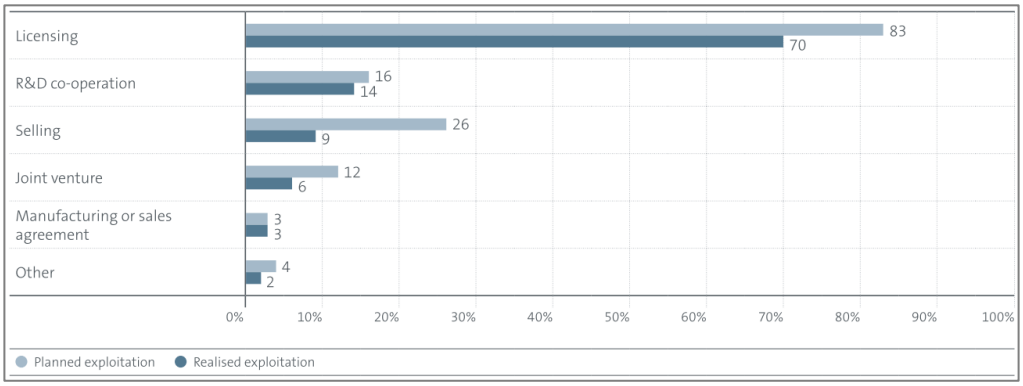
The study entitled "Valorisation of scientific results" published by the EPO in November 2020 surveyed European universities and public research organizations based in one of the 38 contracting states of the European Patent Convention for a total amount of 1540 unique institutions, which are mentioned among the applicants for published European applications filed after the 2007 and granted patents by the EPO between 2010 and 2017 (more than 10800 pending European applications and almost 7600 granted European patents).

The study points out **that Research Institutions already commercialize more than one third (36%) of the inventions** for which they have filed a patent application with the EPO.



*Stage of exploitation of European patented inventions owned by Universities and Public Research Organisations – **Valorisation of scientific results, EPO** (2020)*

Among the different forms of exploitation, **licensing is by far their preferred commercialization channel**, with 70% of commercialized inventions.



*Types of exploitation forms used by Universities and Public Research Organisations which are applicants of European applications or granted patents – **Valorisation of scientific results, EPO** (2020)*

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2. IP as a university asset and the main valorisation pathways

By Annalisa Balloi and Cristina Areste

The creation and dissemination of knowledge has always been the main aim of every university. However, in recent decades, the overall challenge has expanded to include how to turn academic knowledge into innovation and provide the maximum value to the economy, society and the university itself. For these reasons, universities are fully aware of the importance of looking at their IP valorisation as a strategic asset, in relation to their individual policy. This enables universities to set overall IP strategies that optimize the benefits that can be gained from use of their IP and to enhance knowledge transfer beyond the simple commercialization of patents.
In order to create the best IP creation and management, a university must have a suite of IP policies and practices that reflect the university's mission. The policies have to sit in a complementary way with the core objective of knowledge creation, scholarship and learning. An IP policy should at the very least ensure that there are arrangements in place for sharing any commercial returns from commercialisation of IP, that recognizes the range of IP activities of the university, and that displays a balance of engaging in IP work for reputational benefit, for positive social and economic impact, and for fiscal returns. However, beyond individual differences, in order to economically valorise IP, all universities need to consider three main topics:

► USE OF IPR FOR BUILDING R&D COLLABORATIONS
The transition from university to business is not obvious or easy. Firstly, very interesting inventions from a scientific point of view may not have any obvious practical application, or can be unattractive from a commercial point of view because they are a very long way from the market. Furthermore, it is not at all easy to find companies which are willing to invest in inventions created in the university, for several reasons that will be discussed further. In many cases, for the companies, it is easier to collaborate with the research group in a co-development project. In this perspective, patents can be defined as a "tool" capable of bringing the academic and industrial worlds closer together, thanks to the fact that they effectively present the outcome of research in the form of a product that can be commercialised, and express complex scientific activity in a language that a company can understand. This creates a route for opening conversations with companies which may then result in the company investing in a research relationship with a IPR licensing deal as part of an overall transaction.

► IPR LICENSING AND ASSIGNMENTS
In the academic context, the IP valorisation process is a one-way process, from the laboratories of the university to companies, and it can take place in the form of IP Licensing or assignment.
This is also a very complex process because the access to IP rights should be considered in terms of present and future potential uses.
In addition to the entrepreneurial risks related to the market response to the new technology, the main obstacles (or barriers) to licensing are:

- Technological risk: will the device or the product be scalable? Can technology be integrated into a consolidated industrial process?
- Protection risk: there is a Freedom To Operate (FTO)? Is it possible to circumvent the patent? Will the patent be granted? Will the patent be subject to opposition proceedings or a cause of nullity?
- Economic evaluation: How much is my patent worth? It is often difficult to make an economic assessment that is accepted both by the university and the company. Many agreements do not pass the negotiation phase.

Care should also be taken that the granting of licences does not conflict with existing obligations, or limit the potential future use of a piece of IP in another collaboration or another field, application or territory.
Different forms of a licence provide different levels of flexibility and control. For example a stronger bargain may be able to be struck with an exclusive licensee in terms of reciprocal compensation, but this may limit broad dissemination. Non-exclusive licences necessarily provide greater scope for dissemination but less

bargaining power on returns, although the aggregate income from non-exclusive licences can be greater. Another option is to secure an exclusive licence by field or by territory. This will enable an IP proprietor to exploit its IPR in multiple markets which a single company may not be able to target effectively.

► CREATION OF SPIN-OFF COMPANIES

Spin-off companies are usually created to develop the research originating from universities into commercial use. They are often created when there is no existing business to approach about a significant breakthrough in a field of work or because the work has clear possibilities for generating many products and applications and so potentially could be extremely valuable. To be effective, a spin-off company will need to bring together various assets and resources to commercialise the IP. These resources include financial support, as well as a specialist management team with skills in finance, marketing and sales.

This is because, in the context of an academic spin-off, one of the most problematic aspects is the team: in the majority of cases, these are strong from a scientific point of view but weak in the aspects of management and business. Moreover, within the team sometimes there is no common vision regarding the fate of the invention.

Finally, as the spin-offs are legally removed from the institutions, facilities for research and/or manufacturing are needed, although some IP based spin-off business models will seek to outsource manufacture and distribution. In any case the collaboration between universities and start-up incubators and access to venture capital is a crucial aspect to help teams with the process of technological scale-up and business empowerment.

After this general overview on the importance of IP protection and the valorisation process in the academic context, here we can compare some aspects of the IP policy of two European Technical Universities (Politecnico di Milan and Universitat Politecnica de Catalunya) in order to highlight similarities and differences in the IP strategies adopted to optimize the benefits of the IP portfolios created by staff and students.

POLITECNICO DI MILANO

With approximately 42,000 students, Politecnico di Milano (POLIMI) is the largest Italian university for Engineering, Architecture and Industrial Design and it is ranked as one of the most outstanding European universities in these fields. The university has seven campuses located in Milan and in other nearby Italian cities and it is organized in 12 Departments, devoted to research and in 4 Schools, devoted to education.

The University innovation ecosystem is rooted in:

a) High quality research (attested by the various international rankings);

b) Close relationship with the industrial world, highlighted by the volume of collaborations with companies, supported also by the capacity to make technological facilities available to businesses,

c) Strong inclination towards technology transfer and entrepreneurship: POLIMI was among the first universities in Italy to understand the importance of enhancing the innovations arising from its teaching and research activities.

The POLIMI innovation ecosystem mainly relies in two operative structures: the Technology Transfer Office (TTO), that supports the development and transfer of Intellectual Property stemming from research results and activities (such as know-how, patents, designs, trademarks, software) and PoliHub - Startup District and Incubator, a company providing support to highly innovative start-ups operating in different fields of innovation.

The TTO and PoliHub work actively in spreading the innovation and entrepreneurial culture inside the University. They build networks for the development of long-standing partnerships with other Universities and Research Institutions and work closely with other TTOs and incubators associations like NETVAL (the Italian TTO'S association), PNI CUBE (the Italian association of incubators and academic business plan competition) and others.

Politecnico di Milano can follow various valorisation models for IP economic valorisation.

1 Technology Co-Development

Sometimes further research and development may be required to get a technology ready for the market before pursuing a licensing arrangement. This can be funded in many different ways including collaborative industry funding. The information given to the company will be treated as confidential and all the parties will sign a Non-Disclosure Agreement, regulating the interaction and exchange of information and data. In this case the researchers of Politecnico cooperate with the Company for the development of a new technology and its future market entry. This collaboration is regulated with a:

- Joint-development/research agreement: this is a contract in which the cooperation between a research group and a Company is regulated to develop a technology. The main points of the contract are the definitions of the work groups and the research activities to be performed, the cooperation time period, the financial management of the activity, and the management of the current and the future intellectual property rights.
- Contract Research: this contract is aimed to solve a specific industrial problem or to develop a company-owned technology: it is carried out by Politecnico based on certain agreed company funding. The IPRs arising from this type of collaboration are managed as follows. The Company and Politecnico will file the first patent application in co-ownership. The Company will cover all the Patenting costs and rewards the Inventors with a sum called "Inventor price". Subsequently the company could get an exclusive licence or the entire ownership of the patent.
- Revenues from the sale and licensing of Politecnico IP rights deriving from funded research are allocated as follows:
  - 80% to the inventor, equally divided in case of multiple inventors
  - 20% to the Technology Transfer Office to cover the costs of patenting, technology transfer and related activities.
- Open Innovation with Corporate: this kind of process can occur through different activities: call4idea, hackathon, student contests, tailored spin-off with the corporate entity as stakeholder, Venture Capital (VC) investments.

The Technology Transfer Office of Politecnico di Milano manages all the patent applications from the idea disclosures to the licensing of the related invention. The IP strategy is discussed and decided together with the inventors. The TTO collaborates with external IP firms for the patent writing and administration. In the case of innovation from autonomous research, Politecnico will cover all the filing costs until the licensing of the invention. In cases in which the Patent is transferred to a Company or filed in co-ownership, all the IP process is then followed and funded by the licensor/co-owner with the TTO's cooperation.

2. Licensing

The IP rights belonging to Politecnico are transferred to a Company for the commercial exploitation of the technology. A patent licence agreement allows Politecnico to give to the Company the exclusive/non-exclusive right to commercially exploit the technology for a specific time and territory, keeping the ownership. These rights are usually granted upon royalty payments as follows:

- Exclusive or Not Exclusive Licence: is the grant of certain exploitation rights on the Licensed Technology and allows the Company to make commercial use of the Licensed Technology, in order to develop, manufacture, market, distribute or sell a Product, all within the Field and the Territory only, subject to and in accordance with the terms and conditions of the Agreement.
- Licence Fee: usually Politecnico asks for a down payment for the Licence agreement that the Company shall pay to Politecnico. The amount is decided with the Company based on the Technology evaluation and the exclusivity or non exclusivity of the licence.
- Royalties: are the amount that the Company has to pay to Politecnico every year, calculated as a percentage of the Net Sales of any Product under the Licence and usually ranges within 2% to 10% according to the specific technological field.
- Minimum Royalty: usually Politecnico agrees on a minimum royalty that shall be paid annually irrespective of whether the Company, and/or its Affiliates, and/or its Sublicensees have made any sales of the Products.

- Management of Intellectual Property: the Company reimburses Politecnico for all previous documented expenses and costs relating to the registration and maintenance of the IPRs in the Licence Agreement and Politecnico shall attend to the filing, prosecution and maintenance of the IPRs in the agreed Territory, at the Company's expense.

Revenues from the sale or licensing of Politecnico IP rights deriving from funded research are allocated as follows:

- 12% to the inventor's Department to be reinvested in new research projects
- 28% to the Technology Transfer Office to cover the costs of patenting, technology transfer and related activities.
- 60% to the inventor, equally divided in the case of multiple inventors.

3. Creation of Spin-offs/Start-ups

Politecnico di Milano promotes entrepreneurship within its structures by establishing spin-offs, new high-tech enterprises aimed to transform the scientific and technological know-how into innovations that can be exploited from a commercial viewpoint through the realisation of products or services.
In this case TTO and Polihub will collaborate closely and advise the researcher on best practice and will provide all the guidance in order to help the new company to succeed. The University does not directly participate to the new company equity share, whereas Polihub selectively does.

The creation of the VC Poli360 fund allows us to support entrepreneurial projects and stimulate the collaboration of corporate partners. The aim is to impart both internationality and scalability from the very outset of the spin-off's lifecycle, as such characteristics are at the basis of entrepreneurial success. Poli360 is the new investment fund – the only one of its kind in Italy – that hinges on the University's research potentialities and fields of competence, as well as on the Technology Transfer Platform managed by the TTO and the incubator PoliHub. The investments support the development of high technology projects and start-ups – based on research and intellectual property – in the sectors of industrial manufacturing and automation, energy efficiency management, civil infrastructure and telecommunication, development of advanced materials and design.

UNIVERSITAT POLITECNICA DE CATALUNYA

The Universitat Politècnica de Catalunya (UPC) is a public institution dedicated to research and higher education that specialises in the fields of architecture, science and engineering. Every year over 30,000 undergraduate and master's degree students and nearly 2,000 doctoral students enrol at the UPC. Characterised by a high student mobility, the UPC is one of the European universities that receives the most international students. In fact, it has the highest intake of international master's and doctoral degree students in Spain. The UPC is also the European university with the highest number of Erasmus Mundus programmes: 75 master's degrees and 45 doctoral programmes. The UPC's leadership is reflected in the latest university rankings: it is the top Spanish university in engineering and technology in the latest QS World University Ranking and the national leader in engineering (2002–2011) and architecture (2007–2011) in the I-UGR Ranking. According to the SCIMAGO Ranking 2013, it is the top technical university in Southern Europe. The UPC has a long track record of collaboration with companies, increasing their competitiveness and capacity for innovation and working to promote research transfer and valorisation. In 2019, the UPC's turnover for this kind of activity was more than € 58 million. One third of this total was from agreements with companies and institutions, one third from national calls for proposals and programmes, and one third from European programmes. As for international research collaboration projects, the UPC is first in the ranking of Spanish's universities in attracting funds from Horizon2020 and has a long track record of successfully coordinated projects. The UPC has created a complex network of international partnerships with other universities, research institutions and companies that organises new projects and supports many initiatives in which the word "collaboration" is the key. The sphere of action for these partnerships without borders is an interconnected world that promotes the sharing of knowledge and experience

At the UPC, students are trained to become professionals in engineering, architecture, sciences and technology, acquiring the knowledge, abilities and skills needed to tackle new challenges in a way that takes into account the need for technological efficiency and reflects sustainability criteria. The UPC teaches bachelor's, master's and doctoral degrees and continuing education courses, with a complementary offering of international mobility opportunities and double-degree programmes. Student participation and leadership in research projects and work placements help them build relationships in the world of work and bolster their autonomy and initiative. The University is therefore a space for knowledge that stimulates learning and personal growth based on a dynamic, motivating teaching model.

As for the patent portfolio, in 2019 the Innovation Office filed 15 priority patents and 8 international applications. It received more than 260 thousand euros from licences under its existing patent portfolio in 2019. The patent portfolio has also evolved. It previously included many CV-oriented patents of no commercial value; now it is a solid portfolio of patent families with over 60 market-oriented patents. The UPC currently has a portfolio of 80 spin-offs and holds an equity stake in 28 of them. In 2019, it created 11 EBTs (*Empresas de Base Tecnologica* or spin-off) and obtained a return of 105 million euros from linked EBT's licenses. Furthermore, mobilised investment in the active spin-offs in which the UPC has a stake was €8.5 million.

Since 2016, UPC set the promotion of research, technological development and innovation as a challenge with the aim to reinforce technology transfer and IP valorisation in the cooperation between universities and companies. To this end, the UPC Technology Transfer Office focused to ensure the interconnection between the university's research centres and big and small companies. To do so, it provides technical support in three major areas: protection of intellectual property and support in the innovation funnel stages; collaboration and generation of joint ventures; and creation of spin-offs as commercialization of research outputs.

1. IPR management and valorisation process

The TTO of UPC manages the entire Innovation funnel from the idea disclosures to the licensing of the related invention. The innovation funnel involves the researchers as key actors for the success of results commercialization. The TTO are involved and give support in how to protect the research outputs and build a strong IP portfolio able to attract industry's interest and establish a culture favourable to technology transfer.

Furthermore, UPC's TTO is in a position to mediate between parties in the commercialization process and to negotiate fair conditions for licences and link with other stakeholders such as patent attorneys, IPR consultants and governmental personnel involved in the innovation funnel.

2. Collaborations and Joint ventures

Researchers from UPC and Industry often have considerably different interests, objectives, constraints, and incentives. In order to avoid conflicts, misunderstandings and distrust between the partners of the collaboration, UPC has worked at developing an IP policy. So far the IPRs are regulated by agreements arranged previous to beginning the collaboration. In joint ownership, agreement clauses are based on the purpose of the collaboration, the product or technology that it is expected to develop and on whether it consists of a disruptive innovation, and on whether the industry partners will be the exploitation partner. All the information sharing to create the collaboration framework is under confidentiality through NDAs.

When a patent application results from Industry-university collaboration, the Industry partner with the support of UPC TTO is responsible for the preparation, filing and prosecution of any applications for patents, designs or other registered rights in respect of the Joint IPR and to cover the cost for maintaining them.

3. Creation of Spin-offs/Start-ups

UPC promotes entrepreneurship within its structures by establishing spin-offs/start-ups, new high-tech enterprises aimed at transforming the scientific and technological know-how generated in the university

(either by researchers or students) into innovations that can be exploited from a commercial viewpoint through the realisation of products or services.

The TTO works closely with those researchers who are willing to create a tech-company based on the results generated from their research activities in the university. Moreover, the role of the TTO in the creation of a spin-off/start-up might be crucial in the later stages of the process:

- As a vehicle aimed to commercialize scientific and technological know-how generated in the UPC, a technology transfer agreement between the university and the new company has to be signed. Bearing this in mind, the sooner the TTO gets involved in the creation process, the more far-reaching can be the conversations about the technology transfer.

- Depending on the role that the university research staff are supposed to have in the company, the participation of the UPC as a shareholder in the new company shall be required, based on what is stated in Spanish law. If both parties (university and company) are interested in the UPC becoming a shareholder, the corresponding shareholders' agreement must be put in place. This agreement will establish the fundamentals of the relationship between the shareholders of the company, including the university. The negotiation of the UPC rights comprised in the shareholders' agreement is also managed by the TTO.

Apart from those services offered by the TTO, the University has various mechanisms to promote and support the creation of tech-companies created within its framework of activity:

- Espai Empren: An initiative created by the UPC to promote and support entrepreneurship among its community of students. Espai Empren comprises specific co-working spaces located within UPC campuses, which can be used by students to develop the first steps of their entrepreneurship projects. Besides these co-working spaces, Espai Empren provides other services to its users such as consulting, networking and the opportunity to be part of an exciting community of young entrepreneurs.

- University programs: UPC is involved in several programs focused on promoting entrepreneurship. One of these is the "From Science to Market" program, which is coordinated by the UPC. "From Science to Market" is addressed to young researchers (PhD, master, young post-docs) who are interested (or curious) about the commercialization potential of their research projects. The program provides training on the basics of business creation and management, specific advising for each project and the opportunity to visit some of the top spaces within the Catalan innovation ecosystem. Since its creation in 2017, more than 30 participants from over 15 different nationalities have participated in the program. As a result, from the two cycles of the program which have been carried out so far, five new tech-companies have been created and several new collaborations and joint projects have emerged between participants.

- Participation in joint venture programs: UPC can also take advantage of the various entrepreneurship programs that take place within the ecosystem. An example of this interaction are joint venture initiatives in which UPC has been involved. These joint venture programs attempt to attract talent and innovation from research centres by offering them specific ad-hoc advising from business profiles, which might have different backgrounds, experience and profile depending on the scope of the program. The two parties agree to pool their resources for accomplishing a specific task. This task can be a specific project (creation of a business plan) or, in some cases, the creation of a new company.

3. The creation of value and the definition of an exploitation strategy: from the idea to the product

By Annalisa Balloi and Sonia Touriño

POLITECNICO DI MILANO – How to turn ideas into products

Because of its nature as a scientific-technological university, Politecnico di Milano (POLIMI) has always faced the theme of innovation in a close relationship with the industrial world and with a strong inclination towards technology transfer and entrepreneurship, thanks to its ability to integrate the processes of knowledge creation with the application in various industrial sectors.

IP exploitation strategy is one of POLIMI's goals highlighted in the University guidelines "…Politecnico di Milano, in the achievement of its institutional goals, promotes the development of scientific knowledge, the technology transfer and the exploitation of the university research results. In particular: a) promotes and organizes the innovative research of the University, also in collaboration with other public or private partners; b) promotes the protection of the University research results; c) economically enhances the results of the University's research, also through the technology transfer related to the University's intellectual property."

In order to reach these goals and to turn scientific knowledge into innovation, over the last few years, the University has invested more resources in the innovation strategy area through the implementation of the following activities:

- Specific courses on innovation and Intellectual Property Management addressed to students and external attendees like the I.PhD day, a one day workshop on Intellectual Property dedicated to the PhD students of Politecnico di Milano; awareness and training programs on Intellectual Property aimed at researchers and start-uppers and a MOOC about "Industrial Property: patents, designs, trademarks" available on the Polimi Open Knowledge platform (https://www.pok.polimi.it)
- Activation of a Competence Center to guide companies, especially SMEs, into industrial digitalization, that will carry out training activities and implement innovation and joint research projects in different target areas of the Italian Industry 4.0 strategy.
- Implementation of Joint Research Centres for the creation of medium/long strategic partnerships with specific companies and the definition of common interests with the purposes of: I) orientating the basic research developed at the University and its application in industrial contexts; II) creating joint observatories on technological evolution and facilitating the creation of joint research projects; III) encouraging cooperation between researchers and companies through joint laboratories.
- Organization of specific idea scouting programs like the Innovation Challenge Programs Switch2Product (www.s2p.it) and Start Cup http://www.startcupml.net/ which aim at the development of new technologies and/or the creation and consolidation of new Companies.
- Definition of new processes for the evaluation of the innovations more oriented to the technologies applications and market areas. The innovation portfolio has been organized into 6 different technology areas with a consistent focus on industry-related applications: Energy Efficiency, Infrastructures; IT & Automation; Advanced Materials; Manufacturing Technologies; Health & Medical Devices; Design.
- Implementation of a dynamic technology transfer model (Risk and Revenue Sharing) aimed at advancing the technology readiness level (TRL) through the involvement of different actors in the exploitation process, combining different expertise and investing capabilities and proposing a co-development in the industrial validation phase.

An activity that exemplifies in an excellent way the innovative potential of the Politecnico di Milano and the ability to move from an idea to the market is the call for ideas Switch2Product.

Switch2Product (S2P), organized by the Technology Transfer Office of Politecnico di Milano in collaboration with PoliHub, the Innovation District and Start-up Accelerator of Politecnico, and by Officine Innovazione of

Deloitte Italia, is a programme that enhances the market value of innovative solutions, new technologies and business ideas proposed by students, graduates who graduated up to three years ago, researchers, lecturers and alumni of the Politecnico di Milano. S2P provides economic resources, in the form of Grants ('S2P Grant') and consulting services ('S2P Acceleration') to support the development of innovation projects through technological validation and business acceleration paths.
S2P participants will be asked to undertake the various paths to enhance their ideas, in one of the following ways or through a combination of them:
1. Collaboration with the industrial world for the valorisation/licensing of intellectual property.
2. Business creation and development (start-ups).

The final aim of the competition is to reward the best ideas presented by Politecnico's students and researchers, in order to facilitate the development of highly innovative products.
The Switch2Product selection processes are entrusted to the juries of corporate experts such as research and development directors, intellectual property managers, patent attorneys and Venture Capital operators.

During the selection process, all the teams benefit from the evaluation support for the ideas deriving from the activities of the organizers (prior art patent search, analysis of technological and business potential, strategic support), from empowerment programs, training course, lessons and workshops on various disciplines (e.g. IP legal aspects, communication, business planning, finance, etc.).
Starting from the 2019 cycle, some grants have been assigned by relevant companies, to be assigned on the basis of the correspondence to specific themes indicated in the Call4Ideas by the same companies: additional Corporate Grants of 30,000 Euros each.

The S2P Grant and the Corporate Grants are exclusively dedicated to the financing of technology development & validation activities
The main objective is to implement Solution Advancement on the TRL (Technology Readiness Level) scale, from the lower levels (2-3) typical of the laboratory context to higher levels (4-7) thus progressing from an idea to a working prototype, to subsequently reach an industrial scale.

In the Switch2Product path, Poli360 constitutes a further opportunity to support the development of entrepreneurial projects and to stimulate the collaboration of corporate partners in order to ensure, from the earliest stages of the project life cycle, those characteristics of business solidity and scalability that are the basis of entrepreneurial success.

UNIVERSITAT POLITÈCNICA DE CATALUNYA (UPC) – UPC Innovation Ecosystems: spaces for excellence and innovation on each UPC campus.

The UPC aims to contribute to the economic and social growth of Catalonia through knowledge transfer, which is the bridge between science in general and companies' technology needs. Given the available critical mass, and the capacity and range of innovative knowledge provided by UPC research groups and centres, it can provide solutions to complex technical problems that require a cross-cutting approach.

The UPC has been a pioneer at the national level in the creation of instruments to facilitate transfer of knowledge and valorisation of research results. In 1998, the University launched the Innova Programme (now the Innovation Office) to support the creation of technology-based companies and to promote a culture of entrepreneurship and innovation at the UPC.

In the last 10 years, it has collaborated in the creation of over 300 technology-based companies. Eighty of them are UPC spin-offs, and the University holds an equity stake in more than 30 of these enterprises. In 2017, mobilised investment in the 28 spin-offs in which the UPC has a stake was €36.3 million, and these companies employed 300 people. Over 150 tech companies are being incubated in the UPC Research and

Innovation Park. They employ 4000 people, 60% of whom are graduates and PhD holders. Seventy percent of these enterprises operate in the ICT sector, 20% in aerospace, and 10% in electronics.

In 2016, the UPC presented a plan for the definition and implementation of UPC Innovation Ecosystems – spaces for excellence and innovation on each UPC campus. The spaces are geared towards promoting and managing innovation processes generated at the UPC and the community involved in these processes (researchers, students, alumni, incubated companies and large corporates).

Their mission is to generate sources of innovation and increase the UPC's capacity to generate innovation that contributes to the competitiveness of the region's productive fabric. This new approach has been developed to improve coordination and the establishment of strategies in areas such as entrepreneurship, promotion of innovation culture, and business incubation. UPC Innovation Ecosystem is a concept that facilitates more transfer opportunities, increasing the number of innovative projects that emerge from the UPC, boosting the growth of such projects, and bringing them closer to the market. All of this will be achieved – with collaboration and coordination of actions, programmes, interests, and the needs of the various actors in the ecosystem – by seeking to increase public-private cooperation and harnessing the added value the UPC can provide to the business fabric as a facilitator of innovation processes.

UPC Innovation Ecosystems are aimed at creating a distinctive "seal of quality" that identifies a comprehensive process and holistic space for:

- Training talented individuals in innovation and entrepreneurship
- Generating, growing and maturing innovative projects
- Preparing and filtering projects for corporate accelerator programmes
- Providing spaces for the creation and generation of public-private open innovation through innovation hubs

The way UPC approaches the transfer of results is evolving towards a new model based on permanent feedback from companies and its own community. This process builds a relationship between enterprises and universities, enabling the former to smoothly incorporate advances made by the latter (knowledge) into their processes, with the two-way flows this entails.

To promote innovation culture.
Courses on innovation and Intellectual Property Management for students and researchers. Hackathons: Several hackathons are performed in a short format (around 1 or 2 days) and are dedicated to a specific topic or challenge. The participants work in small groups in a unique environment that encourages creative thinking and leads to surprisingly innovative new concepts, ideas, and prototypes. The result of the hackathon is a finished prototype for an innovative product, service or business model.

To enhance the Technology Readiness Level of UPC innovations.
Grants for TRL advance (Reach your results to market). The objective of this call is to finance projects from UPC research groups to obtain prototypes and to make the results of the research more valuable and transferable. The projects accepted must correspond to the test phase of concept 3-7 of the scale of technological maturity (TRL). UPC fund the personnel to give support-structured activities that allow the achievement of a proof of concept (prototype, pilot, pre-industrial or pre-clinical test, among others), reducing the uncertainties about technical and commercial feasibility.

To foster an entrepreneurial culture among students and help them to create new tech-based companies.
De la Ciència al Mercat ("From Science to Market"). This programme aims to foster technology and knowledge transfer among PhD students (through business creation). The programme offers 120 hours of intensive face-to-face training and additional hours of mentoring adapted to the needs of each participant and project. Many different topics are covered (creativity techniques, business model definition, and intellectual property issues, among others). De la Ciència al Mercat is organised by the Universitat de

Barcelona (UB), the Universitat Autònoma de Barcelona (UAB) and the UPC, the three main universities in Barcelona. The first cycle of the programme, carried out in the winter of 2017, led to the creation of three technology-based companies.

Fusion Point. A new learning environment for innovation, led by a technical university (UPC), a business school (ESADE) and a design school (IED). The main aim of this joint venture is to "tackle real-life challenges through interdisciplinary collaboration in education and research" via specific project-based learning topics and activities. Teams are multidisciplinary, so students are able to implement and test concrete solutions, and projects are ambitious and imaginative (even futuristic in some cases).

The UPC is also highly involved in the Industrial Doctorates Plan, a unique initiative supported by the Government of Catalonia in partnership with the Catalan university and research system. The programme has two main objectives: (i) to boost the competitiveness and internationalisation of Catalan industry, and (ii) to give doctoral students the opportunity to work on R&D&I projects with companies.

4. The legal and economic value of IP: how to evaluate the patentability and the registration requirements and how to calculate the value of an intangible asset

By Massimo Barbieri and Gerard Margalef Martinez

Introduction

The evaluation of a new invention is a very difficult task, because sometimes the Technology Transfer Managers (TTM) do not have all the information to do that.
Having a complete description of an invention is a good starting point but sometimes it is not enough. It is of paramount importance to understand the technical problem solved by the invention, to know if and how someone else has already solved the same problem and the closest prior art.
Furthermore, it is useful to highlight the essential technical features of the invention: this is a good starting point to carry out a comprehensive state-of-the-art search in patent databases.
After having identified the closest prior art (one or two documents), the next step is the evaluation of patentability requirements.

Patentability requirements

The patentability requirements of an invention are summarized in Table 1.

Novelty (art. 54 – EPC)	An invention is considered to be new if it does not form part of the state of the art.
Inventive step (art. 56 EPC)	An invention is considered as involving an inventive step if, having regard to the state of the art, it is not obvious to a person skilled in the art.
Industrial application (art. 57 EPC)	An invention is considered as susceptible to an industrial application if it can be made or used in any kind of industry, including agriculture.

Table 1 – List of patentability requirements

The novelty requirement is simple to explain and to evaluate: *an invention is new when it differs from the prior art. Not much difference is requested; a simple difference is sufficient.* [1]
The inventive step is more subjective but the Problem and Solution Approach (PSA), planned by the EPO, can help to solve this task.
The first step is to establish the differences between the invention and the prior art. Then, given those differences, one should ask: would an ordinary skilled technician have been motivated to modify or combine teachings of the prior art in a manner that would arrive at the claimed invention? If the answer is yes, the invention is obvious.
The inventive step hurdle can be easily explained with an example.
Suppose the need is to evaluate an invention which claims an alloy composition ABC for use as a corrosion-resistant material in devices exposed to saline environments.
Two documents (D1 and D2) constitute the prior art. A document D1 describes an alloy ABD having good corrosion resistance (without specifying that it functions in saline environments). The difference is the substitution of C for D in the alloy.
A document D2 discloses a composition suitable for use in the manufacture of boat hulls and comprising B alloyed with C, D or E. D2 teaches that the elements C and D may be mixed with AB, whereas C, D and E are elements which may be interchanged with B. Therefore, a person skilled in the art would be motivated to replace element D with C or E to obtain a good resistance to corrosion in a saline environment.[3] [So does this therefore indicate a failure to produce a genuine inventive step? It looks like it. Maybe best to say so.]

Factors other than the patentability requirements

Other factors to be taken into consideration are listed in Table 2.

Market	Evaluate first the size and growth of the market, considering all possible applications of the invention.
Development stages	The development stages are the following: conceptual stage, experimental stage, simulation of the operative model, working prototype. It is a parameter that indicates the actual gap to the effective commercial exploitation of the product. It is a very important parameter, because it is a strong indicator of the risk related to the decision to patent or not. It is also a parameter to be considered for future licensing.
Time to market	It is the time required, starting from the actual development stage of the invention to the launch of the product on the market. This parameter requires an estimate of the time for the engineering and the industrialization of the invention and to exploit the product. It is a parameter related to the product lifecycle.
Product lifecycle	It is the lifetime of the product on the market or, in other words, the time in which it remains competitive, i.e. not replaced by a new product. There are technical fields in which technologies show slow changes over time and that lead to products with long lifecycles. In other highly dynamic sectors, there is a continuous and rapid innovation that requires a short time to market, before a product becomes obsolescent.
Technology risk	Some inventions are based on a well-established technology, that makes the products well accepted by the market. The risk of failure is very low. Conversely, a good idea at a conceptual or an early experimental stage, can be very risky if it requires an expensive technology and therefore it may be not consistent with the current market.

Table 2 – List of other factors than the patentability requirements

Detectability, design arounds and product value are other factors to consider.

The economic evaluation of an early stage invention

Evaluating an early stage invention is really a challenging task. Cost, market, Discounted Cash Flow (DCF) methods are usually used in the economic evaluation of patented products but they are not suitable to estimate the value of a new technology or an early stage invention. Real Options methods (compound options, hybrid real options) or a combination with other methods (Fuzzy Set Theory, Scenario Planning, Analytic Hierarchy Process or Game Theory) could be better solutions. [4]

Procedure adopted by Politecnico di Milano

Politecnico di Milano has developed a policy in order to better manage the evaluation and protection process.
The "Invention process" is characterized mainly by the following steps:

- compiling of "Disclosure Form"
- evaluation of patentability requirements and the potential commercial value
- filing of the patent application
- identification of potential licensees
- negotiation of a licensing agreement

One of the most important steps in the "Invention Process" is the drafting of a document (Invention and Technology Disclosure form), which has essentially a dual purpose:

- it contains a detailed description of the invention;
- it constitutes a declaration of the inventors to transfer the ownership to the University.

The detailed description of the invention allows the TTO staff to conduct an effective novelty search.
TTO's staff shall evaluate the content of the Disclosure Form.
The criteria applied by TTO include:

- the technical feasibility of the invention;
- the patentability requirements;
- the assessment of a good probability that the invention can be transferred to industry.

If the response is negative, the ownership (the patrimonial rights) will be given back to inventors
If the response is positive, a national patent application will be filed as a priority application.
TTO staff will select a patent attorney who will be responsible for drafting the patent application. The TTO staff will send to the patent attorney a detailed description of the invention.
The priority application will be filed in Italy (Italian mandatory law).
Typically, TTO implements a strategy based on a national first filing, which establishes a priority date.
An application may be filed at one of the 103 Chambers of Commerce, or directly at
the "Ufficio Italiano Mmrchi e Brevetti" (UIBM). An e-filing procedure is also available.
Under the current rules an application is kept under secrecy for military purposes for a maximum of 90 days, after which it could be disclosed to the public if advanced accessibility has been requested by the applicant, otherwise it is available after 18 months, as usual.
The EPO carries out a search report for Italian patent applications filed from 1st July 2008.
The application is sent to the EPO together with a translation of the claims in
English (provided by the applicant himself or made by the EPO at an official fee
of € 200,) within 4 months from the filing date.
The EPO will send the UIBM a search report with a preliminary patentability opinion within 9 months from the filing date to allow the applicant to decide whether or not to proceed with EP or other foreign extensions.
After the national filing there is one year to decide whether or not to extend the patent.
During this year the TTO staff will proceed towards finding companies potentially interested to the patent. This phase requires them to work closely with the inventor.
Licence agreements are the best way to valorise an academic invention.
After an industrial property title has been filed or registered, the problem is how to exploit the invention.
For a company, there are two main options: a) implementation by the company itself, and b) sale, licensing or cross-licensing entrusted to third parties.
By contrast, universities have a rather restricted scope of action. They are not allowed to market inventions directly (except through a spin-off) and must therefore identify a company on the market to negotiate either a licensing agreement for the use of the patent (either exclusive or non-exclusive) or an assignment agreement, which is basically an outright transfer.
A licensing agreement, which may relate to either patents or know-how or both, is an atypical (free form) agreement and has some limitations, such as:

- the territorial scope: the holder has no exclusivity (the invention can be freely implemented) outside the borders of the states in which the exclusive right title has been validated;
- the time scope: the duration of protection is limited (twenty years from when the patent application is filed) and affects the duration of the agreement;
- the scope resulting from the right of use: scope of coverage determined by the contents of the claims;
- the market sector or field of use.

During negotiations, the potential licensee must check carefully:

- the ownership of industrial property rights;
- the legal status;
- the validity of the titles;
- the time to market;
- the estimation of the fields of use and of the markets;
- the freedom to operate.

The agreement may provide for:

- a licence on later improvements;
- collaboration to ease implementation of the invention operation is accomplished;
- any sub-licences.

The costs of maintenance of industrial property rights are usually borne by the licensee.

Other useful tools during negotiations are the following: confidentiality agreements, letters of intent, joint development agreements.
The only guarantee that the licensor takes on is the one relating to ownership, whereas guarantees are expressly excluded from agreements with regard to:

- the validity of industrial property titles;
- the patentability of the inventions;
- the presence of infringements.

Consideration is generally in monetary form [reimbursement for the achievement of the titles; assumption of future maintenance costs; payment of a fixed sum as a down payment/lump sum, possibly divided into several instalments or royalties, usually calculated as a percentage of sales turnover (or periodic fees)], but it can also be non-monetary [cross-licensing, contributions in kind (e.g., equipment, research contracts)]. [5]
Within one year from the filing date, it is necessary to decide whether the patent is extended or not at international level.
The Patent Cooperation Treaty (PCT) is basically an option for future patenting, that provides the applicant with a further delay before deciding to apply or not.
The PCT process provides the advantage of a longer investigation of the technological potential of the invention, and in case of a negative assessment, the application can be withdrawn before entering into expensive national or regional phases.

Procedure adopted by Universitat Politècnica de Catalunya (UPC)

As part of its strategy to enhance the technology and knowledge transfer from its research activity to the market, the UPC settled on a stage-based process in order to procure a better valorisation process.

- Stage 1: Identification
- Stage 2: Protection
- Stage 3: Commercialisation
- Stage 4: Negotiation
- Stage 5: Follow-up

As mentioned in the initial introduction, the evaluation of the value of a certain technology or patent is certainly a complex task. In addition, during this whole process, the state of development (or Technology Readiness Level) of the invention may increase. Therefore, the risk associated to the technology diminishes and, logic says, its potential value rises.

Whether the above-mentioned scenario is the case or not, it looks clear that the value of the technology is subject to some variation during its development and the valorisation process, which might take place in parallel. Thus, the assessment of its value must be understood as a continuous process, of which the outcomes need to be reviewed periodically.

Based on this, the TTO performs successive evaluations on the potential value of the technologies during the different stages during the valorisation process.

Four main features are addressed, among others that might be considered according to the nature of each project:

- Technology: Understand and question the science behind the technology, SWOT analysis (Strengths, Weaknesses, Opportunities and Threats), Technology Readiness Level.
- Market: Identify and size up the market (or markets) to which the invention is addressed, the need to be solved and its relevance, the approach of the invention to solve such a need, etc.
- Current/Alternative solutions: What are the existing solutions that solve (or try to solve) the same need in a different or similar way to the invention, who are the principal competitors, are there other solutions that are already being developed, what are the main advantages of the invention compared to the alternatives, etc.
- Intellectual Property: Evaluate whether the technology has enough features to fulfil the requirements of patentability, benchmark similar technologies already patented (and in which countries) by others, evaluate potential strategies for intellectual property protection other than patents, etc.

The University has a number of specific databases at its disposal, which include specialized information on patents, markets, companies and others, so the TTO can perform the above-mentioned study with as much information as possible. Notwithstanding the relevant sources of data available, the role of the inventors in the assessment of a technology and its commercialization potential is key to drawing proper conclusions from the analysis. The scientific expertise provided by the inventors is needed in each one of the evaluation features at some point. Moreover, their knowledge of the market and its alternative solutions might be highly valuable not only for the assessment of the technology but throughout the commercialization process.

As explained before, this analysis is reviewed by the TTO in each of the stages that confirm the valorisation process, as each of these stages has its own requirements in terms of evaluation of the technology:

- Stage 1: Identification and 1st assessment

An “Invention Disclosure” form is received from the inventor/s. At this stage, the Innovation Unit carries out a first assessment on patent and commercial feasibility of the invention.

A first meeting with the inventor/s is arranged in order to obtain further information about the technology and the background of the invention, some of which may have been introduced in the "invention Disclosure", including:

- Description of the technology
- Market potential
- Other entities (researcher/s, company, institution) involved in the development of the invention

Based on the overall analysis of all of the previous features, the TTO evaluates whether to continue to the next stage in the valorisation process or not. There are different reasons why the TTO might decide not to go on with an invention. What is more, such a decision does not mean that a particular technology cannot be transferred to the market. In this sense, sometimes the TTO considers that the technology is at too early a stage, meaning that more research (in the university) needs to be done in order to further develop the technology.

- Stage 2: Protection

If the invention disclosed is considered to have potential to be transferred to the market, a more in-depth analysis regarding the protection strategy is conducted. This analysis consists of two phases:

- Phase 1: A first state-of-the-art search is performed by the university services, using the data bases available for the University.
- Phase 2: If the first screening is positive or non-conclusive, a second analysis on the state-of-the-art is carried out by the patent attorney. If this phase 2 analysis is positive, the patent attorney starts the procedures for drafting the patent application. The TTO staff and the inventors will be involved in the drafting of the patent, being in close contact with the patent attorney.

Depending on the market potential of the invention, UPC can choose between submitting the patent application in Spain or Europe. For those inventions with a clear focus on European/international markets, the option of submitting a European priority application is preferred. Furthermore, the search reports carried out from EPO patent examiners are usually more exhaustive and thorough, which must be taken into account for certain technologies.

Once the priority application is filed, there is a 12 months lapse before having to decide whether to expand the patent at an international level or not. At this stage, another assessment on the development state and commercialization potential of the technology is made by the TTO in order to determine the feasibility of continuing with the patent process. If the decision is to continue with the patent procedure via a PCT application, there will be a period of 18 months before deciding in which countries the patent is going to be validated. This last stage, 30 months after filing the priority application, is the ultimate deadline for the TTO to have found a licensee to which the technology is going to be (or has been) licensed. The university is unable to assume the extraordinarily high costs related to the validation of a patent in several countries, taking into account its extensive technology portfolio.

- Stage 3: Commercialisation

As discussed above, universities have a limited scope of action when it comes to commercialisation of technologies, as they are not allowed to market inventions directly. Thus, the most viable option for a university invention to reach the market is through a licensing agreement between the university and a company. Although an assignment of rights might also be possible, it is not desired as it implies a transfer of rights. Keeping the ownership on the rights of the invention is a priority for universities and other public institutions.

The commercialisation stage might start right after filing of the priority application. In some cases, such as joint-inventions with third companies, this stage can start before the filing or even be skipped, by jumping

directly into the negotiation stage if the company is interested in leading the exploitation of the joint-invention.

Having considered some particular ad-hoc cases such as those mentioned above, there are two main strategies that are assessed in the commercialization stage:

- License to third parties: The TTO makes use of the different tools at its disposal in order to benchmark and contact potential licensees.
- License to a spin-off: A spin-off is a new company created from a university/research institution as an ad-hoc vehicle to lead the commercial exploitation of an invention. In the recent years, the spin-out of new companies has become more important and today it constitutes a major workload for TTOs.

As remarked previously, the collaboration with the inventor/s is crucial to maximize the possibilities of commercializing a technology. Furthermore, as experts on the technology field and its (most probable) fields of application, their contribution is pivotal in several stages along the commercialization process, including:

- First approach to companies: Most researchers have (or have had) a close relationship with industry throughout their career. When evaluating the best strategy for the commercialization of a technology, the inventor's network plays a key role in order to ease the introduction to potential licensees. Moreover, when the relationship between researcher and company is long-term, the chances of achieving an agreement or (at least) obtaining valuable feedback are significantly higher.
- Conversation with companies: As experts in the technology and its (most probable) fields of application, inventors play a key role as scientific advisors during conversations with potential licensees.
- Preparation of marketing support: A one-page technology leaflet is made by the TTO with the support of inventors. This document explains, in the most commercial way possible, the invention and its key features, advantages and applications.

- Stage 4: Negotiation

At this stage, the analysis of the invention becomes relevant in order to assess its value for the licensee.

During the negotiation phase, the parties will try to agree on the value of the technology.

As discussed earlier, to determine the value of a technology is not simple, especially when negotiating with third parties. There are a number of things that have to be considered before setting the value of an invention for a potential licensee, including:

- Licensee's target market: what is the market that the licensee is addressing? How big is it? Does the market belong to the technology's main field of application?
- Licensee's position in such a market: Is the licensee already in the target market? Is it a main player or a competitor? Is it national or international?
- Licensee's current portfolio: How many technologies/products/services does the licensee already have in its portfolio? Is there any technology in its current portfolio that can be an alternative to the university's invention? How much value does our technology add to the licensee's current portfolio (key, relevant, secondary…)?
- Licensee's technology strategy: What is the licensee's actual R+D policy? What use does it make of its IP? What could be the potential role of our invention in the licensee's technology strategy?

These questions are some examples of the questions that are asked in order to estimate the value of an invention for a potential licensee. Once the TTO has ranked a potential value, the goal will be to agree with the licensee on the fairness of such a valuation and, additionally, on how that value is going to be paid to the university.

The goal in the negotiation stage is to find the best terms to guarantee that the value provided to the licensee is returned to the licensor accordingly, trying to attain (as much as possible) a win-win scenario in which both parties feel confident.

Bearing this win-win goal in mind, the challenge for the TTO when it comes to the transfer of a technology to a spin-off is two-fold. On one hand, usually the technology has a capital value for the activity of the company, being the main (or the only) product/service of its portfolio. On the other hand, being a newly created company implies that in most of the cases the spin-off would not have the cash required to return the value that such technology is providing, at least not in the short/medium-term. Moreover, there is a considerable risk that such a company fails to reach the market, resulting in no return (at all) for the university.

In this position, equity turns into an appropriate mechanism focused on a long-term return strategy for the university. By becoming a minor stakeholder of the spin-off, the university tries to guarantee a certain position in the case that an exit event occurs in the future. Furthermore, as stakeholder, the TTO has access to the latest information on the development of the technology and its roadmap to market, enabling better follow-up.

- Stage 5: Follow-up

After the license of the technology, any licensee is required to provide detailed reports on the status of the technology and its market strategy. There are two main types of reports:

  - Technology reports will help the TTO to track the development and time-to-market of the licensed technology.
  - Finance reports are demanded from the licensee in order to evaluate the performance of the technology once it has reached the market. These reports also provide the TTO important with information for the revision of the royalties that have to be paid in return for the licence.

During the follow-up phase, which may last for as long as the license is active, the TTO will have the opportunity to evaluate the evolution of the value that the technology is bringing to the licensee and the return that the university perceives in exchange. This continuous analysis will allow the TTO to identify out important outcomes from the valorisation process, which can lead to better practices in the technology transfer from the university.

FINAL REMARKS

The economic evaluation of a new technology is only a small portion of the entire technology transfer process.
Usually information made available in a “Disclosure Form” is sufficient to give a perceived value, not a quantitative one.
The assessment of the potential value of an invention should also be understood as a continuous, evolving process.
Determining value for early stage inventions is not an input to the licensing process, where the involvement of the scientist is essential. Moreover, inventor contacts are crucial in marketing the invention. [6]
When negotiating a license, it is not sufficient to understand or to have assessed the technology, but also to know as much as possible about the potential licensee, in order to maximise the chances to reach an agreement.

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5. Academy-Industry relations in intellectual property commercialization and Open Innovation strategies

By Giacomo Garbagnati and Sonia Touriño

POLITECNICO DI MILANO - From confidentiality agreements to the structure of the patent license contract.

The commercialization of an invention is not a simple activity. It has to go through a long process, full of variables, which may not always lead to the same result. From a relationship perspective, the fundamental steps of a technology transfer process may be identified as the following three major moments: 1) acknowledgment of the technology, in which the owner shares with the interested party the technology and explains its potential value; 2) testing and adapting, in which the potential buyer has the chance to verify the feasibility of the technology for its purposes and the owner to adapt the technology to the purchaser's needs; and 3) transfer of the rights on the technology, when the deal is completed and the technology is valorised.

The above approach, based on the relationships of the parties, allows us to identify the three critical moments, in which the parties of a technology transfer deal should define the terms and conditions of their relationship. The said terms and conditions can be assessed only with specific and particular agreements. As stated, the analysis is general, in an attempt to include in one single description a vast framework of different cases, each of which has peculiarities which may differ.

► TYPICAL VALORISATION STEPS

With regard to the steps defined above, we will now analyse in depth their peculiar elements and discuss which agreements are the best suited for each case. The essential elements of each agreement will then be analysed in the second part of this chapter.

1) Acknowledgment of the technology

The first approach to a new technological partner always consists in the exchange of information. This exchange of information could be potentially risky for the technology owner. Not always in fact, and yet in most of the cases, the information related to a technology is publicly available (i.e. patented), this circumstance requires the technology owner to pay high attention to the confidentiality of the information exchange. It is in fact well-known that not all the information publicly available is that which represents the core of the technology, consequently any subject who may enter into possession of confidential information relating to it has to be bound by secrecy obligations. Failing to obtain the confidentiality commitment from the potential technology purchaser in fact has more than one consequence: the first would be – as is easy to understand – that the potential purchaser would not consider the information received as confidential, feeling authorized to use it as if it belonged to the public domain. Secondly, the potential purchaser would not appreciate the importance of the exchanged information, as not even the owner deemed it necessary to protect it from dissemination.

There are two major instruments to secure confidentiality, and they depend on which kind of asset is being transferred at this very first stage. If the technology owner is willing to share with the potential purchaser only pure information, then the legal instrument is the non-disclosure agreement (or "NDA"). An agreement in which the receiving party commits to keep the received information confidential, committing not to disclose it to 3rd parties and not to use it for commercial purposes. On the other hand, should the technology shared consists also in a physical object, such as a prototype or a chemical/biological compound, then the best instrument would be a material transfer agreement (or "MTA"). The MTA is based on a regular nondisclosure agreement: however, being more complex, it integrates the necessary legal framework to handle the material asset which is being transferred between the parties. Not only, considering that the physical assets, once received by the potential purchaser, will be subject to experimentation - or analysis anyhow - it is necessary for the parties to define also the ownership of the results of the said experimental activities.

No matter what the instrument may be, the potential purchaser does not obtain any exploitation rights by entering this first step.

The first step is then concluded once the potential purchaser is fully acknowledged by the owner regarding the technology. It could be that the potential purchaser is satisfied with the information acquired through the above process and therefore may proceed directly with point 3), the transfer of rights. However, it is also common that the technology which is presented has successfully obtained the attention of the potential purchaser, but however still needs to be developed or customized or even personalized to the needs of the purchaser. It is in these cases when the second step has to be taken.

2) Testing and adapting

This is a phase in which the technology owner has already obtained the interest of the potential purchaser. However, the technology is not yet ready to be implemented by the latter and requires further development. This is generally the case when the TRL of the technology is low or still not enough for the potential purchaser to directly implement the technology in its business.

The potential purchaser has therefore a wide range of legal instruments to allow the technology owner to achieve a satisfying level of readiness, and such instruments can be generally grouped in the definition of sponsored research agreements. In such cases, the potential purchaser invests (either cash or "in kind") in the development of the technology.

Should the second step successfully terminate, the potential purchaser may be interested in obtaining the transfer of exploitation rights from the owner. It is in this case when the third step has to be taken.

3) Transfer of rights

Once the technology is ready to be transferred, which could be either directly after the information exchange of phase 1 or following the development activity of phase 2, the parties will enter the proper valorisation agreement. Valorisation is performed basically with either of two different agreements: licensing or assignment. Of the two, the license agreement is a long-term relationship which allows the owner to maintain ownership of the technology, participating in the valorisation process and sharing the profits generated, and the purchaser acquires the exploitation right which allows them to exploit the technology, while sustaining low costs for the technology and not impacting their cash flow, considering that the price of the technology is paid only following the generation of value.

On the other hand, certain technology may not be suitable for a license, in these cases the owner may be required to transfer the ownership of the technology. This relationship is a single step process and has an immediate impact both on the seller, who receives the full compensation immediately, and on the purchaser, who has to commit to pay the entire cost at once (even, perhaps, with an obligation of multiple instalments). In this case, the positive aspect is that the seller receives the entire benefit of the technology immediately, however they do not entirely benefit from the valorisation, while the purchaser benefits from the certainty of the price which is not linked to the success of the technology.

These are the three major steps of a technology transfer process. As stated, the circumstances may alter these processes and the parties could choose different valorisation pathways, perhaps by joining two steps together (such as an MTA with a research activity included, or a research agreement with a conditional already-negotiated license).

At Politecnico di Milano, for instance, the Technology Transfer Office adapts the strategies of valorisation to the peculiarity of the specific technology based on the needs of the research group involved and on the market situation. The ability of the Technology Transfer Managers lies in the identification of the best strategy for each single case, which is the result of well-established practice and a fruitful dialogue with the research group, the owner of the technology. Similar considerations apply also to start-ups, which following a technological development in the laboratory have to face the market and its players.

► TYPICAL AGREEMENTS

Having stated the above we are now capable of defining some of the most common types of agreements which play a role in the valorisation process identified so far. The list is, again, rather general but summarizes the most typical agreements used by the Technology Transfer Manager to support the valorisation:

a) Non-disclosure agreement. This agreement requires the parties to commit to unilateral or reciprocal confidential obligation, undertaking not to disseminate or even transfer, without authorization, the information received from the other party. The NDA usually has a timeframe during which the parties exchange information, which are best marked as confidential (or summarised by email if shared orally), at the end of which the receiving party undertakes to cancel or destroy any information received. As stated, the NDA does not grant any exploitation rights on the shared information, which is delivered purely for informative purposes. The non-disclosure agreement should also include the exceptions from confidentiality obligation for all the information which belongs to the public domain. Further attention should be paid to the confidential obligations for that information which falls under the definition of trade secrets according to the Directive (EU) 2016/943. NDA signed with public entities, such as Politecnico di Milano, may require the fulfilment of specific policies in terms of liability for breach of confidentiality. Needless to say, the NDA should be signed before the information exchange.

b) Material transfer agreement. The MTA integrates the confidential obligation stated in an NDA with the legal framework necessary to regulate the transfer of a physical asset from one party to the other. While defining the MTA, the parties should pay attention to the liability for transferring, keeping, maintaining, using and possibly returning or disposing of the material. In addition, considering that the material will be subject to certain evaluation or even experimental activity, the parties should also define the terms for the sharing of the results of the said activity, which are always of interest for the owner even if the valorisation does not proceed further.

c) Sponsored research agreement. As stated above, this is not a specific kind of agreement, rather a wide category of various type of agreements, such as co-development agreement, consulting agreement, research agreement or any other kind of agreement which involves research activities with exchange for a price and, in the case of Politecnico di Milano are defined under the specific regulation. Regardless of the name that the parties decide to use for the said deed, the latter shall always define a specific research project, the ownership of the results and other rights granted to the potential purchaser. Furthermore, in exchange of the investment for the development of its own technology, the owner may be required to either share some ownership rights on the development (co-owner of the results), commit not to transfer the technology to third-parties for a limited time without informing the potential purchaser (first refusal right) or guarantee that a certain economic condition will be respected, should the potential purchaser decide to enter the third step of transfer of rights (option). As well as for the NDA and MTA, the technology owner should pay attention not to grant any right on its technology at this stage. On the other hand, the potential purchaser has to make its best efforts to support the technology owner in the development process. For instance, in the case of well-established organizations (such as most of the medium and large enterprises) this has to be translated into an easy welcoming of the new technology and also the facilitation of the experimental activities of the new technology within the already existing organization.

d) License agreement. License agreement have developed over the decades, including a very wide range of peculiarities, which require an extensive discussion, which unfortunately we cannot satisfy within this paper: we will therefore define the most common aspects. What is always common is that the license agreement is nothing but an authorization to use a technology in a specific territory in which it would otherwise be prohibited to be used (for example due to the existence of a patent). The said authorization is granted in exchange for a price which can be determined by the parties in unlimited ways, most commonly with a yearly running royalty (a percentage) on the profits generated by the exploitation of the licensed technology, possibly with a guaranteed minimum (other commonly agreed payments are milestone payments or upfront payments). Licenses shall also define the guarantees, under the owners' perspective the sole guarantees it can provide are limited to the best of its knowledge, while it is the duty of the licensee to verify the marketability of the technology. The parties should also agree, on the potential costs of obtaining the patent, the

costs of which could be on the licensee, mostly if the license is exclusive. Licenses in fact, can be either exclusive or non-exclusive, while the recent open innovation practice gave birth to the "field license", and license with exclusivity only in a specific field, leaving the owner free to grant further licenses is different fields (basically a peculiar non-exclusive license). Finally, the Sublicense right has to be defined. License is the very best instrument for the owner to participate in the valorisation, in fact it allows the licensor to benefit from the profits generated by the technology, while keeping control of it. On the other side, the purchaser benefits from lower entrance costs.

e) Purchase agreement. This is the legally simple yet substantially most difficult agreement to be reached in the valorisation process. It is legally simple because it's a purchase: the purchaser pays a price and, in exchange, receives the ownership rights (which include exploitation) on the technology. What is most difficult with this kind of agreement is the determination of the price. There are various theories defined by scholars and practitioners for the evaluation of intangible assets. Without having the intention to define them here, it has to be clear that the parties shall identify the best evaluation criteria applicable for the specific technology, and then convey the outcome of the evaluation. Aside from the determination of the price, as for any purchase of assets, the seller shall guarantee the purchaser from flaws of the assets (i.e. nullity of the patent) and perhaps provide certain support in the adaptation of the technology to the purchaser's framework. On the other side, the purchaser shall guarantee the payment of the price. Differently from the license agreement, the seller is not entirely part of the valorisation process as the value that the latter benefits from is detached from the actual value of the technology for the market. However, not all the technology assets can be valorised with a licence, for example when the technology does not provide an increase in the purchaser's turnover rather a competitive advantage that only maintains its market share.

Whether it is the University itself or a start-up (generated within the University), there is potentially a detrimental aspect in the entire valorisation process, which is the readiness level of the counterpart, namely the purchaser. It is in fact only in an effective open innovation environment in which the technology has the best chances to be valorised properly. This requires a bit of flexibility on the part of the purchaser, who should be willing to accept a different approach to well established internal processes, making the new technology effective not only under purely technological criteria but also under an organizational and operative aspect. There is nothing more disappointing than having an agreement which empowers the parties to formally perform an effective cooperation, but which is substantially frustrated by activities which prove to be powerless.

► CONSIDERATIONS

In conclusion, the valorisation process has to be supported by appropriate contractual frameworks which the parties are certainly free to define but, in order to achieve a successful valorisation and avoid conflicts and, even worse, litigation, still require certain basic conditions. Conditions which should not only be found in the legal framework but also in the factual cooperation of the Parties.

UNIVERSITAT POLITECNICA DE CATALUNYA – OPEN innovation: Strategies and Case study.

Within the strategy of the generation and promotion of the UPC Innovation Ecosystems, there are two different branches (Corporate Venture and the Innovation Hubs), which focus on collaborative research initiatives between the university and the private sector, seek to develop new technology-oriented business capabilities among academic faculty, startup ventures, mature companies, and industry clusters.

Depending on the interests and strategies of the companies themselves, the link to the UPC innovation ecosystem could work in different ways, but share the main goal which is to create an innovation-facilitating network where the UPC acts as the main driver, relying on knowledge-centered connections into a more diversified system based on regional and market incentives and a set of large, medium and small companies' radial sub-networks that become interwoven, resembling a hub-and-spoke spatial structure.

The UPC Innovation Ecosystem has developed several Hubs involving companies settled in the region, of which the most important are CARNET involved SEAT, Volkswagen Group Research (http://www.carnetbarcelona.com), Damm, CRBE (https://proptech.cbre.es) among others, to resolve needs from the following points of view:

•Diagnosis Programs of the technological situation of the company and proposals for improving productivity, encouraging research through the integration of UPC scientific and technological capabilities. Offer of Labs and scientific equipment to promote open innovation.
•Internship programs, development of graduate tailor-made courses for companies and programs of identification of talent through real projects of the company.
•Programs for the development of sector technological entrepreneurship projects, for the incubation and mentoring of new business ideas and innovative projects. Access to a broad portfolio of patents and to investment forums of the best start-ups generated by UPC

The general approach is based on providing a common ground framework that allows for sharing knowledge, which is led and coordinated by UPC, and is responsible for ensuring that the innovation projects can be accomplished correctly from both sides (industry-university).

The Innovation Hubs is a dynamic and flexible concept according to the Industry's needs requirements based on three strategic lines:

1. Promotion of Knowledge Generation from both the Industry and University sides.
2. Linking the most appropriate innovative talent to collaborate to tackle the challenges of the industry sectors.
3. Connect the Industry with The UPC Innovation ecosystems network and activities.

Several actions are performed by the UPC-Innovation Hub in each strategic line in order to reach successful innovative outputs.

1. Promotion of Knowledge Generation

Technology scouting activities proposed by UPC-Innovation Hub represent a powerful tool for enterprises in the selection of both technologies and technology partners (research groups, start-up/spin-off) most suitable for developing innovation in their products and processes. UPC-Innovation Hub carries out the identification of all the possible capacities and solutions either already existing or under development (in research centers, faculties, enterprises that are hosted in the UPC park, start-ups, etc.) which potentially show the capability to solve technical problems and formulate a preliminary feasibility study for their application in the elimination of gaps.

RAMP-UP lab: UPC-Innovation Hub aids the innovative projects during the ramp-up period, offering support for core performance capabilities in the ramp-up period and support of design prototyping and validation of products.

Industrial Doctorate: The Industrial Doctorates Plan is a tool that UPC-Innovation Hub uses to link a PhD Student who develops a research project coordinated by University and Industry. The industrial doctorates act as a bridge for knowledge transfer and encourage closer ties between Industry and UPC. This tool is partially grant-funded by the Catalonia Government.

UPC Co-creation lab: UPC-Innovation Hubs support the Knowledge co-creation process inside this lab, where students, professors, and researchers share feelings, emotions, and experiences to contribute to the concept development in the UPC campus and provide a starting point for evaluating the success of multidisciplinary and multi-actor innovation environments at a conceptual level.

2. Linking the most appropriate innovative talent to collaborate to tackle the challenges of the industry sectors.

Start-up and Spin-off Scouting: UPC-Innovation Hubs apply the knowledge generated at the UPC to create value. UPC-Innovation Hubs evaluate the Industry's projects based on how well they support the applicants to transform their research results to business, being a bridge between Industry and UPC Innovation Ecosystems. Furthermore, UPC-Innovation Hubs give support after the scouting in activities such as writing contract models for the effective and flexible transfer of IPR from research organizations to companies, developing new operating models and working methods in co-operation.

Knowledge talent scouting: The framework of this activity brings professors and students close to Industries' researchers, streams innovative new ideas into the company and is a vital pool to bring talented individuals and knowledge to the Industry.

LET-UPC - Technological Entrepreneurship Laboratory

The Technological Entrepreneurship Laboratory (LET), is proposed as a laboratory for innovative projects, focused on the solution of problems in the sector of interest to the partner. Based on annual calls focused on some of the verticals of the Innovation area, students, researchers, PhD candidates and general members of the UPC community develop solutions and services that can be accepted by the different actors of the sector of interest and/or go to market as a business project, offering a clear and convincing value proposition for its customers. The LET-UPC finds all actors of the triple helix developing innovation in a systematic and strategic manner.

The Industrial partner uses the LET-UPC as a source of direct innovation to advance its own technological interests. The Industry partner has access to highly skilled, varied and innovative profiles with an entrepreneurial spirit, focused on generating potentially interesting solutions to the business of the Partner.

UPC ensures the engagement with industry in terms of an exchange and capacity-building program wherein researchers from both sides can work together with knowledge exchange to understand the real need market. This relationship reinforces trust between UPC and industrial partners.

The students have the chance to develop soft skills such as collaboration and communication, pro-activeness, problem solving and goal attainment by developing their own entrepreneurial projects in technology-intensive enterprises, achieving entrepreneurial skills and new future career opportunities.

Hackathon/Bootcamp. UPC-Innovation Hubs use hackathons and bootcamp events as intense, short-duration competitions where multidisciplinary teams generate innovative solutions. The hackathon model integrates collaboration, idea generation and group learning by bringing together different stakeholders in a mutually supportive setting. Topics such as analysis ideation and prototyping are covered and participants gain experience of working in an interdisciplinary team, including all stakeholders from the extended Knowledge Triangle. It refers to the interaction between research, education and innovation: the key drivers of a knowledge-based society.

Sector Technology Incubation Program

Bilateral UPC-Industry development of Corporative Incubation of Technology Entrepreneurship projects in the sector of interest of the company at an advanced stage of development.

Taking advantage of the potential for generating technological projects focused on the sector of interest to the Partner (LET). We propose the definition and joint development of the structure and operation (incubation itinerary) of a corporate incubator of the Partner (in the Partner's own facilities or In House UPC), which serves as an incubation laboratory for technological projects focused on developing potential solutions and/or products and services of interest to the Partner.

This program gives continuity to the itinerary initiated with LET, and for the company itself it would mean enabling an in-house space (Partner or UPC), to follow the development of those projects that it considers potentially interesting for its business.
The standard collaboration model is proposed:

- Technical advice for the definition and implementation of the Partner's corporate technology project incubator.
- Coordination and monitoring of the Incubator by UPC technical staff dedicated to the coordination of the different bilateral UPC-Partner collaboration programs.

3. Connect the Industry with The UPC Innovation ecosystems network and activities

In order to maintain the Innovation Ecosystems networks, several drivers are utilized to promote interaction between members.

Externalization: the UPC-Innovation Hubs works hard to give visibility to network results and to extend information on them beyond the borders of the UPC-Ecosystem: this work is also pivotal. It can create symbiotic benefits for both Industry and the UPC itself. The visibility given can first of all act as a motivator for members to contribute to the network; secondly, it increases potential industries' interest in participating inside the network, thus introducing new streams of knowledge.

In-house training: the UPC-Ecosystem member can benefit from long-term, customized seminars and development programs designed to grow entrepreneurship and innovation skills.

6. How to economically valorise IP through a university spin-off

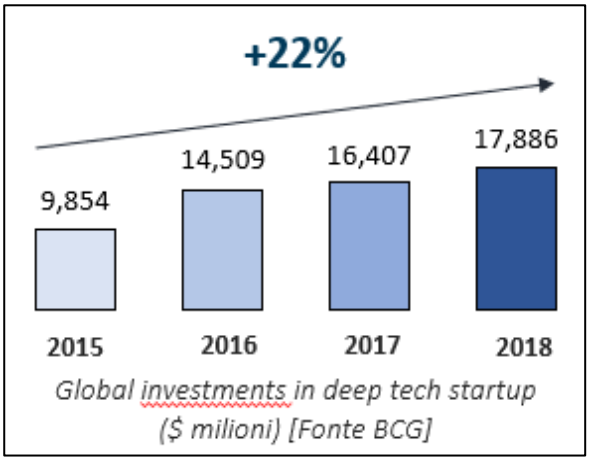
By Giacinto Schiavulli and Gerard Margalef Martinez

Traditional digital platforms and apps, synonymous with the tech industry during the ICT [please spell out]wave in the past decade, are nowadays evaluated on the potential of their fast and wide dissemination, rather than on additional radical innovation. Investors looking for the "next big thing" have shifted their attention to deep tech. Deep technologies are novel and offer significant advances over technologies currently in use. They require substantial R&D to develop practical business or consumer applications and bring them from the lab to the market.

Many of these technologies address big societal and environmental challenges and will likely shape the way we solve some of the most pressing global problems. These technologies have the power to create their own markets or disrupt existing industries. The underlying IP is either hard to reproduce or well protected, so they often have a valuable competitive advantage or barrier to entry.

Moreover, to cope with the increasing complexity and economic and social uncertainty, companies are increasingly open to collaboration with start-ups and the scouting of disruptive technologies, bringing the real needs of the market and the capacity for industrialization and marketing closer to innovation ecosystems.

In this paradigm the role of the innovation ecosystems actors becomes crucial, and the Universities' contribution emerges as an inexhaustible source of inventions and new technologies as well as the first enablers of the technology transfer process, through incubators and/or entrepreneurial acceleration platforms.



Global investments in deep tech startup ($ milioni) [Fonte BCG]

Within the Politecnico di Milano ecosystem, PoliHub, the Innovation Park & Start-up Accelerator of the Fondazione Politecnico di Milano, plays a key role in fostering young high-tech businesses able to transform scientific research into industrial applications.

https://www.bcg.com/it-it/featured-insights/how-to/invest-in-deep-tech-startups

PoliHub facilitates the exchange of experiences, knowledge, reciprocal "contamination" and entrepreneurial networking, making available Politecnico di Milano's enormous store of information and its network.

Its value proposition is based on the Incubation and Acceleration Programs: scouting for new ideas in order to support the development and boosting of innovative and promising start-ups.

The current start-up value model is composed by numerous activities, processes and tools. It begins from an activity of research, also called Tech Scouting, performed through many channels like spontaneous applications to the Polihub web platform, calls for ideas, start-up intelligence, etc.

The research activity is strictly connected to the process of valorisation, also called Tech Acceleration, Spin-off and Licensing. So, once the start-up has been identified in the research phase, customized programs are implemented with the aim of creating value for the start-up and the related industry, to go to the market and to sustain and speed up their growth. The valorisation phase is intertwined with access to funding and advisory tools.

One of the most important tech scouting platforms within the Politecnico di Milano ecosystem is the Switch2Product Innovation Challenge.

The program, organized by PoliHub, the Technology Transfer Office of Politecnico di Milano and Officine Innovazione of Deloitte, aims to enhance the innovative solutions, new technologies and business ideas of students, researchers, teachers and alumni of Politecnico di Milano.
The competition funnel is the following:

- The first 70 selected ideas will have access to the Idea Development & Pitch Workshop with the aim of enhancing and structuring an effective pitch.

- The 30 finalists' ideas will have access to the Innovation Boost Program, a full week of training and entrepreneurial empowerment programs aimed at evaluating the technological and business potential of the projects. In this phase, teams will take advantage of up to 12 hours of one-to-one customized mentoring support and dedicated meetings with Technology Transfer Managers as well as 20 hours of various training modules about Business Model & Market Strategy, Intellectual Property, Financial Fundamentals and Investor Pitch Design.

- The 20 winning ideas will have access to the 4 months' Entrepreneurial Acceleration Program offered by PoliHub, TTO and Deloitte with the aim of supporting the winners in the development of their projects with dedicated mentors and experts.
  The program is tailor-made for every winning team. Every entrepreneurial initiative is supported by one or more expert mentors with experience in the relevant sector, who help to accelerate the growth of the individual start-ups, sustaining them in idea development, the testing phase for market viability, team building, and engagement with customers until the business plan finalization.

At the end of the S2P journey the winning entrepreneurial initiatives continue to be supported in their growth path within the university ecosystem.
On the one hand, PoliHub aims to offer an incubation service and entrepreneurial support on a regular basis, facilitating the Access to funding also thanks to its Italian and foreign Venture Capital funds, Business Angel and important Corporate Ventures network. On the other hand, the Technology Transfer Office guides the teams in any Spin-Off accreditation process of the Politecnico di Milano and protects and increases the value of the business solution by providing support on the management of Intellectual Property issues.
The ability to recognize, manage and enhance the value of Intellectual Property is one fundamental aspect that a start-up must preside over to guarantee itself a few more chances to survive and possibly to climb.
The start-upper is not required to be a patent expert, able to file a patent or to draw up a license agreement with a prospective customer or distributor. Their role remains that of the entrepreneur, who works to start and grow their business using all the tools in their possession.
Recognizing and enhancing Intellectual Property assets can really make a difference for survival and growth of a company. A patent can also allow a start-up to stand up to competition towards subjects with greater commercial strength and even when having limited available resources, as typically happens in a start-up.
Furthermore, the competitive advantage resulting from an appropriate management of Intellectual Property guarantees greater attractiveness to investors or any strategic partners. Intellectual Property Rights, in fact, do not simply represent a passive defence tool aimed at preventing competitors from developing and/or marketing similar solutions. It is also necessary to take into account that the protection of Intellectual Property rights can represent a cost that is not at all negligible for a start-up. Appropriate management and enhancement of Intellectual Property instead becomes an active element in the business strategy, a lever capable of favoring the attractiveness of a venture to capital investors.

Success Story: Bi-Rex

The Bi-Rex project, born within the Department of Chemistry, Materials and Chemical Engineering "Giulio Natta", after being selected among the winners of the 11th cycle of the Switch2Product Innovation Challenge won a grant of € 30k and the Polihub's acceleration path.
Thanks to the skills acquired, Bi-Rex obtained a pre-seed loan of € 160k from Poli360, an investment fund managed by 360 Capital Partners, a leading European venture capital company.

The team of Bi-Rex during the prize-giving of the Switch to Product competition.

Bi-Rex deals with the valorisation of biomass with the aim of obtaining products with high added value, such as cellulose, chitin and lignin, in a green and eco-sustainable way. The pre-seed funding will allow the new firm to validate the proof of concept by addressing the scale-up from the laboratory to the pilot plant. This will allow them to study the technical feasibility and economic sustainability of the project on an industrial scale.
The project was born from the union of two research projects of Prof. Andrea Mele's group: a study of new green and non-toxic solvents, and a study of biopolymers, in particular cellulose. Bi-Rex was born from two projects led by Greta Colombo Dugoni, PhD student of the 33rd cycle, and Monica Ferro, post-Doc, which in just one year and a half led to 4 patents and the winning of an important competition, and is now involved in the Spin-Off accreditation process.

UNIVERSITAT POLITÈCNICA DE CATALUNYA

As explained before, the intensive R&D required to develop deep tech-based products and services has put the universities in the spotlight.

Besides their capability to develop new and disruptive technologies, universities are becoming role players in the generation of entrepreneurship and open innovation strategies. The aim is to approach university capabilities, talent and technologies to the productive network and, therefore, to boost the competitiveness of the region's ecosystem.

This vision has pushed UPC to reinforce its relationship with the different public and private agents, defining an entire innovation ecosystem in which new synergies are fostered in order to empower innovation, knowledge transfer and entrepreneurship within the whole UPC community, including researchers and students.

A key feature for the fulfilment of this mission is to be able to identify and embellish both high-potential technologies and scientific profiles within the same university, in order to maximise the possibilities to push such projects forward and have a significant impact on the ecosystem.

As an example in this matter, UPC leads and coordinates the "Science to market" program, which aims to promote and support knowledge transfer and entrepreneurship among young researchers. The target of this program are PhD (or master) students developing their thesis, and have a strong interest in the potential of their projects to be transferred to the market in the form of new products or services. The mission of "Science to Market" is to provide these profiles with an intensive formation on the most important and up-to-date concepts regarding technology-based business creation and management. Thus, the participants are provided with the tools required to start their own entrepreneurship projects or, also, to be able to focus their research on a more problem-solution-product/service approach.

During the two editions that have took place so far, almost 30 young researchers from more than 16 different nationalities have participated in the "Science to Market" program. Participants came from a wide range of different disciplines within the university's main departments and linked institutes.

As explained before, during an intensive 6 weeks' program the attendees are introduced to the most relevant concepts related with tech-based business creation and management, including: value proposition, customer identification and leading, design thinking, roadmap, idea communication, technology transfer, shareholder's and investment agreement features, among several others. This formation plan is coupled with a number of visits to the most relevant innovation spaces and ecosystem existing in the Barcelona area: ALBA synchrotron, 22@ district and Barcelona's Scientific Park are some examples.

So far, "From Science to Market" has enabled the chance to identify and support deep-tech, high potential projects, which has led to the creation of five new spin-offs from the university and the emerging of exciting new collaborations between participants from different groups, departments and disciplines.

The creation of new businesses leaded by young scientific entrepreneurs supposes a challenge for Technology Transfer Offices. As the majority of these projects are the result of several years of research and development carried out not only by the young researcher but the research group, it is probable that the creation of this new company involves a transfer of knowledge and/or technology from the university to the spin-off. Furthermore, in many cases there is an interest from the company in incorporating specific profiles from the research group (i.e: the principal investigator or other PhDs/post-docs) in order to enhance the scientific expertise of the team. On this scenario, the TTO and the company shall negotiate the terms and conditions for both the technology transfer agreement and, if needed, the participation of the university in the company as a shareholder.

From the TTO perspective, this two-fold role as technology provider and shareholder facilitates a balance between short/mid and long-term return strategy. On one hand, the technology transfer agreement enable a short/mid-term return in the form of royalties based on the value that the technology is providing to the company's activity, always taking into consideration the nature and roadmap of these newly created tech companies. On the other hand, becoming a minor stakeholder of the spin-off is part of a long-term return strategy, as the university tries to guarantee a certain position in the case that an exit event occurs in the future. Moreover, as stakeholder the TTO has access to the latest information on the development of the technology and its roadmap to market, enabling a better follow-up.

Success story: Mitiga Solutions

Mitiga Solutions was born as a result of a PhD thesis in the Computer Applications on Science and Engineering research group of the Barcelona Supercomputing Center (BSC) and UPC. The research was focused on the development of a software-based technology capable of predicting the impact of particles dispersed during atmospheric catastrophes on airspace management.

After being selected to participate in the "From Science to Market" program, the scientific project lead to the creation of the spin-off.

As the technology was based on the technology resulting from the research activity in the university and the PhD, a technology transfer agreement was put in place between UPC, BSC and Mitiga Solutions. Thus, to provide the company with full effectiveness for the commercialization of the technology and to reinforce the relationship between the research group and the spin-off for the development of new and improved solutions. UPC and BSC also became shareholders of Mitiga Solutions.

The company rapidly attracted the attention of several industries (especially aviation) and investors. In fact, Mitiga Solutions raised its first funding round of 1.2 million€ within just few weeks after its creation, with a pre-money valuation of 6 million.

Mitiga provides software solutions for impact prediction on atmospheric catastrophes, harnessing supercomputers and data science/analytics to build whole-cycle solutions for the aviation industry, insurance and humanitarian sectors, amongst others. Today, Mitiga Solutions has a team of 25 people.

IP EXPERIENCE project

IP EXPERIENCE- *Intellectual Property Experiential Program* is an awareness-raising project to engage university and high school students on Industrial Property Rights, their fundamentals, and their strategic value, through a program of workshops and live events in Milan and Barcelona.
The project lasted 14 months (November 2019/ December 2020), is carried out by Fondazione Politecnico di Milano, Politecnico di Milano – TTO, PoliHub - Innovation District and Startup Accelerator, Universitat Politecnica de Catalunya and is cofounded by the European Union Intellectual Property Office-EUIPO, GR/001/19, Lot 2: *Reaching consumers/citizens and especially young people*, Application reference n° 0185, Agreement Number 1320190007.

The main target of the project is young people from 15 to 24 years. The project has been designed to cluster the target into two specific groups: High School students from 15 to 18 years and university students from 19 to 24 years, especially from technical faculties (engineering, architecture, and design).
Additionally, the project promotes content of interest for young researchers, Ph.D. students, and young entrepreneurs/start-uppers.

The General Objectives (GO)

- (GO-1). To support the development of future young citizens and consumers aware of Intellectual Property issues and well informed on how to protect the results of their creativity, to enrich the human capital of young individuals;
- (GO-2). To support the growth of young future workers informed concerning the main elements on IP rights (patents for inventions, trademarks, design) potentially emerging from research & development activities.
- (GO-3). To promote the culture of IP rights and the respect of the IP rights of other people in the context of the collaborations between University and Industry, empowering all the actors involved (academic teachers, companies, and especially university students), to strengthen and enhance the emerging models of co-creation between University and Industry.

The Specific Objectives (SO)

- SO-1. To promote the fundamentals of IP Rights through an experiential education and simulation approach during a program of interactive workshops (*Interactive Program*).
- SO-2. To inspiring university students with best practices of IP value exploitation, involving successful Italian and Spanish companies and entrepreneurs that will share their experiences.
- SO-3. To create new training material that will be promoted in the already running and existing activities.

For further details and project outputs, visit www.ipexperience.eu

Autor's profile

(in alphabetical order)

CRISTINA ARESTE

Degree in Law and Master's degree in public and social policy from the Universitat Pompeu de Fabra (UPF) and The John Hopkins University. She is currently Head of the Innovation Unit in UPC and as such oversees and coordinates the Valorisation Unit at the UPC, in keeping with the UPC's Research and Innovation Plan. Aresté is an expert in detecting and evaluating technological opportunities, defining and implementing strategies for creating value from opportunities, setting up technology-based companies and licensing. She is also a specialist in providing support to companies in their consolidation, growth and internationalisation. In her current job she has acquired skills in managing teams and public and private resources. She has also gained knowledge of the University and research organisation and a broad understanding of the science and technology system of the region, its agents and the relationships between them.

ANNALISA BALLOI

is a Biologist with a PhD in Environmental Microbial Biotechnology.
Until 2014 she worked as researcher at the Department of Food, Environmental and Nutritional Sciences at the University of Milan and by exploiting the results of her research, she founded an academic spin-off. Thanks to her experience as researcher and star-upper, she gained significant expertise in Knowledge and Technology Transfer. Annalisa joined the Technology Transfer Group of the Politecnico di Milano in November 2016 as a Technology Transfer Officer, with main responsibility for networking activities and knowledge dissemination.

MASSIMO BARBIERI

Chemist, and patent documentalist with a specialization in "Industrial Property Management". He has been working at the Technology Transfer Office of the Politecnico di Milano since 2003 as a Senior Specialist in technology transfer and in the economical evaluation of patents in the chemical and mechanical sectors.

GERARD MARGALEF

MsC in Molecular Biotechnology at Universitat de Barcelona and post-graduate in R+D+I projects and innovation management at Universitat Oberta de Catalunya. He has 4 years of experience in supporting the transfer of knowledge generated within the framework of public research institutions to industry. At Universitat Politècnica de Catalunya, his main focus is to back Intellectual Property management and valorization and commercialization of the university's research. Gerard joined as an active member of ASTP-proton and he is part of the Free Open-Source Software Innovation Group.

GIACINTO SCHIAVULLI

MsC in Social Economics at Università degli Studi di Bologna. As always been interested in innovative solutions generating a positive impact, he is an expert in the social impact assessment field.
He gained a four-year experience in managing Open Innovation projects and supporting startups during acceleration programs at Polihub Innovation Park and Startup Accelerator. He is a technology enthusiast and he has been approaching advisoring for deep tech early stage businesses.

FILIPPO SILIPIGNI

Mechanical Engineer and Ph.D. in Design and Product Development Methods at Politecnico di Milano. He has 15 years of experience in tools and techniques supporting the new product development, promoting collaboration between Politecnico di Milano and SMEs, big companies and public institutions and supporting the transfer of academic knowledge to Industry through training and service projects. He was the project leader of the youTH intEllectual prOpeRty Education prograM-THEOREM project (EUIPO, Call-for-Proposal GR/001/17). He is the Program Manager of the Italian Center of Competence for Systematica Innovation https://innovazionesistematica.it/en/

SONIA TOURIÑO

Food Technology PhD from Universitat de Barcelona and more than 6 years of experience in Innovation and technology transfer. Sonia facilitates innovation and the competitiveness, helping to transfer the results and the knowledge of UPC's research groups to the industry. Before, She also worked as a Health innovation coordinator and manager at Fundació Parc Taulí developing, testing, and implementation of new strategies to improve the innovation on health and health care. Prior to joining as an Innovation manager, she worked previously as a scientist in private and public research entities as is reflected in several peer-reviewed papers and her participation in national and international projects. She also gives support to evaluate technological and innovation projects and join as an active member of ASTP-proton.