JUNE 2022

les Nouvelles

JOURNAL OF THE LICENSING EXECUTIVES SOCIETY INTERNATIONAL

Europäisches Patentamt
European Patent Office
Office européen des brevets

LES

European IP Helpdesk

Advancing the Business of Intellectual Property Globally

Special Issue In Cooperation With The European Patent Office And The European IP Helpdesk

Volume LVII No. 2 www.lesi.org June 2022

LES NOUVELLES JOURNAL OF THE LICENSING EXECUTIVES SOCIETY INTERNATIONAL

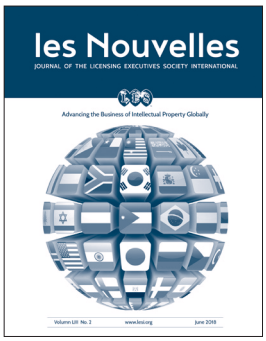
les Nouvelles—June 2022 Contents

In Cooperation With The European Patent Office And The European IP Helpdesk

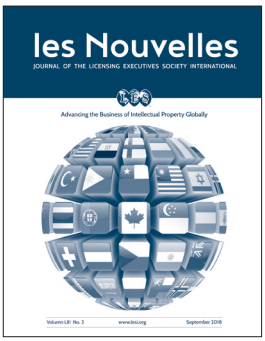
les Nouvelles Covers

Our plan is to rotate the globe a quarter turn with each issue. The current view on the cover will be presented in every June issue of the Journal. We have worked hard to be sure that no country is slighted as we move around the globe. For your reference, the graphics below represent our view of the LESI globe each quarter.

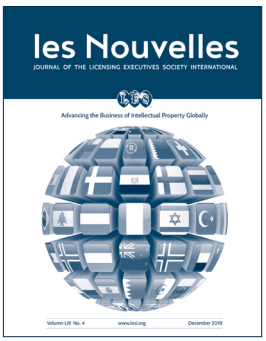
David Drews, *Editor@lesi.org*.



June



September



December

March

LES International

Officers

President	Ichiro Nakatomi	Vice-President	Junko Sugimura
President-Elect	Mike Lasinski	Corporate Secretary	Tatiana Campello
Past-President	John Paul	Treasurer	Sonja London
Vice-President	Mattia Dalla Costa	Legal Counsel	Emmanuel Gougé, Ningling Wang
Vice-President	Karin Hofmann	Executive Director	Dana Robert Colarulli
Vice-President	Madelein Kleyn	Non-Executive Directors	Hayley French, Duncan Ferguson, Russell Levine

Delegates

Andean Community
Renzo Leonello Scavia
Juan Pablo Triana

Arab Countries
Majd Khaddash

Argentina
Gustavo Giay
Verónica Canese

Australia & New Zealand
Sue Muggleston
Mark Pullen

Austria
Andreas Pföstl
Thomas Adocker

Benelux
Kathleen De Belder
Achim Krebs
Carmen Correa Martin

Brazil
Bruna Rego Lins
Thereza Curi

Britain & Ireland
Patrick Cantrill
Mark Wilson

Chile
Pablo Acevedo
Andrea Lobos

China
Christopher Shaowei
Zhongqi Zhou

China Hong Kong
Rosita Li
Michael Lin

Chinese Taipei
Vincent L. Shih
James Hou

Czech Republic & Slovakia
Petra de Brantes
Vojtech Chloupek

France
Véronique Blum
André Gorius
Claire Le Floch
Sophie Pasquier

Germany
Christian W. Appelt
Ingo A. Bruckner
Alexander Haertel
Dr. Martin Heinebrodt
Gabriele Mohsler
Dr. Jochen M. Schäfer

Hungary
Georgina Busku
István Molnár

India
Richa Pandey
Archana Shankar

Israel
Dalit Sagiv
Liad Whatstein

Italy
Antonio Di Bernardo
Sergio Lasca
Dario Paschetta
Marilena Garis

Japan
Chikako Hashimoto
Yorikatsu Hohokabe
Kenichi Nagasawa
Makoto Ogino
Hiroki Saito

Korea
Kwang-Jun Kim
Donghyun Shim

Malaysia
Anita Kaur Gerewal
Sri Sarguna Raj

Mexico
Abraham Alegria
Héctor Chagoya

Philippines
Bayani Loste
Reena Mitra-Ventanilla

Poland
Monika Kaczmarska
Krystian Maciaszek

Russia
Natalia Karpova
Alexey Vakhnin

Scandinavia
Sonja London
Dan Bjerg Geary

Singapore
Lionel Tan
Catherine Lee

South Africa
Danie Dohmen
Madelein Kleyn

Spain & Portugal
Francisco Velasco
Mariano Santos

Switzerland
Martin Schneider
Raymond Reuteler

Thailand
Michelle Ray-Jones
Ploynapa Julagasigorn

Turkey
Murat Idal
Mustafa Cakir

U.S.A. and Canada
Bob Held
Keith Lutsch
Brian O'Shaughnessy
Karthika Perumal
Natalie Raffoul
Jim Sobieraj
Hilton Sue
Scott Williams
Jeff Whittle

Society Officers

Chapter	President	Secretary
Andean Community	Renzo SCAVIA	
Arab Countries	Talal ABU-GHAZALEH	Majd KHADDASH
Argentina	Gustavo P. GIAY	Helena NOIR
Australia & New Zealand	Mark PULLEN	Michael COSSETTO
Austria	Rainer HERZIG	Thomas ADOCKER
Benelux	Kathleen DE BELDER	Jurriaan JANSEN
Brazil	Paula MENA BARRETO	Cedric SIKANDAR
Britain & Ireland	Patrick CANTRILL	Tom GAUNT
Chile	Andrea LOBOS	Pablo ACEVEDO
China-Hong Kong	Rosita LI	Annie TSOI
China	Zhongqi ZHOU	Aimin HUO
Chinese Taipei	Vincent SHIH	James HOU
Czech Republic & Slovakia	Denisa ŠVECOVÁ	Ingrid AMBRUZOVÁ BERÁNKOVÁ
France	Sophie PASQUIER	Claire Le FLOCH
Germany	Klaus HAFT	Stephanie PAUTKE
Hungary	István MOLNÁR	Georgina WACHTLER BUSKU
India	Richa PANDEY	Lakshika JOSHI
Israel	Hananel KVATINSKY	Dalit SAGIV
Italy	Mattia DALLA COSTA	Alessia FERRARO
Japan	Ken-ichi NAGASAWA	Masaki HATANO
Korea	Kwang Jun KIM	Donghyun SHIM
Malaysia	Sri Sarguna RAJ	Wong Dan YI
Mexico	Claudio ULLOA-ESCOBEDO	Mariana GONZÁLEZ-VARGAS
Philippines	Bayani LOSTE	Reena MITRA-VENTANILLA
Poland	Wojciech KULIS	Monika KACZMARSKA
Russia	Sergey DOROFEEV	Alexey VAKHNIN
Scandinavia	Olli PEKONEN	Julius BERG KAASIN
Singapore	Catherine LEE	Cairan HE
South Africa	Danie DOHMEN	Chyreene TRULUCK
Spain & Portugal	José Miguel LISSÉN	Guillermo CRIADO
Switzerland	Stefan KOHLER	Michèle BURNIER
Thailand	Michelle RAY-JONES	Ploynapa JULAGASIGORN
Turkey	Mustafa ÇAKIR	Murat IDAL
USA & Canada	Scott WILLIAMS	Kevin SPIVAK

les Nouvelles

Volume LVII Number 2 (ISSN 0270-174X)

les Nouvelles is published quarterly by the Licensing Executives Society International (LESI). LESI is an association of 33 National and Regional Societies, each composed of individual members who are engaged in the profession of licensing and other aspects of transferring or profiting from intellectual property. Subscription to the journal is included in the membership dues paid by all members. Subscription for the print publication is available to non-members for US$250/year. Please contact the Editor for further details or go to *www.lesi.org/les-nouvelles/about-les-nouvelles/non-member-subscription*

The articles published in *les Nouvelles* reflect the views of the authors and not of the Society as an association or its officers. Material printed in the journal is covered by copyright. No parts of this publication may be reproduced, displayed or transmitted in any form, without prior permission from the Editor or Board of LESI.

A peer review and evaluation system is used to maintain the scholarly nature of the material published in this journal. All articles submitted for publication are reviewed and evaluated by members of the Editorial Review Board (ERB). The ERB members are chosen for their expertise in the fields of licensing and intellectual property. All evaluations are reviewed in a double-blind fashion to remove any bias in the results. The final decision on publication rests with the editor.

A guideline for authors can be found on our Web site at the following address: *www.lesi.org/lesnouvelles/advertise.asp#submission*

DEADLINES FOR *les Nouvelles*: Copy for publication in *les Nouvelles* should be received by the Editor-in-Chief as far as possible in advance of the final deadlines, **January 1, April 1, July 1 and October 1**. Articles are reviewed by the LES Editorial Review Board, and they are published as soon as possible after acceptance. All materials are to be submitted electronically in either MS Word or Text Only format.

Foreword To The Special Issue

By Jörg Scherer and Dana Robert Colarulli

Small and medium-sized enterprises (SMEs), universities, and public research organisations are critical drivers of innovation, employment, and economic growth. Today, intellectual property (IP) has become a core business asset for any organisation—whether developing technology in-house or acquiring it through assignment or licensing—and effectively managing and leveraging these assets is critical. This is especially true for SMEs.

This special issue of *les Nouvelles* looks at a number of successful technology transfer journeys demonstrating the importance of patents and other IP rights when translating research results into commercially successful products and services. Based on a new case study series jointly developed by the European Patent Office, the European Patent Academy, and the European IP Helpdesk, the articles cover a range of economic sectors, countries, and types of technology transfer. Each article uses case studies to illustrate how strategic IP management facilitates critical collaborations and technology transfer (from lab to market), helps boost the market success of spin-offs and start-ups, and advances the business of IP globally in tangible ways.

We are delighted to collaborate on this issue of *les Nouvelles* and thank the European Patent Office for their contributions to make this issue possible. This publication adds to LESI's previous joint efforts with the EPO, in *les Nouvelles* and elsewhere, to focus discussion and the development of tools for SMEs on commercialization topics. ■

■ Jörg Scherer,
Managing Director,
EURICE—European Research, and Project Office GmbH,
St. Ingbert, Germany
E-mail: j.scherer@eurice.eu

■ Dana Robert Colarulli,
Executive Director, LESI,
Washington, DC USA
E-mail: dana@lesi.org

Jörg Scherer,
Coordinator,
European IP Helpdesk

Dana Robert Colarulli,
Executive Director,
LESI

Thomas Bereuter and Ilja Rudyk of the European Patent Office were co-editors and cooperation partners for the Special Issue.

The European Intellectual Property (IP) Helpdesk: Helping SMEs And Researchers Valorise Their IP

With knowledge being one of the main driving forces of modern-day economies and "Open Innovation" becoming an increasingly important concept of collaboration, intellectual property (IP) has become a central (business) asset. Different kinds of IP—whether trademarks, patents, copyright, know how or design—can be used and exploited in various settings and multiple ways. It is the effective use and uptake of novel scientific discoveries and promising research results that will keep European businesses at the forefront of growth, prosperity, and competitiveness in the future. Consequently, project teams and companies engaged in research and innovation activities need to come up with convincing valorisation strategies to actually turn those results into "real" innovations capable of addressing pressing societal and economic challenges of our time.

However, successfully assessing, monitoring, and managing IP remains a daunting task for many, especially for researcher and small and medium-sized enterprises (SMEs). This is where the European IP Helpdesk[1] comes into play: conceived as a first-line IP support service funded by the European Commission, the European IP Helpdesk helps European SMEs and research teams involved in cross-border business and/or EU-funded research activities manage, disseminate, and valorise their IP.

Offering a broad range of informative material, a Helpline service for direct IP support, as well as a training schedule boasting more than 70 training sessions per year, the main goal of the initiative is to promote IP capacity building along the full scale of IP practices: from awareness to strategic use and successful exploitation. In addition, the European IP Helpdesk in collaboration with the Enterprise Europe Network, the world's largest support network for SMEs, has set up an extensive network of national "European IP Helpdesk Ambassadors" all across Europe aiming to overcome language barriers and help SMEs deal with IP issues at their doorstep.

Given the increasingly complex and diverse landscape of IP, business, and innovative support services available in Europe, cooperation between the different players to join forces and streamline activities is key. To this end, the European IP Helpdesk and the European Patent Organisation (EPO)/European Patent Academy (EPA) look back on a long-standing collaboration especially with regard to joint training activities and publications. One of the most recent joint activities has been the development of a new series of case studies showcasing how IP (and patents in particular) facilitate technology transfer from universities and public research organisations in Europe and help boost their market success.

Featured in this special edition of *les Nouvelles*, the new technology transfer case study series forms an important milestone in the EPO's and European IP Helpdesk's shared mission to develop hands-on, relatable, and practical information material to raise awareness of the value of IP in general, and to help small and medium-sized enterprises, academic institutions, and public research organisations make better use of their IP. The case studies are accompanied by a series of podcasts on the EPO's "Talk Innovation" channel. Plus, the European IP Helpdesk and the European Patent Academy have teamed up for an online training series, which takes a closer look at each of the cases and provides key takeaways for stakeholders in universities, public research organisations, and businesses. ■

"From Lab to Market" Training Series—Upcoming Sessions

29 June 2022: Atlantic Therapeutics

12 July 2022: Dermis Pharma

13 September 2022: Blubrake

18 October 2022: Perceive3D

1. For further details on the service please visit: *https://intellectual-property-helpdesk.ec.europa.eu/regional-helpdesks/european-ip-helpdesk_en.*

Find all podcast episodes here: *https://intellectual-property-helpdesk.ec.europa.eu/podcast_en.*

Recognising High-Growth Technology Businesses

By Audrey Yap

Growth as spectacular as that of BioNTech, inventor of the Covid-19 vaccine, depends on sequencing a combination of intellectual assets, says Audrey Yap in an article inspired by the EPO and LESI's High-Growth Technology Business Initiative.

It is time to update our definitions of various types of business. We all understand the difference between corner shops and industry giants. We are less clear about what now characterises a high-growth technology business (HTB) or, if you prefer to be more encompassing, a high-growth enterprise (HGE).

Some are happy to take the simple step of adopting the definition of SMEs (small and medium-sized enterprises) for HTBs. Each country has its own interpretation thereof but, in general, they are independent firms that employ less than a given number of employees. European SMEs have been found to generate a 47 percent cumulative increase in gross value added and a 52 percent cumulative increase in employment of the EU's non-financial business sectors.[1] The most frequent upper limit designating an SME is 250 employees, as in the European Union. In Singapore, an SME is officially where the company's annual sales turnover is not more than SGD100 million, or it has no more than 200 employees. This approach to understanding HTBs as a category is limiting and somewhat myopic in this day and age.

A better perspective than a textbook definition is identifying businesses that contribute to significant economic growth. We are talking about high-growth businesses: those where the average annualised growth rate increases by at least 20 percent per annum over a three-year period.[2]

Regional reports highlight their impact. In May 2019, the European Patent Office and the EU Intellectual Property Office released a study, "High-growth firms and IP rights," profiling high-potential SMEs in Europe. More recently, the Financial Times published a special report, "High-growth enterprises Asia Pacific," taking the line that "businesses with a strong online presence have been turbocharged by pandemic-led digitalisation."

■ Audrey YAP,
LL.B (Hons), LL.M,
Advocate & Solicitor/
Registered Patent Attorney,
Managing Partner,
YUSARN AUDREY LLC,
SINGAPORE
E-mail: audrey@yusarn.com

This subset of companies engages in all forms of innovation and lives with risks that their larger counterparts may not or cannot consider. With that intriguing description, how best then to define them? Rather than pigeonhole these businesses as just SMEs, spin-offs, or start-ups (all of which are included), it is better to describe them by their features and characteristics. Regardless of size, these HTBs emphasise:

- Product expertise and focus
- Innovation and ideation in all forms
- Intellectual assets
- Research and development
- Leveraging intellectual property
- Human capital
- Operational excellence
- Experimentation
- International growth
- The ability to adapt fast

HTBs are agents of change. In his book, Start-up Science, Masayuki Tadokoro includes other features that fit the idea of HTBs:

- Having disruptive innovation
- Potential for exponential/explosive growth
- Willingness to target entry, even in uncertain markets
- Taking on unknown challenges without competition
- Having a product with a devoted following of customers

Finally, it should be noted that HTBs can also include large enterprises, particularly those that are committed to open innovation and collaborative R&D and/or those who use technologies developed by SMEs and research organisations.

It is therefore critical to debunk the myth that HTBs are only small enterprises that fall within the purview of public support structures offering pro bono legal advice because they are dependent on cost-free support.

1. EPO and EUIPO (2019), High Growth Firms and IP Rights, a joint project report, p14.

2. Eurostat and OECD (2007) Eurostat-OECD Manual on Business Demography Statistics, chapter 8, p61.

The EPO-EUIPO High Growth Firms and IP Rights study applies the same methodology, using turnover as the indicator of growth.

The European Commission classifies HTBs as enterprises with more than 10 employees and with average employment growth of at least 10 percent over the previous three-year period—European Commission (2018) Annual Report on European SMEs, p76.

On the contrary, HTBs warrant significant attention in any growing ecosystem because these players are and will continue to be the major engines of economic growth in any region or country.

Surprisingly, company executives and R&D or technical staff in these HTBs are often unaware of the fundamental role that an effective use of the IP system plays in emerging technology sectors. Significant strides are now being made to engage, inform, and train those in and around HTBs. Following the inaugural HTB conference in Dublin in November 2019,[3] a task force for high-growth enterprises was established by the EPO and LESI: the HTB Initiative.

A Shot at High Growth

It helps to learn from live case studies of those that have embraced the IP journey effectively. In any iteration or definition, it is always useful to see what success looks like. BioNTech, the German company made famous by its launch of the Covid-19 vaccine, is an inspiring example. This biotechnology company, based in Mainz, develops and manufactures active immunotherapies for patient-specific approaches to the treatment of diseases.

Covid-19 has proven the theory that, while large established companies clearly dominate in mature and stable markets as incumbents, small businesses—more nimble and agile—tend to perform better in a crisis, such as a pandemic, or where there is technology uncertainty (National Academy of Engineering, 1995). The BioNTech story underscores how HTBs are early movers, in particular with respect to recognising and realising industry-specific growth opportunities (Bos and Stam, 2014).

It is almost stating the obvious that the road is long and rocky. Özlem Türeci, Uğur Sahin and Christopher Huber, the core team behind BioNTech, began exploring the use of mRNA more than 25 years ago. The company was then founded in 2008 with seed funding of €150 million. Covid-19 vaccines are the first truly successful application of this technology after 13 years. In other words, their first achievement was surviving.

As new therapies are developed, scientists build an understanding of possible adverse drug effects from the start of the discovery process. There are early toxicological tests in the lab, clinical testing, and the late, pivotal Phase 3 trials. However, the 20 years of data accumulated from researching and developing mRNA foster trust in its long-term safety and confidence in its use.

It should be noted that the R&D required to create the vaccines is incredibly expensive, while employing top-tier, qualified staff with rare expertise over many years requires significant funding. This calls for endurance, outstanding teams, and expensive laboratories with corresponding biosafety levels and standards, filled with equipment such as bioreactors, centrifuges, cold storage, and very specific devices. IP rights enable ventures like BioNTech to capture the value of their inventions and play a pivotal role in helping secure a return on risky investments because they ensure the exclusive exploitation of protected innovation. The scientific community and companies like BioNTech will struggle to find investment without IP rights.

IP and Complementary Assets

However, IP rights do not stand alone and clearly cannot compensate for weak business management. An in-depth understanding of what advantages IP can offer the HTB in combination with other business assets will allow the company to better exploit its innovation in products and services that create sustainable growth. Powerful combinations include:

- IP and confidential information protected as trade secrets.
- IP and complicated product design.
- IP and speed to market (first-mover advantage).
- IP and other unique, complementary assets, such as regulatory approvals, operational excellence, human capital, and a cultural fit with future partners.

Collaborations and High Growth

All these different combinations can accelerate growth by unlocking the potential for collaborations. The ability to collaborate or be a partner of choice is critical for HTBs that typically have resource constraints. HTBs are innovation-intensive by nature, which requires substantial resource commitment and endurance. Furthermore, in all probability, they lack the ability to fully scale in-house to meet demands, quickly build distribution networks, communicate their strengths, and market their product or services.

BioNTech's team recognised this and one of their main opportunities came in the form of a joint venture with Pfizer. And thus, Comirnaty was born, the mRNA Covid-19 vaccine better known by its collaborators' names, the Pfizer BioNTech vaccine.

What Pfizer brought to BioNTech's table was financial strength, regulatory expertise for approvals, the manufacturing capability to ramp up quickly, and immense channels for distribution. When asked in an interview why Pfizer chose to partner with BioNTech, Brian Zielinski, vice president of Pfizer-BioNTech and its chief IP counsel, gave the following reasons:

- BioNTech was a foundational player in mRNA.
- Although there were other critical players in the

3. Details of the "High-growth technology business conference" (HTBC 2019) at *www. epo.org/sme*.

space, BioNTech had in-depth knowledge, expertise, and was a leader in the field.

- Pfizer was already collaborating with BioNTech.
- Pfizer saw a strong cultural fit with BioNTech.
- BioNTech had a robust IP portfolio.

Living the Deal

Cultural fit and operational excellence between organisations cannot be underestimated as virtues. In situations where big pharma is looking to partner with smaller specialised biotech companies, an understanding that they have a similar approach to governance, for example, is crucial.

Big pharma is known for its many procedures and rigorous compliance. Finding a partner that shares these values but also has an SME's advantage of speed is a great bonus.

Operational excellence means not only having efficient and effective processes and procedures to get to where you need to be in terms of IP and innovation, it also affects how the merger or collaboration unfolds.

When handling IP once the technology transfer has occurred and best practices shared, how do you ensure that both parties benefit from the deal? Indeed, Pfizer believes it now also has technical expertise in mRNA after collaborating so closely with BioNTech. Were firewalls needed when this was taking place?

Vigilance is essential as contamination of IP is difficult to unravel. Accordingly, from an early stage, processes to facilitate and protect trade secrets and IP in general should include:

- Separating localised R&D related to the mRNA work for the vaccine from other unrelated worldwide research
- Using different teams and separating scientific personnel
- Meticulous mechanisms for storing data and results—technology should be harnessed to allow for this

Finally, given the unique subject matter of vaccines, safety, and safety protocols, diligent reporting and reaction capabilities are a priority. Team experience is vital when responding to adverse events and handling issues in an open way.

Operational excellence will be well and truly tested when growth hits hard and fast: the more complex the network of production, packaging, storage, distribution, and administration of the vaccines, the greater the risks of untoward events.

In this particular instance, Pfizer and BioNTech came together surprisingly quickly because both collaborators had an interest in the scientific venture with the equal intent of harnessing the embedded technology for future applications. In itself, collaboration could naturally give rise to conflict and competition. However, a win-win mindset allowed them to be first past the post, rewarding their endeavour with supportive clinical data and building the trust and reputation that are critical in a healthcare crisis.

The Layers of IP

It is an understatement to say that IP should be robust in this field. Any biological application has layers and layers of IP in a variety of forms, even more so for vaccines during a pandemic. The most obvious are patents, as they protect the core inventions that are fundamental to the entire product development. Nonetheless, there are also trade secrets and expertise in the key processes and procedures, as well as the reputation embedded in a company's brand and trademarks, crucial to building trust for the urgent roll-out of global vaccination programmes.

In the deal with BioNTech, IP issues were clarified at an early stage. Arguments about IP for core technology, improvements, and patentability issues would have been counterproductive, distracting attention from work on the vaccine itself and getting it to where it is most needed. A useful checklist of aspects to resolve in such collaborations is shown below.

- IP Inventory: it is advisable to draw up an IP inventory as to who owns what and what is brought to the table. Differentiating between the background IP (what has been developed, identified, and owned) versus foreground IP (what will and continue to be developed) is critical.
- Dealing With Joint IP: keep a record of how it occurs and who owns what rights at the end of the collaboration, if a timeline can be anticipated.
- Defining the Entities Involved: which companies and what cultures are we referring to? Where are they based? Will that continue and will new entities be involved?
- Exclusive and Non-Exclusive Licences: clarify and specify what IP will be licensed exclusively and non-exclusively, with a clear understanding of its relationship to future and background IP. Again, deciding how these licences will be handled at a termination event will be key.

The challenge is keeping all these issues straightforward and preventing them from becoming obstacles to progress. Experience and specialists can help strike the right balance. Apart from IP expertise, the depth of the team's transactional abilities is what gets the deal through.

IP and Ramping Up Production

Understanding what works and quickly embracing it allows for an even faster ramp-up geographically. On the strength of its robust IP protection, Singapore was

selected as BioNTech's fully integrated mRNA manufacturing facility and its first regional headquarters for Southeast Asia. When it opens in early 2023, the facility is expected to have highly automated, end-to-end mRNA production capabilities. A similar plan is in the pipeline for South Africa's Biovac Institute to manufacture for the African Union. A great IP portfolio welcomes and allows for regional growth that translates effectively across borders.

Innovation Continues After Take-Off

It is a fallacy that innovation only takes place at the beginning of the journey, when candidates are identified, targets selected, and delivery platforms defined. The truth is that, once technology takes off and an enterprise ramps up for the next level, there is an explosion of innovation—and it continues. The Covid-19 vaccine development illustrates this entire experience perfectly, despite being compressed and accelerated at breakneck speed.

Innovation is required at every level and every stage, from the focus on which variants to use to the challenges of rapid scale. It naturally follows that although, quite correctly, the initial vaccine research prioritised safety and efficacy, escalating demand required that production timelines be cut back. Innovation decreased the initial 110 days for manufacturing one vial of vaccine to 60, while efforts to reduce this period still further are ongoing. Transportation difficulties in sub-zero conditions similarly spurred the search for new formulations that are equally stable at higher temperatures and for specialised storage equipment.

Sudden worldwide demand meant that transportation and logistics also had to be considered. New, unique containers were designed that could fit and maximise delivery in cold storage trucks. Tracking where and how the vaccines were delivered (to ensure optimal conditions were maintained) involved using new methods such as probes combined with GPS. Innovation was also needed to cut costs, whether in production or distribution, to ensure that more of the global population could benefit.

BioNTech clearly believes in continual investment here, as its R&D spending in the first six months of 2021 was €417.3 million, compared to €160.3 million for the same period in 2020. It is interesting to note reports that the increase was due to development expenses for BioNTech's BNT-162 programme as purchased services, initially incurred by Pfizer and subsequently charged to BioNTech under the collaboration agreement. Being able to defer expenses with support from big pharma allows ventures such as BioNTech to focus on their core tasks, confident that the necessary financial resources are available. As such, BioNTech was able to report significant progress across its various programmes, mainly those that target the Delta variant of Covid-19, as well as in its other work in oncology, influenza, and malaria, creating a virtuous cycle of new growth and products.

Conclusion

BioNTech estimates the revenue generated by its Covid-19 vaccine at €15.9 billion for the 2021 financial year, on delivery of its targeted supply under contracts of about 2.2 billion doses by July. This underscores that IP is not just pie in the sky but has a real impact on the value and financial strength of HTBs.

BioNTech's story emphasises that having a robust IP portfolio and including an IP strategy in the overall business strategy are key success factors. IP rights (and patents in particular) are instrumental in overcoming barriers in value-creation transactions. In the case of the collaboration between Pfizer and BioNTech, they created a virtuous and positive cycle of greater and better innovations that were complementary and built on the core technology. For future HTBs, it maps out a clear path to follow from start-up to SME and to a partner of choice as one of the major players. ■

Available at Social Science Research Network (SSRN): *https://ssrn.com/abstract=4099671*

For further details of the High-Growth Technology Business Initiative, see www.epo.org/high-technology-businesses. To stay updated, follow the high-growth technology business community on www.linkedin.com/company/htbcommunity.

Textiles For The Extreme

By Bowman Heiden and Caroline Pamp

Based on his academic research at Sweden's Chalmers University of Technology, Nandan Khokar developed a new tape weaving technology. This technology and its woven materials became the basis for the foundation of the start-up company Oxeon in 2003. IP protection for the technology helped to attract private investment and funding, and Dr Khokar also benefitted from business support from Chalmers School of Entrepreneurship. This combination of private ownership and public innovation support led to the commercialisation of innovative tape-woven textiles for use in the sports, industrial, and aerospace sectors, and the licensing of the weaving technology for non-competing applications.

TEXTREME Spread Tow Carbon Fabrics.

Textreme Spread Tow Carbon Unidirectional Tapes.

From Conventional to Extreme Textiles

Weaving is one of humanity's oldest techniques and still applied on a large scale throughout the modern world. However, in many advanced economies the weaving and textile industries have almost vanished as activities are outsourced to emerging nations. Sweden is no exception: its traditional textile industry has been replaced by businesses focusing on design, fashion, and innovation. Emerging from the ashes of the 19th-century Swedish textile capital Borås, Oxeon provides 21st-century textiles—this time woven using carbon fibres.

■ Bowman Heiden,
Co-Director,
Center for Intellectual Property (CIP),
University of Gothenburg,
Gothenburg, Sweden
E-mail: bowman.heiden@gu.se

■ Caroline Pamp,
Founder Lextruct,
Legal advisor of Oxeon
Gothenburg, Sweden
E-mail: caroline.pamp@lextruct.se

Nandan Khokar initially came to Sweden from the south of India in the early 1990s. He planned to work on a small project focused on traditional weaving technology at Chalmers University of Technology in Gothenburg. However, a new, related project was starting at the same time. This focused on producing three-dimensional (3D) composite textiles, using new types of fibre, such as ceramics and carbon.[1] He developed fundamentally new 3D fabric-forming techniques, which eventually developed into a full PhD thesis. While working on his thesis, Dr Khokar attended a conference, where a professor confronted him with a technical problem: he was looking for a way to weave tapes of specific fibres and structure into a sheet. In a flash of inspiration, Dr Khokar came up with a solution that evening and created a bare essential prototype the very next day. This provided the basis for several novel ideas, which led to the business development of unique tape weaving technologies and resulting materials. Oxeon, the company Dr Khokar co-founded, was recognised as Sweden's fastest-growing company in 2010.

1. These 3D materials are made from fibres that are placed in three mutually perpendicular directions.

"Securing patent protection allowed us to have several options when developing our business."

Nandan Khokar
R&D manager and main inventor

Launching Oxeon to Drive Innovation

The "professor's privilege"[2] in Swedish universities awards academics the right to fully own the IP of their research, unless they agree otherwise. With the help of Fredrik Winberg, a serial entrepreneur and private investor, financing was arranged from business angels to patent the tape weaving technologies developed during Dr Khokar's research. The ownership of these patents was assigned to a company called Biteam and later transferred to a newly created company called Tape Weaving Sweden. Both companies are co-owned by Dr Khokar, Fredrik Winberg, and business angels.

In late 2001, Dr Khokar and Fredrik Winberg presented their tape weaving technology to a group of students at Chalmers School of Entrepreneurship (CSE). At CSE, students support technology ventures together with innovators as part of their university education. As a result, a pre-incubation project was created, enabling four students to work with Dr Khokar and his technologies to further develop a business plan and the go-to-market strategy.

In 2003, Oxeon was created to focus on the use of the tape weaving technology to produce fabric reinforcements for composite materials, in particular using carbon fibres. Oxeon was formed from the combination of the following three key assets (see Figure 1):

- The patented tape weaving technologies made available via the acquisition of Tape Weaving Sweden, which acts as a holding company for the patents, licensing the required IP to Oxeon.
- The management team, comprising Dr Khokar and two of the CSE students, Andreas Martsman (now VP Marketing & Sales) and Henrik Blycker (now CEO).
- Financial capital from private investors, business angels, and AB Chalmersinvest (now Chalmers Ven-

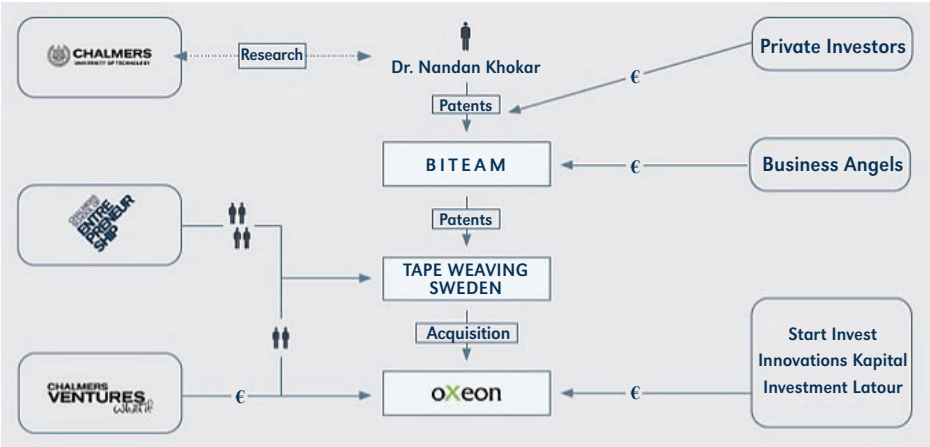
"Developing IP protection early on helped us to attract venture capital."

Fredrik Winberg
Board Member and visionary entrepreneur

"We continuously fine-tune our IP strategy to match our business model."

Henrik Blycker
CEO

Figure 1: The Venture Creation Of Oxeon In The Chalmers University Innovation Ecosystem



2. This is regulated in Swedish law as an exemption to the Right to the Inventions of Employees Act (SFS 1949:345); see Section 1, second paragraph. This ownership model differs from the U.S. Bayh-Dole Act-inspired model used in many countries, where the university becomes the owner of patentable research results created by its employees.

tures), and later from Start Invest (now Almi Invest), Investment AB Latour, and InnovationsKapital.

Benefitting From the Local Innovation Ecosystem

Oxeon's creation wasn't managed by a university technology transfer office (TTO). Instead, it benefitted from other structures within the Chalmers University innovation ecosystem, including CSE for business development support and Chalmersinvest (now Chalmers Ventures) for financial investment. Informal IP assets, such as know-how and trade secrets, were acquired from Dr Khokar, the CSE students, and external consultants. In particular, the pre-incubation project at CSE played a vital role in developing the business and the venture through:

- Provision of significant business development resources to identify market needs.
- Investigation of potential business models and market segments.
- Flexibility for early venture activities outside of the university.
- Availability of working machines provided by earlier development (by Tape Weaving Sweden).

Takeaway: Innovation Ecosystem

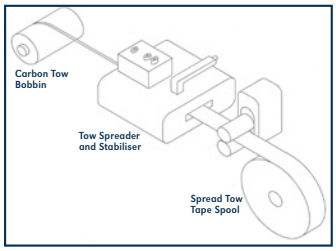
Combining private commercial mechanisms with informal university support can form a valuable public-private partnership for effective and efficient technology transfer.

A Solid Technology Platform

Oxeon doesn't focus on a single technology corresponding to a single product. Instead, it has a platform of technologies that allows for a number of use scenarios in different application fields. Its unique "spread tow" technologies provide better mechanical performance combined with very low areal weight (i.e., weight per unit area) and ease of fabric handling. They are capable of employing different types of fibres and tapes in the production process, which in turn results in a variety of products for different industries.

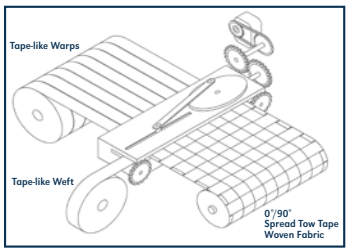
Oxeon's Family of Technologies:[3]

1. Spread Tow Technology



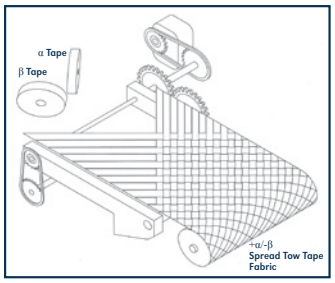
This technology spreads a bundle of continuous fibres ("fibre tow") into a unidirectional tape, known as a spread tow tape. Such tapes are much thinner than conventional carbon-fibre tows or tapes and have more well distributed fibres packed into the same area, which allows for better mechanical performance.

2. Tape Weaving Technology



This production process for weaving with tapes produces spread tow fabrics by interlacing spread tow tapes of the desired fibres. The resulting textile combines the mechanical performance of cross-plied unidirectional materials with the ease of handling of a fabric.

3. Oblique Fabric Technology



This novel production process for weaving with tapes placed at any angle enables continuous-length production of novel fabrics by interlacing two sets of spread tow tapes at different angles, for example +45/-45 (as in the image), +30/-60 and +50/-25.

The use of tapes instead of yarns allows for a greater concentration of fibre volume. This produces lightweight materials with greater strength and rigidity, improved impact tolerance and surface smoothness.

Creating a Portfolio of Opportunities

Oxeon's novel technologies are applied to a wide range of markets, industries, and business models. A hybrid business model that included both licensing and product sales in different market segments (see Figure 2) drove the evolution of Oxeon's business strategy. This allowed Oxeon to view its patented technologies as a portfolio of commercial opportunities to support business growth through different development phases.

Starting with the tape weaving technologies, the CSE project team evaluated and prioritised the best business options from a long list of possible applications (technology push). This initially included the potential sale of manufacturing machinery. After several dialogues with potential customers, it soon became apparent that there was a bigger need for specific fabrics (market pull). Oxeon's focus quickly shifted to the more promising sales of novel textile materials to other businesses.

Because of the aerospace industry's large market size, Oxeon's long-term plan was to become a supplier to it. However, strict regulatory requirements, long procurement cycles, and risk aversion would have made this a difficult industry to break into, slowing

3. *http://oxeon.se/technologies/.*

Figure 2: Oxeon's Hybrid Business Model And Product Market Segment Development

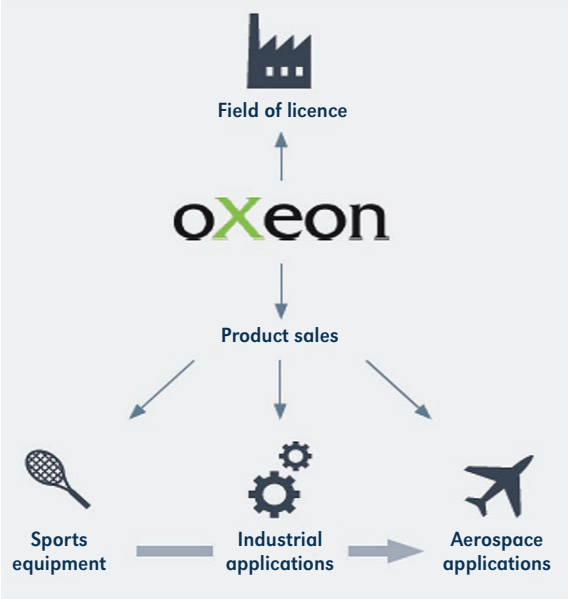
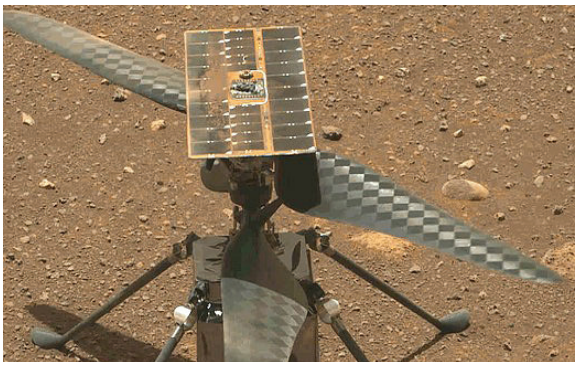


Figure 3a: High-Performance Ski Built With TEXTREME

Figure 3b: Ultra-Lightweight TEXTREME Carbon Fabric Reinforcing The Rotor Blades Of NASA's Mars Helicopter Ingenuity



down the adoption of new technologies. In contrast, sports equipment was seen as a good market segment, open to experimentation with different products and marketing strategies, from hockey sticks and tennis rackets to skis (Figure 3a).[4] This strategy has paid off in the long run—Oxeon TEXTREME fabric is reinforcing the rotor blades and some other parts on NASA's first Mars helicopter, Ingenuity.

Takeaway: Marketing Strategy

Capturing receptive niche markets to build sales and brand awareness is a useful entry into larger markets with higher entry barriers.

The early evaluation of selling machinery led to the idea of licensing the process technology as a parallel commercial avenue. As a result of early dialogues with interested customers, Oxeon's business model was extended to include licensing. The licensee was a company that wished to use Oxeon's technology to create its own products, but which didn't compete in Oxeon's markets.

"We never excluded the possibility of licensing. We were just waiting for the right opportunity."

Andreas Martsman
VP Marketing and Sales

Technology Proof of Concept Was an Early Necessity

Access to a weaving machine for small-scale production was crucial to Oxeon's business success. Oxeon quickly developed a suitable weaving machine, allowing it to provide samples to potential customers and collaboration partners. This provided proof that the technology was commercially viable and became a convincing argument for the first potential licensee, who was under severe time pressure. "If we hadn't had the machine, I don't think they would have chosen us as a partner," says Mr Martsman.

Therefore, the combination of patent protection and the ability to produce samples created the opportunity to set up a licence agreement. The licensee would probably not have been satisfied by just reading the patent; further steps were needed. Without samples,

4. See, for example, *http://www.textreme.com/the-faction-collective-releases-new-prime-series-ski-collection-reinforced-by-textreme/*.

potential licensees probably would have contacted a machine supplier to find alternative solutions.

Licensing Supported IP Proof of Concept

This early licence agreement became a good source of revenue for Oxeon, co-financing technology and business development in other application areas. It also indicated a strong IP rights basis. Oxeon had to demonstrate that its materials fulfilled the requirements of many applications in different industries. Therefore, the technology proof of concept, which led to the licensing agreement, was a necessary step towards the IP proof of concept. It also created a positive feedback loop towards the extension of the technology into other application areas. As Mr Martsman puts it: "We were able to make licence revenue on our process and use that money to create other business opportunities. That wouldn't have been possible if we'd only patented the end product."

The licensing revenues made Oxeon less dependent on venture capital. Nevertheless, Oxeon needed external capital as well. "These investors have had to be patient," explains Mr Martsman. "We have key investors that understand the long timeline for introducing new material into risk-averse applications with long industry lifecycles."

Takeaway: IP Licensing

Licensing can complement the implementation of the main business strategy and be a means of co-funding the company at an early stage.

Oxeon doesn't actively market licensing opportunities. However, it continues to advertise its openness to different licensing possibilities on its website. Oxeon sometimes receives licensing requests that have led to exchanges with potential partners but hasn't yet found a good match for another licensing deal.

Building a Patent Portfolio

Oxeon has always aimed for broad IP protection, i.e., the combination of processes/methods and fabric materials/structures, and applies for patents as far downstream the value chain as possible. Oxeon also works closely with its customers to identify their needs, and applies for corresponding patents, as appropriate.

Takeaway: Strategic Patent Protection

Consider patenting further along the value chain and protecting applications of a technology close to the consumer market to increase the scope of protection and build a comprehensive control position.

Dr Khokar has been actively involved in Oxeon's patent strategy and patent portfolio development from day one.[5] He studies patent databases to review the prior art and checks the competitors' patenting activity. Together with his patent attorneys, he co-drafts patent applications (except the claims) and responds to communications from IP authorities, as he knows how to explain the technology. Given his extensive knowledge in the field of weaving technology, Dr Khokar's active involvement in the patenting process has proven to be invaluable.

Takeaway: IP Management

Involving top managers in the patent portfolio building process is vital to the strategic relevance of patent protection.

Oxeon has several patented inventions, reflecting the continued further development of its technologies. Instead of simply relying on what was achieved with its initial technology, Oxeon has continuously worked at improving and expanding its patent portfolio in the course of new developments.

As there is no real market in Sweden for composites, textiles, or textile machines, Oxeon has always sought to obtain patent protection in other markets. Oxeon holds several patents for its technologies and unique tape-woven materials in a number of countries in Europe, Asia, and the U.S. Patent applications are typically filed first at the EPO with the benefit of a centralised patent granting procedure and the option to choose which countries to validate the European patent in after grant, as well as early certainty about the extent of patentability. In addition, international applications (under the Patent Cooperation Treaty) are used to eventually seek protection in other territories such as the U.S., Canada, Japan, and China.

Oxeon's patent portfolio protects production methods as well as its unique tape-woven materials (see Table 1). It has been used defensively for the protection of market share in its core business and also to add new markets by allowing access to the technology through licensing.

In one case, Oxeon successfully enforced a patent against an infringer in Germany. Despite the relatively high litigation costs and the drain on internal resources, this helped it secure its leading position. By proving its willingness to sue an infringer, Oxeon reassured its customers and licensee that it was prepared to make meaningful use of its patent rights and defend its market share.

A Holistic Approach to IP

Oxeon follows a strategic approach when it develops its IP portfolio. It always considers the different options, analysing the pros and cons and choosing the

5. Dr Khokar has never completely left academia and has been a professor of textile technology at the University of Borås.

most suitable IP rights. Oxeon decided to sell materials instead of machinery, and therefore its process-related inventions suffer less from the risk of reverse engineering.

Oxeon develops and sells its material under the registered trade mark TEXTREME. This trade mark is registered for different applications in goods, and in several countries and regions, including the EU. The trade mark is more important for sporting goods applications, where TEXTREME is visible on end products, thereby creating an indirect relationship with the end user. It is less relevant for industrial applications where the interaction is business-to-business.

In some cases, Oxeon has chosen not to patent certain inventions and instead keep them as a trade secret. This strategy is typically used for some manufacturing processes that are difficult to reverse-engineer from end products, and for which infringement is difficult to detect and prove. There is then no public disclosure, and no legal time limit to secrecy.

Takeaway: IP Portfolio

A portfolio approach that combines patents, trade marks, and trade secrets provides complementary protection, facilitating both exclusivity and licensing of technologies.

Oxeon's bundle of IP rights, including patents, trade marks, and trade secrets, has proven to be one of the main pillars of the company's commercial success. Oxeon's IP strategy combines the creation of a broad patent portfolio, used for licensing to partners and for blocking competitors, with a trade mark strategy, securing visibility on all products, particularly consumer ones. See Figure 4. ■

Available at Social Science Research Network (SSRN): *https://ssrn.com/abstract=4099723*

Further technology transfer case studies can be found at *epo.org/case-studies.*

Figure 4: Technology Transfer Timeline

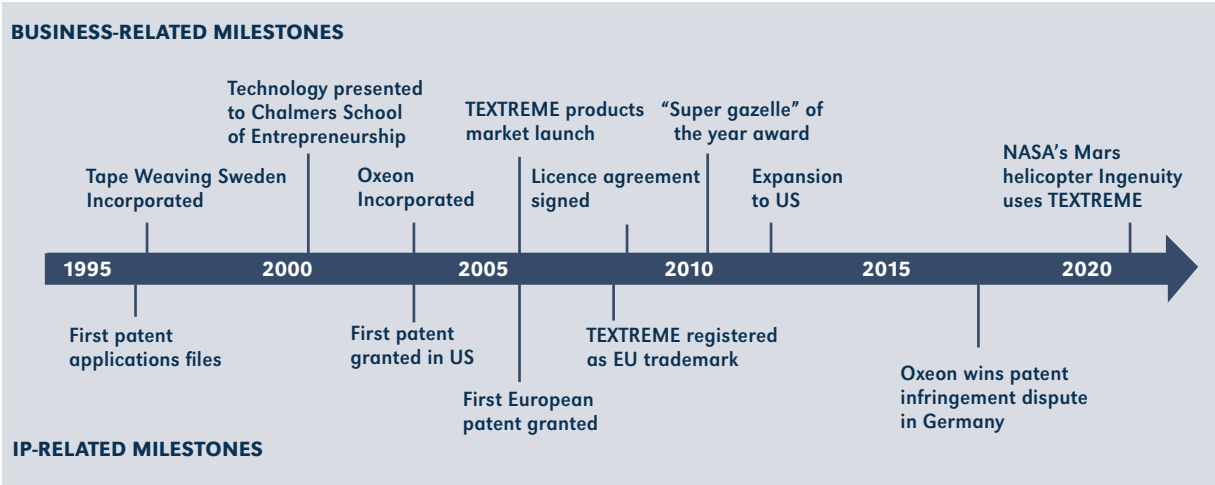


Table 1: Oxeon's Patent Portfolio Applicable To Spread Tow Technologies

Patent Number	Title	Priority Date
EP1354991B1	Woven material comprising tape-like warp and weft and an aid for producing the same	14 April 1997
EP1838909B1	A woven material comprising tape-like warp and weft, and an apparatus and method for weaving thereof	17 January 2005
EP1838911B1	Method and apparatus for weaving tape-like warp and weft and material thereof	17 January 2005
EP2444535B1	Method and means for measured control of tape-like warps for shedding and taking-up	19 October 2010
EP2479324B1	Method and means for producing textile materials, comprising tapes in two oblique orientations	20 January 2011
EP3587477A1	Ultra-thin pre-preg sheets and composite material thereof	21 June 2018

Source of IP

Nandan Khokar

- Researcher and key inventor behind the tape weaving technologies and materials
- Co-founder of the companies Biteam, Tape Weaving Sweden, and Oxeon
- Actively involved in the patent strategy and patent portfolio development

Chalmers University of Technology (chalmers.se)

- One of Sweden's top technical universities; located in Gothenburg, where initial IP was created

Tech Transfer Catalysts

Fredrik Winberg

- Provided entrepreneurial vision and initial business support
- Co-founder of the companies Biteam, Tape Weaving Sweden, and Oxeon
- Member of the board of Oxeon

Chalmers School of Entrepreneurship (Chalmers CSE)

- Pre-incubator, where students create technology ventures as part of their university education
- Facilitated the creation of a viable business model for Oxeon and provided business planning support
- Two students became top managers of Oxeon (CEO Henrik Blycker and VP Marketing and Sales Andreas Martsman)

Business angels and Chalmersinvest (now Chalmers Ventures)

- Provided capital and access to networks

IP Commercialisation

Oxeon (oxeon.se)

- Founded in 2003 and headquartered in Borås, Sweden
- Spin-off from Chalmers University of Technology
- In 2019 it generated a turnover of over EUR 6 million with 34 employees
- "Super gazelle" of the year in 2010
- Provides tape weaving technologies and tape-woven materials to the sports, aerospace, and other sectors
- Materials are sold under the registered trade mark TEXTREME

Editors: Thomas Bereuter, Yann Ménière, Ilja Rudyk
Collaborators: Jörg Scherer, Stephanie Weber (European IP Helpdesk), Anna Malec (EPO
Photos: Oxeon AB

Improving Quality Of Life

By Ciaran O'Beirne

Research collaboration between University College Dublin (UCD) and Bio-Medical Research (BMR) led to the patenting of an innovative solution to an unmet clinical need and created real impact on the quality of people's lives. Following licensing of the technology by UCD, BMR validated it in clinical trials, secured regulatory approval and launched the product in Europe. Due to the attractiveness of the U.S. market, the strategic decision was taken to create Atlantic Therapeutics, a spin-out company of BMR, to raise investment to finance market expansion based on a strong patent portfolio.

INNOVO shorts, electrodes integrated into the shorts deploy pulses to strengthen the pelvic floor muscles.

Industry-Academy Collaboration

"IP management processes can benefit the smooth passage of a research project."

Brian Caulfield
Inventor and Professor of Physiotherapy

BMR, based in Galway, Ireland, is a privately owned company with over 50 years' experience in the design, manufacturing, and marketing of medical-grade products based on electrical muscle stimulation (EMS).

In the early 2000s, BMR decided to explore the commercial potential of Multipath technology, an innovative approach to electrical stimulation. It engaged Brian Caulfield, a UCD physiotherapist with EMS expertise, as a consultant. The two parties submitted a grant application to Enterprise Ireland, the Irish state organisation responsible for the development and growth of Irish enterprises. With Enterprise Ireland funding, UCD and BMR undertook two collaborative research projects to investigate Multipath applications. An initial project in 2006, with a budget of around EUR 200,000, focused on obesity and stress-induced urinary incontinence (SUI). A 2008 project, with a total budget of EUR 1.15 million, had a broader focus, including lower back pain, SUI, spinal cord injury, and chronic obstructive pulmonary disease (COPD).

Collaboration Agreement

Enterprise Ireland's funding conditions required the parties to enter into a collaborative research agreement. UCD's Knowledge Transfer Office (KTO) negotiated the terms, including key IP terms on ownership and access rights, before then drafting the binding contract.[1]

Contract Negotiation

Takeaway: The IP terms should fairly reflect both parties' collaboration input.

Complexities can arise when two or more parties jointly own IP. For example, who should lead the patent filing strategy? Who should pay for the patenting costs? And who is entitled to compensation from the revenues received?[2]

These complexities become even more pronounced in joint ownership arrangements between an academ-

1. The binding contract is the full research collaboration agreement between an academic party and a company. It includes IP terms, financial terms, liabilities, warranties, publication rights, termination, dispute resolution, etc.

2. There is no professor's privilege in Irish universities. The university owns the IP under its contracts of employment and in accordance with its polices, unless an agreement with a third party precludes this. Academic researchers benefit from licence income under the university's IP-revenue share policy.

ic institution and a company, which is able to directly exploit the joint IP. In contrast, the academic party can potentially only license or sell to a third party with the industry joint owner's permission unless there are specific terms in the collaboration agreement that grant the academic party the necessary rights.

Joint Ownership Agreement

Takeaway: A joint ownership management agreement is necessary to facilitate later commercialisation if joint foreground IP is anticipated.

Due to the above issues, the UCD KTO typically seeks to avoid joint ownership situations in collaboration with industry parties. However, given that BMR's contributions were not limited to the project costs since a BMR employee was a member of the research project team, the parties agreed that jointly created IP would be jointly owned, too.

Treating SUI With Multipath Technology

A wide spectrum of treatment options is available for patients with SUI. These include absorbent pads, surgery (*e.g.*, bladder outlet reconstruction), and electrical stimulation. However, treatments that are reversible, simple, non-invasive, and cost-effective are optimal for most patients. EMS meets these criteria. It has proven to be effective in a variety of areas ranging from muscle strengthening to spasticity management and the prevention of disuse atrophy.

EMS activates muscles, causing them to contract, similar to a voluntary muscle contraction. The technology was previously limited due to high skin resistance and difficulties targeting muscles in deeper tissues. These difficulties have been overcome thanks to an innovative approach to electrical stimulation, using novel pulse generation and a switching mechanism, known as Multipath technology. Multipath efficiently targets deeper tissues to achieve stronger muscle contractions, thus re-educating the pelvic floor muscles that control bladder function in a completely non-invasive and pain-free way. See Figure 1.

Focus on SUI and Patent Capturing

The initial idea was for EMS to treat lower-back pain before the focus switched to its use in the treatment of SUI. This is a major medical problem, affecting up to one third of middle-aged women, as well as men, particularly after prostate surgery or a pelvic fracture. It has a significant impact on quality of life.

Firstly, Ruth Maher, who trained as a physical therapist in the U.S., joined Brian Caulfield's project team, adding her knowledge of incontinence to the 2008 project. In addition, positive results were achieved in a small controlled study on 13 volunteers, which focused on the use of EMS as a therapeutic modality for SUI. Further research proved that the novel device was significantly better than conventional EMS devices in reducing the symptoms associated with SUI.

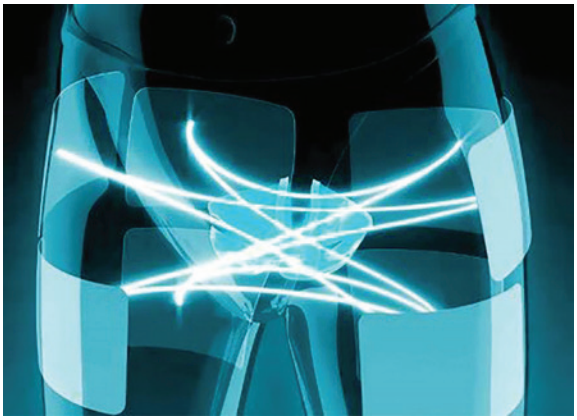
Based on this data and following internal due diligence led by the KTO, the parties agreed to file an Irish patent application to protect the technology and to establish a priority date. Based on this application, an international application under the Patent Cooperation Treaty (PCT) was filed in January 2010, which entered into the national/regional phase in the U.S. and in Europe in June/July 2011. The patents are now granted in both Europe (EP2389222B1) and the U.S. (US8494658B2) and in several other countries.

■ Dr. Ciaran O'Beirne,
Head Knowledge Transfer,
NovaUCD,
University College Dublin,
Dublin, Ireland
E-mail: ciaran.obeirne@ucd.ie

Protecting University Inventions

Currently, UCD's KTO files priority applications with the European Patent Office (EPO) in order to secure a search report within the priority year and then file under the PCT after 12 months. The EPO typically provides search reports within four months, meaning a request for search filed with the EPO guarantees an applicant answers in good time within the priority year.

Figure 1: Illustration Of Working Principle



Multipath technology embedded in shorts. It sends gentle muscle stimulations from the electrodes on the buttocks to the electrodes at the front. This criss-cross pattern stimulates the pelvic floor muscle at the centre.

Typically, the technology is licensed by universities to companies when the patent application is still pending, either during the priority year or during the international phase of the PCT application. It is then up to the company to pursue the patent applications and decide in which countries protection needs to be sought, depending on its key markets. Besides a sound IP strategy, this requires market research and foresight so that a cost-benefit analysis can be completed. But even then, it is sometimes difficult to anticipate the initial success of a patented product or business opportunities in various EU Member States.

Also, the current fragmentation of the European patent system and the costs of maintaining patent protection in several states can be a barrier. As a result, many companies often end up with protection only in a small number of countries. With the Unitary Patent, UCD would obtain protection in up to 25 participating EU Member States, thereby creating enhanced flexibility to enter the various national markets whenever opportune.

"The benefits of transferring the research, it's not just getting a licence agreement over the line, it is the outcome, it's the impact when new products or services are launched at the back of that."

Ciaran O'Beirne
Head of Knowledge Transfer

The claims in the patent detail a method and apparatus for stimulating pelvic floor muscles through the use of externally applied electrodes to all related muscles of patients with SUI. Importantly, the claims anticipated integrating the electrodes into a piece of clothing. In this way, the device evolved from Vital Compact into the INNOVO shorts (see Figure 2).

How Knowledge Transfer Offices Can Successfully Operate as Facilitators

- Skilled and experienced staff
- Continuity in management of IP
- Good working relationship with researchers and company
- Mutual recognition of each party's strengths

Figure 2: INNOVO Wearable Shorts

- Use of external patent attorney with domain expertise
- Pragmatic approach to legal agreements
- Deal structure benchmarked to be fair and reasonable, and reflect industry norms

Licence Agreement

UCD considered BMR as the commercial partner in the project and, under the terms of the collaboration agreement, granted BMR an option to negotiate an exclusive licence to UCD's rights in the foreground IP. The KTO led the negotiation of key licensing terms, and then drafted the licence agreement, which was executed by the parties in 2011.

Industry Collaboration

Takeaway: In academy-industry collaborations, recognise all partners' needs and define incentives and criteria so that the company can act as the commercial partner.

The company was granted a global, exclusive, but field-restricted licence to UCD's rights in the patented technology and a non-exclusive licence to other non-patented IP in the treatment of stress incontinence. The agreed royalty rates were benchmarked against industry norms and on comparative deals in the medical technology sector. Based on this information, the parties agreed on fair and reasonable royalty rates that reflected the technology's stage of development, the company's contributions to the project and

the further development and validation efforts that would be undertaken by the company. The licence deal also included other financial considerations, such as an upfront fee and milestone payments.

Consistent with the KTO's practice, UCD assumed no liability and sought an indemnity from BMR through its use of the licensed technology. The company was also responsible for ongoing patent prosecution and maintenance, including full payment for the costs for obtaining and maintaining the patent given the licence's exclusive nature. Finally, through a grant-back clause the UCD secured a non-exclusive, royalty-free licence to use the technology for academic research and teaching purposes.

Benchmarking

Takeaway: The deal structure should always be benchmarked so that it is fair and reasonable and reflects industry norms.

The licence agreement included a commercialisation plan with mutually agreed milestones. Under these, the company committed to undertake trials to clinically validate the technology, secure relevant regulatory approval, and launch the product within an agreed time. BMR further developed and validated the product (approximately 500,000 treatment cycles were completed with zero adverse incidents) and successfully launched it under the brand name Vital Compact in 2014, following certification under the European Medical Devices Directive 93/42/EEC. It took three years from the execution of the licence agreement to the launch of product—a relatively short time based on comparable licence deals executed by the KTO.

Creating a "Win-Win-Win" Situation

The company secured exclusive rights that enabled it to invest further in validating the technology, launch the product, and develop new markets with associated revenue generation. UCD in turn has received royalties from sales of Vital Compact since its launch in 2014. BMR was also granted option rights to expand the field of use for the treatment of other medical conditions. Under the terms of a second licence, BMR was granted exclusive rights to the use of the patented technology for the treatment of lower-back pain. This area remains the subject of ongoing clinical studies.

Managing Collaborations

Takeaway: Agree on key development and commercial milestones early, to guide and facilitate market success, but be willing to amend as necessary.

This licensing case supports UCD's strategic objective of translating its research outputs for wider societal and economic good. In addition, it provided a constant stream of royalty revenues for the university, a portion of which is distributed to the academic inventors in accordance with UCD's IP policy. The successful transfer of technology developed within the university exemplifies real impact through patient satisfaction and job creation.

UCD's IP Policy

UCD supports excellence in innovation and encourages UCD researchers to create IP. Its policy ensures that the creators of the IP receive recognition and a share of revenues from licensing, which are split between the creators, the academic centre (school) in which they are based, and the central university (UCD) in accordance with the sliding scale shown in Table 1.

Table 1: UCD's IP Policy

Net Revenues	Creators of IP	School	UCD
Up to €100,000	75%	15%	10%
Portion of Net Revenues From €100,000 to €200,000	50%	30%	20%
Portion of Net Revenues From €200,000 to €1,000,000	40%	30%	30%
Portion of Net Revenues Over €1,000,000	30%	30%	40%

Targeting the U.S. Market

Vital Compact was initially sold via referrals from urologists and gynaecologists. Later, the company adopted different distribution channels, including internet sales, primarily in Germany, Ireland, the UK, and the Middle East. Following encouraging sales, the U.S. was viewed as the next major target market due to its size and its overall share of the global incontinence market, which is expected to reach USD 13 billion[3] by 2022.

Investment was needed to gain market traction in the U.S. and drive product innovation. This led to a strategic decision to spin out Atlantic Therapeutics (AT) from BMR to attract investment and maximise the product potential, first in the U.S., and then worldwide. UCD supported the company's decision and the licence was transferred from BMR to AT in 2017, after its incorporation in Ireland. The Vital Compact product was rebranded as INNOVO.

3. Source: Global Market Insights.

Financing Expansion

Key players in the global market for SUI include major international companies such as Johnson & Johnson; Boston Scientific Corporation; and Becton, Dickinson and Company. It is not easy for a small company to gain market share from incumbents with well-established branded product lines and extensive distribution channels. By 2021, AT has raised nearly EUR 50 million in investment to overcome that challenge.

In 2017, two European venture capital firms Seroba Life Sciences (Ireland) and Earlybird (Germany) supported the spin-out of AT from BMR and invested EUR 15 million in funds for the company. The investment was preceded by comprehensive due diligence, including a competitor analysis and a review of market trends, the licensing agreement with UCD, and the IP rights (two freedom-to-operate reports were commissioned). This due diligence and a technology that has proven itself in Europe persuaded investors that INNOVO afforded first-mover advantage as a non-invasive therapy in the treatment of SUI. See Figure 3.

As part of this initial investment, a key early milestone was to secure clearance from the U.S. Food and Drug Administration (FDA). In November 2018, the INNOVO therapy device became the first-ever transcutaneous electrical stimulator to be cleared as a safe, clinically effective, and non-invasive product to treat SUI. FDA approval triggered a further EUR 28 million investment in 2019, led by LSP, one of Europe's largest healthcare investment firms along with Andera Partners (France) and Atlantic Bridge Ventures (Ireland). A further EUR 12 million was raised in 2020 and 2021 with two new investors, Borski Fund (Holland) and WDC (Ireland). The company is aiming for Series C financing to further accelerate growth.

Figure 3: INNOVO Therapy Device In Practical Use

"For an investor, the key attraction of INNOVO is a large, unmet medical need. Plus, it is non-invasive and easy to use. The strong IP allows us to develop the technology for many other indications."

Daniel O'Mahony
Partner in Seroba Life Sciences

Scaling Up

Takeaway: Follow the markets and seek growth financing.

The investment has also been used to drive product development. The external electrodes were incorporated into wearable shorts that were the subject of priority UK patent applications in 2017 and 2018 that led to another international patent application (under the PCT; WO2019110595A1). This innovation also reflected increasing consumer demand for wearable therapies. Further innovations, including a smartphone app to control the device, are in progress.

In 2020 the company opened an office in Boston and has recently featured on a number of major U.S. TV media outlets. These PR activities feature Dr. Ruth Maher, whose knowledge of SUI and involvement in the development of INNOVO reinforces brand credibility and trust. In parallel to ramping up and scaling of its U.S. activities, AT is continuing to develop existing sales channels in Europe. It is also exploring opportunities in Asia, which, with an annual growth rate of 5 percent is forecast to be the fastest-growing market for SUI. See Figure 4. ■

Available at Social Science Research Network (SSRN): *https://ssrn.com/abstract=4099730*

Further technology transfer case studies can be found at *epo.org/case-studies.*

Figure 4: Technology Transfer Timeline

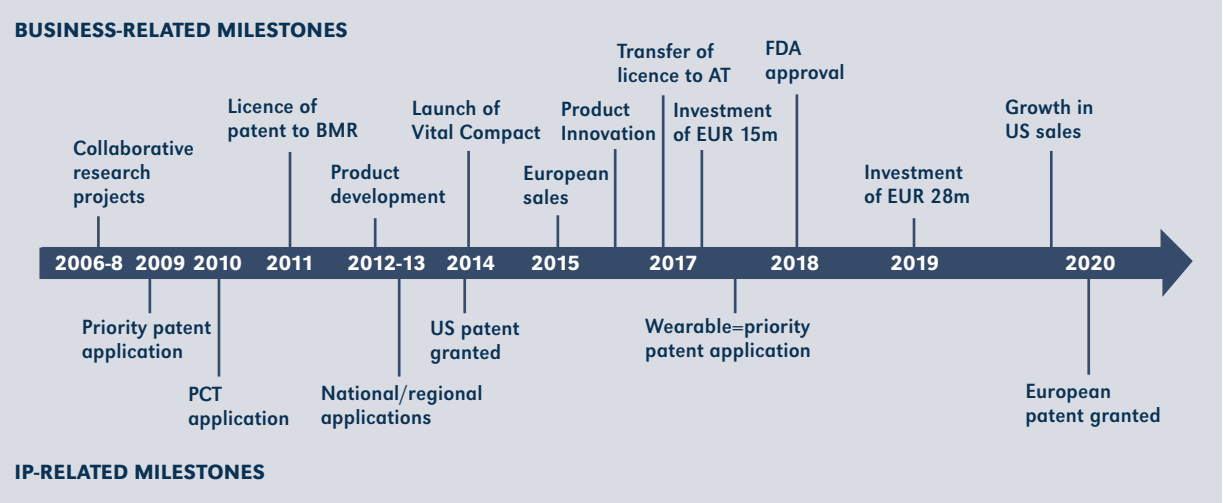


Table 1: Patent Portfolio

Patent number	Title	Priority Date
EP2451525B1	Apparatus for stimulating the lower back and abdominal muscles	10.07.2009
EP2389222B1	Apparatus for stimulating pelvic floor muscles	26.01.2009

Source of IP

Brian Caulfield
- Main inventor and physiotherapist
- His UCD IP portfolio includes eight invention disclosures, four priority patent applications, six licenses and two spin-outs

Ruth Maher
- Main inventor
- Clinical Advisory Board member for Atlantic Therapeutics

Univeristy College Dublin (UCD)
- Founded in 1854, Ireland's largest university with over 30,000 students from 136 countries

Tech Transfer Catalysts

Knowledge Transfer Office
- Facilitated the collaboration between UCD and BMR
- Led the negotiation of key licensing terms and drafted the licence agreement
- Facilitated the commercialisation plan and licence agreements between UCD, BMR and Atlantic Therapeutics

Enterprise Ireland
- Provided funding for collaboration projects between UCD and BMR

Andera Partners, Atlantic Bridge Ventures, Borski Fund, Earlybird, Life Science Partners, Seroba Life Sciences, WDC
- Provided investment for U.S. and global expansion to Atlantic Therapeutics

IP Commercialisation

Atlantic Therapeutics
- Company created in 2017 as a spin-out from BMR
- Winner of 2019 Innovation of the Year Award–Irish Times and the London LSX Medtech Company of the Year 2019
- 29 employees
- Licence transferred from BMR
- Products sold under the registered trade mark INNOVO (registration number 1311618: Priority date 31 August 2015)

BIO-MEDICAL RESEARCH (BMR)
- Privately owned company with over 50 years experience
- Industrial partner of UCD
- Turnover of EUR 29.5m with a profit of EUR 1.5m and 73 employees (2018)

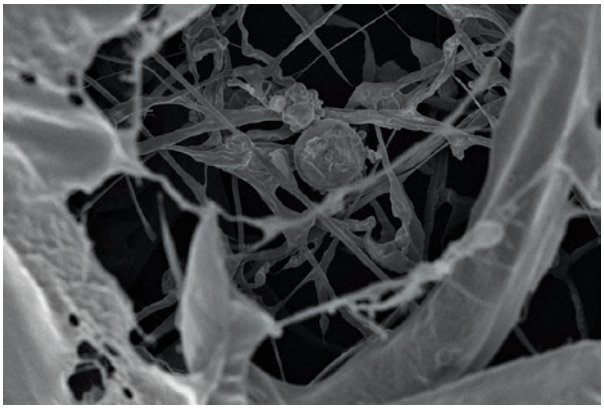
Editors: Thomas Bereuter, Yann Ménière, Ilja Rudyk
Collaborators: Jörg Scherer, Stephanie Weber (European IP Helpdesk), Anna Malec (EPO)

Photos: Atlantic Therapeutics Group Ltd.
Disclaimer: Any opinions expressed in this case study are those of the author or the company and not necessarily those of the European Patent Office.

Healing Wounds

By Dr. Fazilet Vardar Sukan and Mustafa Çakir

R&D led by four female inventors from a Turkish university laboratory resulted in a product that can treat open wounds, such as diabetic ulcers. Although IP protection was secured early on with the help of the local technology transfer office, initial commercialisation attempts through licensing failed. Encouraged by their participation in a start-up acceleration programme, the female inventor team created the start-up Dermis Pharma. With the help of strong IP, the young company was able to secure the necessary venture capital funding for cost-intensive clinical trials and product development. A corporate partnership became possible through an IP-assignment deal with a big Turkish pharma company and accelerated the commercialisation process.



Once applied to scarred tissue, Dermalix wound dressing generates a web-like structure containing microparticles which form a new, skin-compatible layer over time.

Developing a Disruptive Technology

In 2012, a research team comprising Professor Özgen Özer, Professor Evren Homan Gökçe, Assoc. Professor Sakine Tuncay Tanrıverdi and Professor İpek Eroğlu from Ege University Pharmaceutical Technology Lab grew interested in substances that could be incorporated into microparticles for treating wounds.

The team decided to focus their research on the development of biocompatible and biodegradable matrices for wound-healing applications. Through market research they became aware that chronic wounds were a huge and growing challenge worldwide. There are approximately 400 million diabetic patients around the world and 10 percent of them suffer from diabetic foot ulcers, which can lead to a complete loss of mobility. The researchers quickly recognised the technology's potential to speed up the healing process while reducing patients' pain and thereby improving their overall quality of life.

They came up with the innovative idea of using the technology to develop a skin patch that would help the skin to heal and then disappear when the body's own cells formed new tissue. In this way, Dermalix wound dressing was developed: a novel patch made from natural skin components for treatment of chronic and open wounds. Animal experiments showed that the patch provided a fast, effective, and convenient pharmacological treatment: a single dosage led to a wound's full recovery within two weeks. Its multiple-layer structure strengthened the skin's tissue-repair mechanism thanks to microparticles loaded with the antioxidant resveratrol. Since the dermal matrix was prepared with natural skin components, there were no adverse effects.

Figure 1: Dermalix Wound Dressing

Dermalix wound dressing is a skin patch used to accelerate wound healing, especially for foot wounds caused by diabetes.

Strong IP Protection for Market Success

In 2015, the four researchers decided to turn their invention into a marketable product. They knew that commercialisation in the healthcare sector was impossible without patent protection.

"A patent is like a birth certificate in the healthcare industry. If the product does not have patent protection, you may lose most of your competitive advantage in the market. If there were no patents, we would not even have a chance to get in contact or co-operate with companies."

Evren Homan Gökçe, Sakine Tuncay Tanrıverdi, Özgen Özer, İpek Eroğlu

Team of inventors and founders of Dermis Pharma

At the time, Turkey was still practising what is called the professor's privilege, meaning that the academics were expected to file their own patent applications.[1] However, not many patents were being filed at the time due to a lack of knowledge, time, and funding. The team consulted Ege University's EBİLTEM technology transfer office (TTO), which provided guidance and encouraged the R&D team to file and submit an invention disclosure.

The TTO's preliminary assessment showed that the invention was patentable. However, the researchers were not sure if they could spare the necessary time and secure financing to follow up on the patenting process.

As a result, they transferred the IP rights to the university. This gave them full access to TTO support to manage the patent application process, as well as access to university funds to cover the costs.

1. The professor's privilege was abolished in Turkey in 2017. All inventions made by employed scientific staff are deemed to belong to the university.

2. Clarification of legal aspects such as ownership of the inventions was a prerequisite for bringing a proposal to the IP Commercialisation Committee.

Funding Protection

Takeaway: Patent cost funding can be an important factor for technology transfer in the pharmaceutical industry. It regularly takes more than 30 months until a sustainable commercialisation deal is closed.

Assessing the Technology

The university required the approval of its IP Commercialisation Committee to process the patent application. The committee aims to make the best possible use of the university's funds to promote promising inventions, achieve revenue payback, and ultimately bring recognition to the university.

In preparation, the Ege University EBİLTEM TTO conducted a comprehensive technology assessment in three major dimensions:[2]

- **Technical:** technology-readiness level, feasibility, novelty, development needs, possible claim coverage;
- **Market:** market size, market predictions, value propositions, status of freedom to operate, competitors; and
- **Strategy and Finance:** compatibility with university innovation strategy, portfolio position, project sustainability, inventor support, financial support from stakeholders.

■ Dr Fazilet Vardar Sukan,
RTTP Director,
Sabanci University
Nanotechnology Research
and Application Center,
Istanbul, Turkey
E-mail: faziletvardar@sabanciuniv.edu

■ Mustafa Çakır,
Patent Attorney, RTTP, QPIP
Co-Founder at Patent Effect,
Istanbul, Turkey
E-mail: mustafa@patenteffect.com

Technology Assessment With IPscore

Takeaway: The TTO team used the EPO's free IPscore tool as a basis for the technology assessment. IPscore makes it possible to qualitatively analyse, graphically visualise, and document the pros and cons of technologies and research projects identified during the assessment.

The committee was won over by the invention's technical novelty, commercial opportunities, and a target market of over 50 million patients worldwide.[3] As a result, the IP rights were transferred to the university

3. IDF Diabetes Atlas, International Diabetes Federation, Sixth Edition, 2013.

"Technology evaluation or assessment are key elements in the technology transfer process in order to select the most valuable technologies to focus the efforts put into commercialisation."

Mustafa Çakır
Patent attorney and commercialisation manager at the time at EBİLTEM TTO

in return for institutional technology transfer services to bring the invention to the market.

The positive decision of the IP Commercialisation Committee marked the starting point in the team's entrepreneurial journey. Based only on a Turkish priority patent application, the TTO team developed an IP protection strategy, with a strong claim set and broad patent protection around the core invention. In addition, to keep all commercialisation options open, it agreed to seek broad geographical protection to cover all the main markets.

Challenging the Options

Regulations categorised Dermalix wound dressing as a medical product (medical device, class 3), not a drug. This helped to speed up the certification process as the market entry requirements for medical products were not as strict. However, the categorisation required further tests for approval that needed to be funded.

The TTO team considered two options: to license the patented technology at this early stage, or to find a partner who would provide funds and know-how to develop the technology by increasing its readiness level so that it could meet market requirements.

Before reaching out to international companies for licensing or collaboration, the TTO and the research team unanimously agreed to implement the IP protection strategy developed and to extend the patent protection by using the Turkish priority application to file an international application under the Patent Cooperation Treaty (PCT). This secured the option to obtain patent protection in a large number of countries while also providing an important advantage: more time to decide in which countries protection of the invention should eventually be sought.[4]

Initially, the inventor team and the TTO were inclined to license the technology to either a Turkish or a global pharmaceutical company, since establishing a spin-off was considered riskier and more time-consuming. The TTO team used different channels, such as medical clusters, industry associations, and direct personal contacts to identify potentially interested companies. However, this approach did not lead to any concrete results because the technology was still not considered to be mature enough and success was too uncertain.

The second option to engage either Turkish or global pharmaceutical companies in a research co-operation failed as well. After analysing feedback from various established contacts, as well as conducting several interviews with Turkish and global executives of pharmaceutical companies and carrying out an additional market assessment, the team realised that the "not-invented-here" syndrome of many large pharmaceutical companies was too large an obstacle to overcome. Although the technology had some initial favourable in vitro results from cell-line and animal tests, global pharma companies still considered it too much effort to make it market-ready.

The Turning Point

Accessible local grants were quickly being exhausted. New applications to local and European Union Horizon 2020 grants required substantial time and effort, with an uncertain outcome. Nevertheless, the TTO team and the inventors still believed that Dermalix wound dressing could change the wound care solutions market and deserved to be tested in the market.

Thankfully, an award from a start-up acceleration programme opened up a new avenue and directed the commercialisation strategy towards a university spin-out. The special programme provided hands-on training to the inventor team on how to assess the product-market fit of a technology and how to evaluate a product's market potential. It provided the opportunity to conduct many expert interviews, as well as further market studies, and to visit new and established wound care providers and pharmacies in Istanbul to learn about the critical dynamics of the market.

Start-Up Creation

Takeaway: Having a strong business orientation is a great benefit for academic spin-out formation.

4. The PCT makes it possible to seek patent protection for an invention simultaneously in a large number of countries through the filing of a single, "international" patent application instead of several separate national or regional ones. Applications under the PCT can be filed directly or within the 12-month period provided for by the Paris Convention for the Protection of Industrial Property from the filing date of a first application, which has legal effect in all of the over 150 contracting states to the PCT. When an applicant files a PCT application, in most cases they have up to an additional 18-19 months from filing (or usually 30-31 months from the filing date of the initial patent application from which priority is claimed) before they have to begin the national phases with individual patent offices and to fulfil the national requirements.

The Dermalix wound dressing team was selected as the most successful team and, due to its favourable product-market fit characteristics, the technology was ranked first in the start-up acceleration programme. This gave the research team national visibility and encouraged it to invest yet more time and effort in its entrepreneurial activities.

Both the TTO and the researchers realised, however, that field-specific support was necessary for this specialised application area. The technology promised market value, but needed the expertise and mentorship of medical and commercial experts. An improved and well-defined start-up commercialisation plan had to be defined to attract funding, investors, and big-pharma companies as partners or customers.

University Spin-Off Interaction

Around that time, EBİLTEM TTO was selected as an official partner of the TÜBİTAK entrepreneurship initiative and entrusted to implement a start-up funding and acceleration programme. With a revised business concept targeting spin-off creation, the Dermalix wound dressing team was successfully selected as one of the most feasible technology-based submissions. Their business concept was awarded TRY 150,000 (EUR 50,000 in 2015) in government funding for the creation of a start-up called Dermis Pharma with the aim of increasing the technology's readiness from technology-readiness level (TRL) 4 to 6.[5]

In accordance with its IP policy, Ege University expressed an interest in becoming a shareholder of the spin-off company in return for financial and in-kind contributions. The technology patented by the university was transferred to the spin-off company in return for an equity deal through a dedicated agreement signed between the parties. This was the first example of its kind, since the tech-transfer ecosystem was in its infancy in Turkish universities. The partnership agreement between the university and Dermis Pharma allowed the TTO to continue supporting the inventor team on its entrepreneurship journey.

University Innovation Ecosystem

Takeaway: A well-defined IP policy, qualified commercialisation experts, the support of university administration, and a widespread network are critical success factors for IP-based spin-off companies.

IP Strategy and Market Segmentation

As the PCT patent application was approaching the end of the 30/31-month period, the team had to decide where to obtain patent protection.

The TTO team further developed the initial market analysis with the goal of identifying the most promising countries and regions in which Dermis Pharma could commercialise the invention. In addition, the TTO team used its personal networks at organisations such as the Licensing Executives Society International, the Enterprise Europe Network and the European IP Helpdesk, as well as contacts in big pharma companies, to inquire about their patent strategies for wound care technologies.

IP Expertise

Takeaway: Involving a global IP and licensing network can provide deeper insights and novel pathways for better IP strategy and IP management facilitating commercialisation.

This led to the selection of a wide set of patent jurisdictions, ensuring the best chances for subsequent commercialisation: the U.S., Canada, Russia, China, Japan, South Africa, Brazil, Australia, and Europe (validated in 36 countries through the European patent system under the European Patent Convention).

Approaching Venture Capital Companies

As well as the initial start-up financing, the young company still needed additional funds to further develop the technology, complete clinical tests, and progress with the patenting process. Through its national network, the TTO arranged pitching sessions with several venture capital (VC) companies in Turkey, two of which selected Dermis Pharma for more in-depth assessments.

Following an extensive due diligence analysis, the TTO selected one of the companies. Despite the company's difficult terms and conditions, the parties managed to reach a consensus and sign an investment agreement.

Criteria to be Considered When Assessing Venture Capital:

- Business networks
- Prior knowledge about technology and targeted markets
- Past experience in life-science technologies
- Flexibility
- Equity sharing strategy
- Capacity for business growth
- Personal attitudes
- Business philosophy
- Company development perspective
- Relations with former co-investors

5. There are nine TRLs. TRL 6 is defined as technology demonstrated in relevant environment (industrially relevant environment in the case of key enabling technologies).

The Real Power of Patents

The funds provided by the VC company were used to finance clinical trials, technology development needs, and patent protection in ten countries. However, establishing production and sales pipelines and obtaining regulatory approval from different countries still required significant additional funding.

Dermis Pharma did not want to sacrifice too much of its autonomy in return for further investment. The researchers and the TTO therefore decided to pursue an alternative path and collaborate with an established pharma company.

Technology Transfer Models

Takeaway: Spin-off and corporate partnership models are attractive approaches that can be widely implemented by technology transfer offices.

The Turkish pharmaceutical company Abdi İbrahim was soon identified as a strong potential partner. In line with its strategic vision for 2025, Abdi İbrahim was aiming to identify new products for international markets and assessing acquisition and partnership opportunities. Last but not least, it had gathered prior collaborative research experience with Ege University's research teams.

Abdi İbrahim's Open Innovation Strategy:

- Expand and improve the product portfolio by relying on local scientists and universities
- Develop new R&D projects with universities in order to enhance innovation capacity and stay close to the latest developments
- Develop a vision to establish a well-structured IP portfolio to become one of the leading companies in the respective sector
- Be open to adding new over-the-counter (OTC) products to the portfolio in growing treatment areas such as oncology, metabolism (osteoporosis, diabetes, obesity), the immune system, ophthalmology, the cardiovascular system, and the respiratory system
- Be able to quickly and successfully add original and generic biotech products in international markets to the portfolio through start-up investments and academic partnerships
- Be open to opportunities to mutually develop products to improve patients' lives

The key to convincing Abdi İbrahim proved to be the product's well-established patent protection with its broad geographical coverage, as well as it being a perfect match for patients' needs in terms of price-benefit ratio.

"We always think that it is all about the development of new technologies. No, it is all about converting these new technologies into solutions touching people's lives. And technology transfer is one of the best ways for early-stage university technology to do so."

Professor Fazilet Vardar Sukan

TTO director at the time and Professor at Ege University at the time at EBİLTEM TTO

The TTO team helped the spin-off company to negotiate with Abdi İbrahim. It was important to carefully define how much of Dermis Pharma's rights and autonomy could be given up in the course of the negotiation.

Preparing for Negotiations

Takeaway: It is important to hold training sessions with academic inventors to inform them about the terms of the possible deal and provide negotiation tips before any meeting with venture capital companies.

The main issues concentrated on developing strategies for better commercialisation outputs:

- Customer segments
- Marketing channel
- Cost and pricing management
- Sustainable know-how management and transfer from researchers to the company
- Developing the best patent protection strategy in different countries
- Possible exit strategies for the research team members

After two years of negotiations, the two signed a deal, assigning all patent rights from Dermis Pharma to Abdi İbrahim. Dermis Pharma remained responsible for R&D activities, and the inventors were able to stay on as researchers at the university. Abdi İbrahim, strong at logistics and in bringing a product to market, took over responsibility for production and marketing. This clear-cut definition of roles helped to eliminate potential conflicts.

The product Dermalix wound dressing received CE certification for meeting EU standards for health, safety and environmental protection. It has been on the shelves in Turkey since June 2021. Abdi İbrahim is also ready to sell Dermalix wound dressing in international

markets, after clarifying the marketing strategy.

Beyond the potential commercial success of Dermalix wound dressing, Dermis Pharma is growing steadily as a well-respected research and development company catering to pharmaceutical and cosmetic sectors. ■

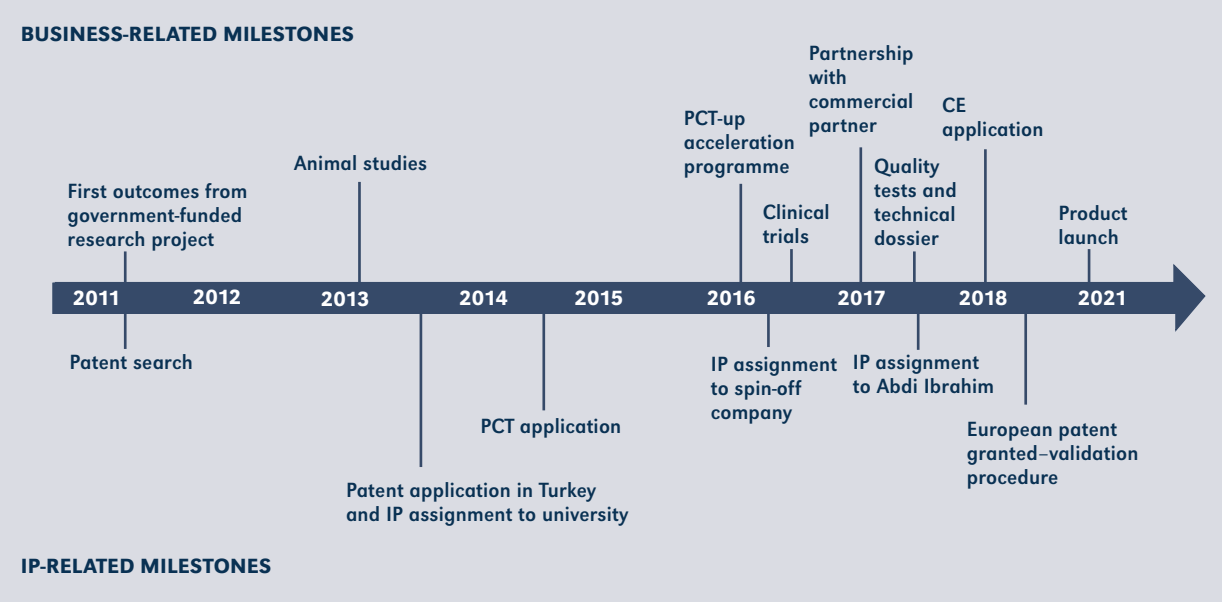
Available at Social Science Research Network (SSRN): *https://ssrn.com/abstract=4099733*

Further technology transfer case studies can be found at *epo.org/case-studies.*

Table1. Patent Information

EPO Patent Number	Title	Priority Date
EP3024505B1	A dermal matrix and production method thereof having synergistic effects comprising microparticles, which provide tissue repair	25.07.2013

Figure 2: Technology Transfer Timeline



Source of IP

Özgen Özer, Evren Homan Gökçe, Sakine Tuncay Tanrıverdi, İpek Eroğlu

- Four female inventors and founder fo Dermis Pharma
- Original owners of IP rights (due to professor's privilege)

Ege University

- Established in 1955, one of Turkey's leading scientific institutions with a strong research infrastructure and 3,150 academic staff
- Owner of IP rights during patent application: IP rights later transfered to Dermis Pharma

Tech Transfer Catalysts

EBİLTEM Technology Transfer Office

- Pioneered as the first university-industry co-operation interface institution in Turkey in 1994
- Established to strengthen university R&D through industry co-operation and technology commercialisation
- Provided guidance and encouragement to the R&D team to file an invention disclosure
- Conducted a comprehensive technology assessment covering technical, market, strategy, and finance aspects
- Developed an IP protection strategy

TÜBİTAK and venture capital company

- Provided funding for clinical trials and patent protection

IP Commercialisation

Dermis Pharma (dermispharma.com)

- IP-based university spin-off
- Founded in 2016 to commercialise the technology for chronic wound care
- remains responsible for R&D activities

Abdi İbrahim

- Commercialisation partner, responsible for production and marketing
- Final IP Assignee (from Dermis Pharma)
- A market leader in the pharmaceutical industry in Turkey for more then 15 years, with a history going back 109 years
- Prior experience in collaborative research with Ege University
- Products are sold under Turkish trademark Dermalix (201672034)

Editors: Thomas Bereuter, Yann Ménière, Ilja Rudyk
Collaborators: Jörg Scherer, Stephanie Weber (European IP Helpdesk), Anna Malec (EPO)
Photos: Dermis Pharma

Cycling Safely Into The Future

By Massimiliano Granieri

A collaboration between a Politecnico di Milano research team and e-Novia, a company creator, led to the development of new technology for ABS control systems and the creation of a disruptive spin-off company Blubrake, with some of the inventors later becoming involved in the management of the company.

Blubrake's Integrated ABS System for e-Bikes.

From Lab to Market

In 2015, a research group led by Professor Sergio Matteo Savaresi, full professor of automatic control at Politecnico di Milano (Polimi), was working on the development of a braking control system for e-bikes when they were approached by e-Novia. Milan-based e-Novia, which was co-founded by Savaresi, is dedicated to the creation of deep tech spin-offs. Its engineers and managers scale up technologies by identifying untapped potential and then create specially designed spin-offs to which they assign the technology. e-Novia had previously collaborated with Polimi on other projects, including smart mobility.

e-Novia had the idea of forming a company to commercialise an innovative ABS controlling system for e-bikes. They saw market potential in Polimi's technology and approached a group of researchers in the electronics department. e-Novia's technical staff and Polimi researchers started to collaborate, with the goal of developing a marketable solution.

Takeaway: Entrepreneurial Mindset

Good researchers and good inventors can also become good managers in the right environment; for example, when provided with proper training.

In the same year, Blubrake was formed as a spin-off of Polimi and e-Novia. Under a collaboration agreement, Polimi agreed to share its intellectual property (IP), while e-Novia became the main shareholder and the provider of the engineering services and capabilities needed to develop a market-ready solution. Blubrake became the hub for the long process of R&D development, prototyping, and, ultimately, manufacturing and selling.

■ Massimiliano Granieri, Professor of Law at the Department of Mechanical and Industrial Engineering, University of Brescia, Italy
E-mail: massimiliano.granieri@unibs.it

e-Novia

In 2015, a group of entrepreneurs in northern Italy created e-Novia, a large operation made up of an élite mix of innovators, including engineers, designers, and business experts, who scale up technologies by identifying untapped potential and create specially designed spin-offs to which they assign the identified technology.

e-Novia acts as a start-up accelerator, promoting and growing innovative companies in the areas of robotics, artificial intelligence, and mobility. It builds upon intellectual property that is created together with research institutes and international corporations and invests in coaching technical people on how to become managers.

e-Novia's enterprises focus on deep technologies and operate in three main strategic areas:

(i) "Collaborative mobility": products, services, and solutions for future vehicular mobility, impacting performance, safety, and comfort.

(ii) "Augmented human": wearable devices helping humans to augment their perception and capabilities.

(iii) "Humanised machines": technologies for automated and smart systems to increase efficiency and flexibility in factories and industrial environments.

e-Novia's business model is based on the idea of leveraging IP from multiple sources and combining it with competences and financial resources to create businesses with international ambitions.

More specifically, e-Novia sees universities, start-

ups, and corporations as potential providers of ideas to create new business according to a service factory model. The standard process of company creation follows a clear path from idea (generating innovation), to invention (transforming innovation), to enterprises (transferring innovation).

So far, e-Novia has generated 35 entrepreneurial projects and created 20 active enterprises, including Blubrake. The company provides a full range of engineering services to both portfolio companies and external clients. It also endeavours to introduce technical people to business and trains them to become managers.

The Value of Collaboration

The technology at stake refers to AI-powered algorithms controlling a mechatronic braking system. There were significant complexities to overcome in order to apply the controlling technology to bikes and turn it into a commercial product. It required the specific expertise of the bicycle industry to develop relevant use cases (*e.g.*, e-bikes, e-cargo bikes) and meet the manufacturing requirements of bike producers and their suppliers, as well as the expected product market price.

Takeaway: Inventors' Involvement

The involvement of the research team in the technology's industrialisation helped the company to address technical problems effectively, such as fitting the ABS system in the bike chassis without compromising other functions, and thereby become more credible to original equipment manufacturers (OEMs).

It was therefore crucial to the success of the technology transfer for the academic researchers and e-Novia professionals to combine their respective skills and expertise. The Polimi research team provided expertise in control systems and optimisation of the braking system's controlling algorithms and developed the seminal technology on the ABS control system. However, the braking system is also made out of hardware components that must be adapted to the bike and to its subsystems, including batteries and gearshifts. Its design and implementation require skills in design, engineering, manufacturing, quality control, and supply chain management—all of which were within the capabilities of Blubrake and its professional team.

But first and foremost, e-Novia was responsible for the managerial growth of the young technical people and PhD students involved in the project, turning them into entrepreneurs. It is therefore not surprising that some of the inventors took on managerial responsibilities within the company. Fabio Todeschini, a former PhD student at Polimi, and an employee of e-Novia when the company was set up, played a particularly important role. He became a co-founder of Blubrake, acting as a link between Savaresi's team at Polimi and the start-up, and later taking on the role of Blubrake's general manager.

Takeaway: Multi-Layered Technology Transfer

Technology transfer, including the transfer of knowledge by people, is important for market success. Inventors can become co-founders and take over management functions.

"IP is important in two main respects. Firstly, it helps to attract investors when companies are mature enough to grow. Secondly, it is important for exit purposes as it increases corporate value."

Fabio Todeschini
Co-founder and general manager of Blubrake

A Disruptive Approach to IP

From the outset, Blubrake's solutions were developed with a view to generating IP. The team learned to identify new inventions and seek adequate protection. However, Blubrake and Polimi did not file their first jointly owned patent on the control system for e-bikes ABS until 2016. This is unusual for a university technology transfer: universities will normally file a patent as a prerequisite for testing the technology on the market and to allow scientific publications. In contrast, Blubrake was created from the outset around a specific USP and a specific market (e-bikes). This enabled the company to have trade secrets and to draft the first patent more in terms of tailored technology features and design. Of course, strict confidentiality had to be maintained during the development stage.

This proved to be a successful avenue for a deep tech start-up. In 2017, Blubrake was already able to develop its first market-ready solution and to start commercialisation efforts. In 2019, the company's ABS control system for e-bikes was certified and it entered its first commercial agreements with early adopters, OEMs such as manufacturers of braking

systems, gearshifts sets and frames, and e-bike manufacturers in general. The company today employs more than 25 engineers, plus managers, and has been awarded a number of grants, awards, and prizes over the years:

- Eurobike Winner in Bicycle Component category (2019)
- Bicycle Brand Contest Winner (2019)
- SME Instrument Phase 2 (2018)
- Intesa San Paolo Innovation Center Award (2018)
- Gaetano Marzotto Award (2017)

Financing the Journey

e-Novia not only helped to create Blubrake but also played a key role in attracting financing and negotiating with the initial funders. Early financing was important for the deep tech start-up to finance four years of R&D before concluding the first contract. It took longer than expected to reach the market because the technology needed to be thoroughly tested to meet the strict safety requirements. In return for a majority share in the company, e-Novia agreed to support researchers with the funding of developmental activities and the filing and maintenance fees for the ensuing patent applications.

Until 2020, e-Novia, together with other early investors, funded Blubrake, which was also supported by a grant from the European Commission's Executive Agency for Small and Medium-sized Enterprises. At the end of 2020, the company raised EUR 5.2 million from private investors to finance growth. Due diligence from investors pointed to the importance of the proprietary solution, its protection with IP rights, and the existence of a technical roadmap that would be matched by adequate, parallel patent protection. The newly raised funds were used to develop a second generation of ABS, miniaturised and fully integrated into the bike frame, which were launched on the market in Q4 2021.

IP as Part of the Framework Agreement Between Polimi and Blubrake

Under a framework R&D agreement, e-Novia and Polimi worked together to develop new technological products and companies. Regulating the relationship between Polimi and Blubrake before starting the collaboration research proved to be a crucial move as it reduced transaction costs and smoothed the process of IP generation. This is a key point, as many universities fail to effectively market technologies due to a lack of clarity on IP ownership or poor management of relationships with interested business parties.

Takeaway: Collaboration Framework Agreement

A well-defined collaboration framework agreement will smooth the process of IP generation and its later use, reduce transaction costs, and create incentives for all partners.

One of the main advantages of the framework agreement between e-Novia and Polimi was that it regulated the ownership of the foreground inventions and ensured that the rights to file for patent protection belonged to the institutions and not to the single inventors involved in the research activities. While Italian patent law recognises the so-called professors' privilege when it comes to faculty-generated inventions, it also allows employers to own the patent rights when research funding comes from an external source. Individual researchers are consequently designated as inventors, but the patent rights are assigned to Polimi.

Under this arrangement, the patent application was filed in the name of both Blubrake and Polimi. Blubrake was not interested in being the sole applicant, as Polimi's name on the application added credibility and visibility. The technology transfer office (TTO) consented, as it too gained in visibility. For Blubrake, there is no risk that Polimi will share the technology with others or develop it in a different direction. There is an additional option for Blubrake to buy out Polimi's share of the patent ownership if required.

The same agreement acknowledged the company as an official spin-off of Polimi, a status which gave enormous advantages to the researchers involved. Under Italian law, academic professors and researchers, who are public servants, are permitted to become involved in companies and to engage in operative and executive roles while retaining their full-time position with their institution, but only in cases where the company itself is acknowledged as a spin-off.

When Blubrake became a spin-off company, the TTO managed jointly generated inventions and patents. Under the framework agreement between Polimi and Blubrake, it also managed the initial patent family's IP portfolio, but with Blubrake as licensee bearing the costs.

The Technology Transfer Office at Polimi

The TTO's core mission is to create economic impact at the local, national, and international levels by enhancing and exploiting scientific and technological innovation. This is achieved by:

- Seeking the most innovative research results
- Using IP rights to increase the level of protection of the research
- Increasing the valorisation and economic exploitation of the research results

The spin-off community is supported both by the TTO and a university incubator known as PoliHub.

The TTO follows the spin-off and the associated IP protection issues and strategy from the start of the project. After the spin-off creation and accreditation, the IP rights owned by Polimi are licensed or assigned to the new company under facilitated agreements. Polimi cannot directly take shares in the company. Typically, PoliHub takes an equity stake and also provides support through mentorship, entrepreneurship, and acceleration programmes.

The recently established Poli360—the Politecnico di Milano and 360 Capital SGR Venture Capital Fund—will help to support the development of entrepreneurial projects and stimulate collaboration with corporate partners in order to establish internationality and scalability—the basis of entrepreneurial success.

The TTO actively builds networks for the development of long-standing partnerships with other universities and research institutions and works closely with other TTOs and incubator associations such as NETVAL (the Italian TTO association) and PNI CUBE (the Italian Association of University Incubators).

The Technology

The company develops and produces advanced mechatronic systems, focusing on braking and sensing applications for bicycles, in particular e-bikes and e-cargo bikes. Today, Blubrake is already producing and selling the second generation of an ABS system that integrates digital services, generating data that can be processed with AI engines to improve performance.

Blubrake provides the only "open-platform" ABS system powered by a mechatronic system currently available in the e-bike market. This can be fully integrated inside the bike frame and can drastically increase safety for all types of e-bikes. The overall technology is both a hardware and a software system. The hardware includes sensing devices and actuators that allow the wheel to read the road and send a signal to the AI-powered system. The software includes AI that elaborates the signal and sends the controlled instructions to the braking unit. The actuator modulates the pressure in the front brake in order to guarantee smoother braking and avoid front wheel lock-up, which is a major cause of accidents when riding an e-bike.

The software component—the control system which responds in real time to the bike's behaviour—was developed within a long-standing collaboration with Polimi, regulated by long-term research contracts. See Figure 1.

The main components of the integrated system are:

- The speed sensor and the phonic wheel, which are designed to measure the front wheel speed with high precision and in real time
- The main unit, which combines an electronic board that acts as the proprietary system's brain, powered by state-of-the-art AI architecture developed by the research team, with the ABS actuator, designed to continuously and instantly increase or reduce hydraulic pressure in the front brake
- The ABS human-machine interface (HMI) for driver control of the status

In the integrated system, the electronic board and the actuator are embedded within the bike frame. The system can be commercialised both through OEMs (bike manufacturers) and as an aftermarket solution (plug & play) that can be installed on existing bikes. It includes:

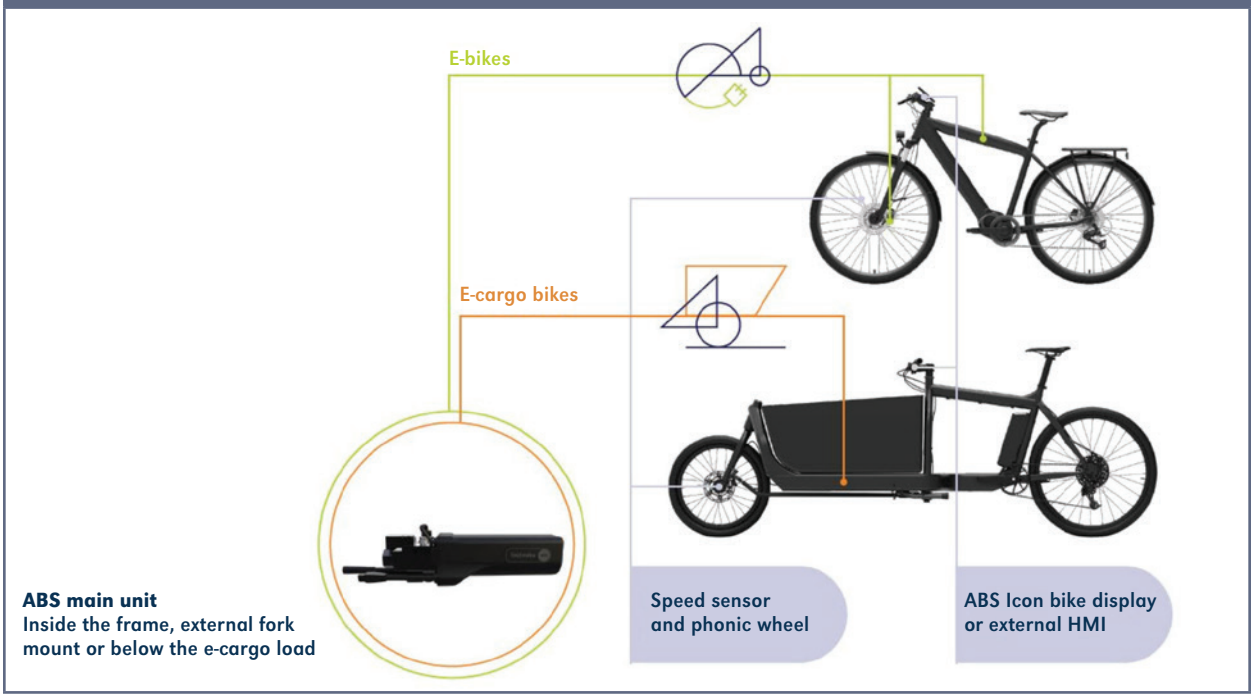
- The speed sensor and the phonic wheel
- An external ABS actuator and electronic board
- The ABS HMI

The Market

Blubrake collected data using surveys conducted by major consulting companies. The data showed that 58 percent of accidents involving e-bikes happen while braking and 24 percent are related to braking. When people fall off their bikes, 39 percent of cases are caused by the front wheel locking and 25 percent by a loss of balance. As e-bikes can reach even higher speeds, this makes the braking issue even more serious. There was clearly a need for a market solution in the field of smart mobility. This helped to identify Blubrake's USP and create the business around it.

There is limited market competition in the field of ABS bike brakes. That said, those few competitors are big players. It took longer than expected for the technology to reach the market due to the testing process and the need to make it compatible with existing biking systems. The Bosch ABS, the main market competitor, is a closed solution that is mounted on the bike only in combination with other Bosch components and Magura braking systems. Blubrake offers an open system and its solution can be adapted and integrated into any other bike system—and not just with a specific bike brand. This means that straight assignment of IP

Figure 1: Components Of Blubrake's ABS Control System



or exclusive licensing to third parties is not practical, as implementing the solution also means adapting the system to the bike's specifications. Therefore, interactions with the OEM are crucial for the technology to be adopted.

The market for e-bikes is booming, not least because of the different concepts of smart mobility triggered following COVID-19. In 2016, 98,000 e-bikes were sold in the European Union. Since then, sales have increased to over four million per year. According to estimates from the European Cyclist Federation, between 2018 and 2030 over 50 million e-bikes will be sold to a variety of different users: urban commuters, bike enthusiasts, families, and so on.

Currently, the widespread need for smart mobility systems means that there is an extremely high level of interest in the technology in all global markets. The global e-bike market is valued at an estimated USD 18.2 billion and is expected to grow at an average annual rate of five percent until 2024. The Asia-Pacific area, with a value of some USD 13.5 billion and around 33.7 million e-bikes sold, is the biggest market worldwide. However, it is characterised by the slowest growth rate and the lowest average price, with an estimated premium segment that amounts to only 4 percent of the total. Europe is the second market by size, valued at around USD 4.6 billion, with some 2.9 million e-bikes sold. This is characterised by the highest average price and a growth rate above the world average, making it the most important market for Blubrake, with a 46 percent share of premium e-bikes (price above EUR 1,500). North America is still a relatively small market but shows the highest growth.

Safety is one of the main inhibitors to accelerated market growth. Increasing high speed, the risk of safety systems failing, and low motor vehicle awareness of e-bikes all raise safety concerns. In this context, the strength of an e-bike manufacturer's brand alone does not drive customers' purchasing decisions. In fact, most cyclists are not even familiar with OEM brands. Instead, it is component quality and improved user experience that mostly drive their decision to buy a particular e-bike. Battery performance and brake reliability are the most relevant components. According to a survey by Brose Antriebstechnik of 200 respondents, 42 percent said that the braking system plays an important role when selecting and purchasing an e-bike.

Blubrake meets the market demand for braking systems by providing a solution that reduces the risk of front wheel lock-up, which causes the bike to roll over the rear wheel lift-off, which in turn causes the bike to skid in the event of sudden braking.

The Business Model

Blubrake sells its ABS control systems to OEMs. At the same time, it is also a technology platform provider, supporting OEMs in adapting its technology solutions to specific needs and bike models. Its open-ended ABS hardware and software system for e-bikes can be

adopted by any OEM and any bike manufacturer. This makes it adaptable for use on any e-bike and renders it highly flexible and scalable in any market segment.

In a market dominated by major players such as Bosch, Brose, Yamaha, and Shimano, the strategic value of patents is instrumental for market penetration and recognition for a newcomer such as Blubrake.

Takeaway: IP Business Models

IP protection is instrumental to many different business models. In the case of commercialisation of open-ended solutions IP allows for control of the technology also in the course of collaboration with others.

IP Management at Blubrake

Consistent with the original DNA of the company, Blubrake is still very active in innovation and patenting. It is part of the managerial skills of its technical people to understand that the solutions developed can be a source of enormous competitive advantage and that such advantage should remain with the company through adequate forms of protection. "Design, develop, and protect" is the formula for Blubrake's patent management strategy.

As the provider of a braking system that is integrated within a complex object such as an e-bike, Blubrake relies on its patent portfolio to be recognised as a highly skilled and robust technology player and to reinforce its bargaining position in global supply chains with international partners.

Takeaway: Patent Protection Is Not Just a One-Off Decision

The alignment of technology development and patent protection is important as a company undergoes technology redesign and market customisation. Patent protection requires continuous management, rather than one-off decisions.

Awareness of the importance of patent protection within the company, its management, and its alignment with the technological roadmap, and the support of a network of trusted IP professionals, allowed Blubrake to build a remarkable portfolio of high-quality patents. See Table 1.

Some of the EP applications listed are still pending and no decision to grant has been taken. Granted patents may also undergo an opposition or appeal procedure, in accordance with the procedures laid down in the European Patent Convention, which could limit the scope of protection of the patent. All legal events are published in the European Patent Register and can be accessed via *www.espacenet.com*. ■

Available at Social Science Research Network (SSRN): *https://ssrn.com/abstract=4099736*

Further technology transfer case studies can be found at *epo.org/case-studie.*

Figure 2: Technology Transfer Timeline

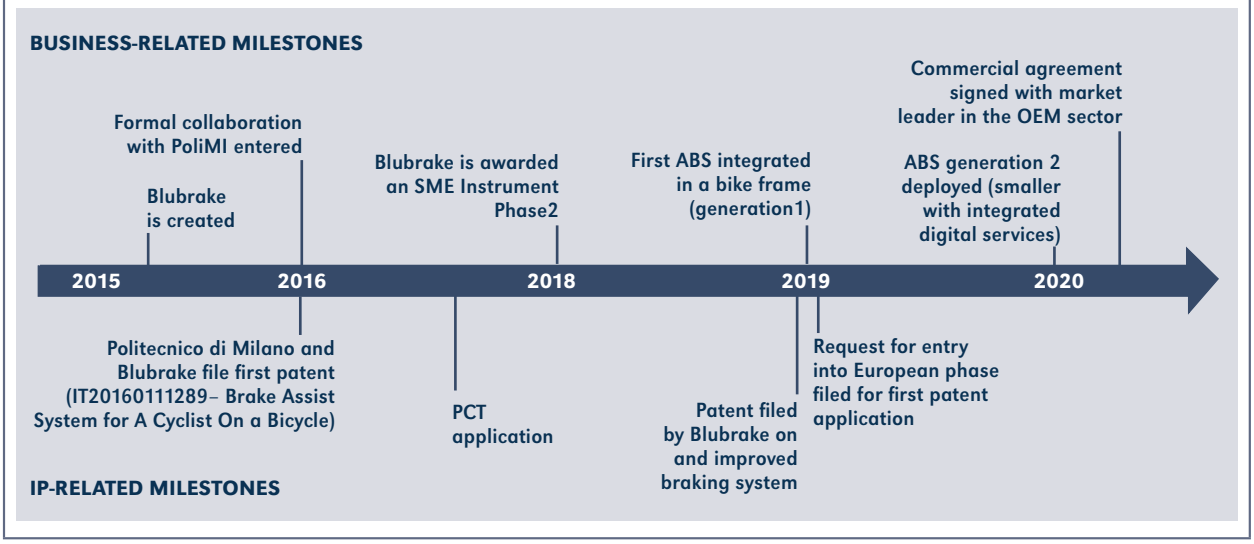


Table 1: Blubrake's Patent Portfolio

Patent number	Title	Priority Date	Applicant
EP3310628B1	Brake assist system for a cyclist on a bicycle by a haptic feedback	19.06.2015	Blubrake
EP3380847B1	Device for determining the angular speed of a bicycle wheel and the pedaling cadence applied to the pedals of said bicycle	24.11.2015	Blubrake
EP3535169A1	Brake assist system for a cyclist on a bicycle	04.11.2016	Blubrake, Politecnico di Milano
EP3411285B1	System for assisting in driving a bicycle by sending a haptic feedback to a cyclist	04.02.2016	Blubrake
EP3717318A1	Adaptive brake assist system for a cyclist on a bicycle by an aptic feedback	27.11.2017	Blubrake

Source of IP

Sergio Matteo Savaresi

- Full professor of control systems at Polimi
- Co-founder of e-Novia
- The team's principal investigator and now a company shareholder
- Worked for the spin-off company during its technology transfer transition stage while still retaining a full-time position at the university

Politecnico di Milano (Polimi)

- An Italian public university that already had fundamental controlling technology before the creation of the spin-off. Here, the technology continued to be researched and adapted for the market after meeting e-Novia

Fabio Todeschini

- Former PhD at Polimi, co-founder and now General Manager of Blubrake and board member

Tech Transfer Catalysts

e-Novia

- Founded in 2015
- A company builder and incubator made up of engineers and managers who scale up technologies by identifying untapped potential fields
- Identified a team from Savaresi's group within Polimi (end 2015)
- Identified the need in the market and the corresponding technology and created Blubrake
- Provided first financial aid

Polimi TTO

- The first contact for inventors
- Responsible for managing the IP procedures and the IP portfolio of the initial patent family

IP Commercialisation

Blubrake spin-off

- Founded in 2015 as a spin-off from Polimi within the e-Novia group to which identified technology was assigned
- Formed before the first patent application was filed
- The co-owner and licensee of the ABS technology
- Provides "open-platform" ABS system currently available on the e-bike market

Awards and prizes:

- Eurobike Winner in Bicycle Component category (2019)
- Bicycle Brand Contest Winner (2019)
- SME instrument phase 2 (2018)
- Intesa San Paolo Innovation Center Award (2018)
- Gaetano Marzotto Award (2017)

Staff

20 (mostly engineers)

- Turnover EUR 1,675,171 (2019)
- Key products/services: integrated ABS system for e-bikes

Customers

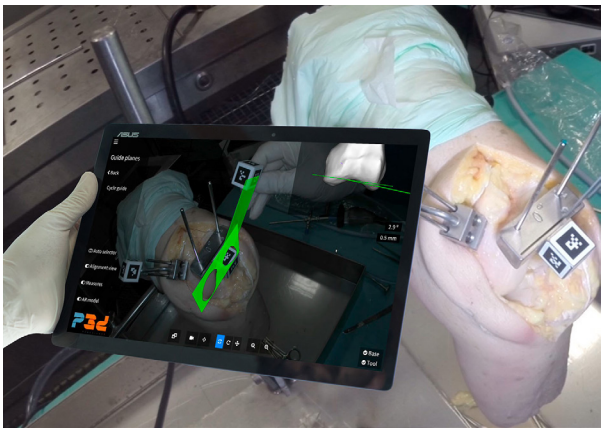
Crescent, Bulls, Stromer (other non-disclosed OEMs)

Editors: Thomas Bereuter, Yann Ménière
Collaborators: Jörg Scherer, Stephanie Webber, Anna Malec
Photos: Blubrake
Disclaimer: Any opinions expressed in this case study are those of the author or the company and not necessarily those of the European Patent Office.

Disrupting Surgical Navigation

By José Ricardo Aguilar

Spinning out from the Portuguese University of Coimbra proved to be the best way forward for Perceive3D to commercialise a promising technology in the medical imaging area. Due to the small size of the local market, broad patent protection proved crucial to both targeting international markets and securing continuous investment during the long development and approval phases leading up to commercialisation of the technology.



Augmented Reality Guidance for Arthroscopy

How the Journey Began

It all started when Professor João Pedro Barreto and his PhD student Rui Melo embarked on a research project on camera calibration and real-time image processing for endoscopy systems, which quickly led to the development of early-stage prototype software. João Barreto became aware of the importance of intellectual property (IP) in R&D projects after attending a training session addressing IP protection at the University of Coimbra (UC). The session was delivered by the Instituto Pedro Nunes (IPN), a private non-profit association that runs a business incubator. Immediately after the training, Professor Barreto contacted UC's technology transfer office (TTO) to disclose an invention that described a new way of solving radial distortions in images, a problem inherent in existing surgical navigation systems.

As part of the disclosure, Professor Barreto had to complete an invention disclosure form, including information about the development path of the technology, the potential applications, and what companies might be interested in licensing the IP, together with an outline of the potential early disclosures of the intellectual assets involved. With this information, in 2011, the UC TTO began the process of evaluating the patentability and technology transfer potential of the invention. Through the screening process it was determined that the invention met the criteria for patentability, and UC filed a first patent application (EP12772538) in July 2011.

Takeaway: IP Awareness

IP awareness among researchers is key to ensuring that research results are properly assessed and protected prior to novelty-destroying publication.

Creating a Spin-Off

The next step in the process was to get a better understanding of market needs. Potential commercialisation partners were contacted with a view to out-licensing the technology right away or cultivating relationships that could advance the research to the extent where it could be out-licensed. During this period, João Barreto was very involved in the initial attempts to find a partner and became interested in launching a spin-off company himself. According to the UC TTO's evaluation, this was an appropriate route to commercialisation since a dominant IP position had already been established. Finding a licensing partner in Portugal on the other hand proved to be difficult for an early-stage, high-risk technology in a small local market. Larger multinational companies are usually not very keen to invest in technology directly emerging from universities, at least not until the technology reaches a certain market readiness level. At the same time, public funds to upgrade the prototype to a level that would be attractive to industry partners were scarce. So, the decision was taken to launch a spin-off company that would advance the technology to more sustainable and market-ready solutions. The resulting company, Perceive3D (P3D), was incorporated in 2013, with João Barreto and Rui Melo as founders and first investors. An exclusive licence agreement was signed between UC and P3D in the same year.

Securing Access to Technology on Preferential Terms

Special conditions were defined by UC to facilitate the incorporation. It did not claim any upfront payment and royalties were only due once P3D started to make its first sales. In exchange, P3D agreed to take over part of the patent administration and maintenance costs, not only for the initial patent application, but also for future patent applications arising from R&D

co-operation with UC in the same technical field. This represented a considerable outlay for P3D, but it was able to apply for co-funding from structural European funds, which allowed it to reduce its financial obligation by 80 percent. By way of a further advantage, such costs are tax-deductible under Portuguese law.

According to the terms of the licence agreement, P3D had to pay royalties to UC on gross sales arising from patents exploited by P3D. The agreement is constructed to ensure that the university can claim royalties not only from products but also from services arising from any of the licensed patents. The agreement further defines a ceiling value—the maximum accumulated royalty to be paid, after which the university would cease its claims—together with the obligation of the company to cover all legal and patent maintenance costs, with the possibility to deduct those costs later from the ceiling value. 2020 marked the first year in which royalties were paid by P3D under this licensing agreement. The agreement includes a future option for P3D to buy all these intangible assets from the university for a predefined lump sum.

Takeaway: Continuous and Flexible Support

Universities should continue supporting their spin-offs once the licence agreement is signed and the spin-off has been created. In most cases, licence agreements should include the option to be adjusted to react quickly to rapidly changing economic environments.

Financing the Journey

The first venture capital (VC) fund to invest in P3D was Portugal Ventures, a Portugal-based public VC fund. This investment, in 2013, followed the "classic" seed round approach of securing a minority share in the company, leaving the majority of the shareholding in the hands of the founders. This approach facilitated P3D's future development and any forthcoming rounds of investment. Part of the money collected in this first investment round was used to cover the patenting costs. Despite support from European Structural Funds, and as P3D needed patent protection in many markets, IP expenses consumed a substantial share of the amount received from the VC fund in P3D's first few years of operation. However, without this strong IP protection effort, it would have been more difficult to obtain funding for such an early-stage and R&D-intensive project. In fact, prior to the decision to invest in P3D, Portugal Ventures carried out a thorough due diligence to assess the company's IP strategy and ongoing patent application filings.

In 2017, P3D received a grant from the SME Instrument from EASME, the EU's Executive Agency for SMEs, now known as EISMEA. Currently, substantial additional funding from VC funds is on the agenda to boost P3D's operations, proving the effectiveness of the company's IP strategy and its effort to ensure broad and international IP protection of its key technologies.

The Technology

P3D is built on a set of continuous developments in the medical imaging area. Beginning with image enhancing improvements, developments expanded into navigation and guidance technologies for arthroscopic and open orthopaedic surgery. The company offers simplified and cost-effective solutions, reducing the amount of sterilised materials needed for each surgery significantly, enabling faster and cheaper proceedings. All P3D's software solutions run on universal handheld smartphones/tablets, surgical cameras, and even mixed reality headsets, thereby avoiding the need for more capital-intensive equipment that would not be portable and would occupy valuable operating theatre space.

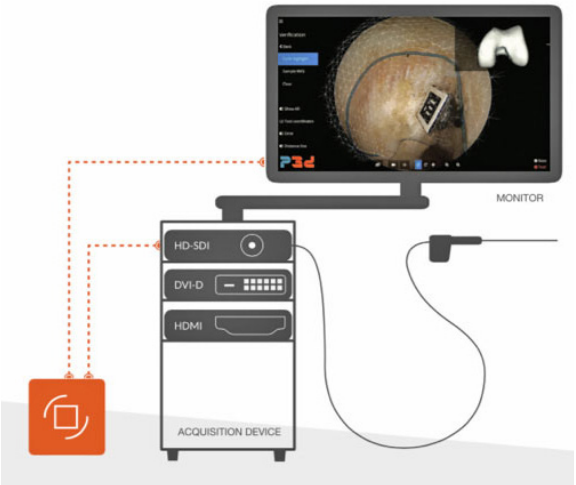
■ José Ricardo Aguilar,
Head of Legal & IP
Instituto Pedro Nunes,
Coimbra, Portugal
E-mail: jraguilar@ipn.pt

At the first stage of development, P3D focused on new camera calibration methods applying pixel value and pixel position techniques to improve visualisation and correct the surgical camera lens distortion, or fish-eye effect.

An image-based surgical navigation, combining a pre-operative 3D surgical planning tool with real-time intra-operative guidance, based on augmented reality (AR) technology, was the next stage of development. This included the development of the first navigation system for computer-assisted orthopaedic surgery (CAOS) in arthroscopy. It overlays the existing video from an arthroscopy tower with clinical information displayed in AR, which means that the tunnels can be placed depending on patient-specific anatomy with unprecedented accuracy and control.

The latest and current phase of improvements is centred around the idea of "open surgery." P3D's proprietary software runs in commercial off-the-shelf devices (mobile phones or tablets), overlaying AR guidance information to the device's video feed. This brings together a guidance system based on video that unites real-time image processing with AR for cutting, drilling, rimming, or aligning parts with confidence and accuracy. Further developments in open surgery include an image-free navigation system for total knee arthroplasty that does not require pre-operative information. Since surgical planning is performed intra-operatively, this reduces medical costs and eliminates the need for pre-operative planning.

Figure 1: P3D's Software



P3D's software runs in a universal add-on service device, overlaying the existing video from the arthroscopy tower with clinical information displayed in AR.

Figure 2: P3D's Software Platforms

P3D software can be deployed in a multitude of computer platforms equipped with a video camera, including mobile phones and tablets.

The Market

P3D's technology is adjustable to many procedures and anatomies in orthopaedics (hip, spine, shoulder) and, taking into account both open and minimal invasive surgeries, has an estimated total potential market of EUR 4.2 billion. Thanks to its superior navigation technology, it also has the potential to reduce surgical revisions by 20 percent, with estimated direct savings of EUR 2 billion. This estimate comes from a recent study that shows that the percentage of revision procedures after 12 years is 12 percent, from which at least one fifth, corresponding to more than 312,000 surgeries per year, could be avoided by ensuring accurate implant placement.[1, 2]

P3D acts in a very competitive technical field, populated by big multinational companies. On top of that, healthcare-related markets have typically a considerably longer time to market compared with other technological areas, due to the extensive regulatory and approval processes that exist in many countries. This results in a long and challenging process that needs to be overcome before any product can be offered for sale, and requires significant initial capital investment as well as patience on the part of all stakeholders involved.

The Business Strategy

In the healthcare industry, it is vital to convert the ideas and prototypes covered by patent applications into actual products that can be used by healthcare professionals. In the early days, P3D showcased its technical achievements to practitioners at trade fairs and other events, looking for direct sales. These patent applications were filed prior to any relevant technical disclosure, to keep the inventions' novelty secured. P3D finally managed to find a "shortcut," launching its navigation system for hip surgery by licensing its technology to a global implant manufacturer. The development phase for the product has been successfully concluded and the system is expected to enter the market in early 2022.

In parallel, P3D is also working on launching its own branded product, a navigation system for total knee arthroplasty that runs on a small device like a smartphone or tablet. The regulatory phase is expected to kick off by the end of 2021 and launch on the market in 2022. This will enable the company to prove market readiness through initial direct sales and increase its potential value in the event of an exit strategy.

IP at the Centre of the Core Value

This dual business strategy is only possible due to the broad patent coverage that was taken care of early on by UC and P3D. Originating in a relatively small country, while targeting competitive international markets and working with a long time-to-market period, it was important for P3D to continue to invest in R&D in order to improve and offer new solutions. At the same time, it had to make sure that its technology

1. C. W. Jones and S. A. Jerabek. "Current Role of Computer Navigation in Total Knee Arthroplasty," *The Journal of Arthroplasty* 33 7 (2018) 1989-93.

2. K. Thiele, *et al*. "Current failure mechanisms after knee arthroplasty have changed: polyethylene wear is less common in revision surgery," *The Journal of Bone and Joint Surgery*, American Volume 97 9 (2015) 715-20.

was properly protected by patents and other IP rights in its main markets: Europe and the U.S.

The commitment of its founder João Barreto and his team to identifying opportunities to protect the company's technical improvements and his and the team's direct involvement in the patent drafting process was a key factor in the success of their strategy to build up a strong and geographically broad patent portfolio. This allows the company to be competitive in the MedTech sector and improves its chances of attracting more investment from VC funds in the pursuit of a successful exit.

The protection of the key enabling technologies early on was a crucial factor in P3D's success, especially in the initial phase of its development. It allowed the company to block competitors' movements in the same fields, providing it with more time to reach the market and simultaneously giving it freedom to operate while reducing the chances of third-party infringement.

Takeaway: Key Enabling Technologies

Protecting the IP of the core technologies is a critical success factor in the initial phase of technology and business development.

"Once in place, the unitary patent will open new perspectives for the future of patents in Europe, in particular because of the wider protection available in up to 26 participating member states, not to mention the reduction in complexity and administrative burden."

Rui Melo
Co-inventor, co-founder, and CTO

Managing IP

From the outset, the P3D team had a clear strategy when it came to patents: "patent the roots, not the branches." Protecting only enabling and multi-purpose computer-implemented inventions rather than those with specific and more focused inventive steps was the key to covering a broader scope of technical applications of the technology with fewer patents. This allowed the company to maintain a sensible trade-off between costs and protection, which is a crucial issue for any early-stage start-up.

It is worth mentioning that protection was obtained for the first patent application in Europe, the U.S., Japan, and China, whereas the following applications were restricted to Europe (Germany, France, and the United Kingdom) and the U.S., as these two economic areas account for roughly 70 percent of the potential market for the company's products. In Europe, the first patent is still maintained in Germany, France, United Kingdom, Switzerland, Portugal, and the Netherlands. This invention would clearly have benefited from a unitary patent, as this would have reduced the overall costs of protection.

Choosing a skilled patent law firm with a good reputation (especially in the U.S.) is vital to ensuring the technical and legal correctness of the patent documents, while the credibility and reputation of the patent attorneys concerned sends a signal to the market, competitors, and future investors alike.

"As a researcher you might feel tempted to stick to science and stay away from the business side of the venture. However, if your venture does not have a businessperson as an early founder, then staying away from business is not an option."

João Barreto
Professor, co-inventor, co-founder, and CEO

P3D is currently working on filing new international patent applications as the sole applicant,[3] demonstrating its strength and solid growth, as well as keeping IP as a central priority in its business strategy.

The Teacher-Entrepreneur Approach

The involvement of the research team in the commercialisation process was fundamental, not only because of their scientific and technical background, which made it easier to assess market opportunities, but also to ensure that the negotiated agreements met the expectations of all stakeholders, including the university, the inventors/entrepreneurs, and any future investors. However, to achieve that, the entrepreneurial skills of the researchers, whose efforts are traditionally focused on the academic side (teaching, publishing, and performing fundamental research) had to be improved. They therefore attended business courses and workshops provided by IPN and UC, developed the initial value proposition for the company, partici-

3. In accordance with the agreement between UC and P3D, all patent applications were filed with UC as applicant. An exclusive licence was granted automatically to P3D.

pated in the negotiation of contacts with potential investors, and validated the opportunity with potential clients worldwide.

This "teacher-entrepreneur" approach is epitomised by João Pedro Barreto, P3D's CEO and founder, who keeps up his teaching and research at the university alongside his duties as company CEO.

The Role of the TTO

With the aim of promoting knowledge transfer from academia to the market by liaising between researchers, public authorities, and private companies, the UC TTO supported P3D's creation and development from the moment João Pedro Barreto first contacted it to disclose his invention. The UC TTO helped draft and manage the first IP applications and registrations and promoted the licensing of the IP from UC to P3D. P3D has benefited from this innovation ecosystem from the start, combining a vibrant and open-minded approach with the direct support of UC's business incubator IPN.

"Although not without risks in the long term, helping to create local spin-off companies such as P3D greatly contributes to the regional and national economy by creating highly skilled jobs, retaining qualified staff in the region, and increasing the competitiveness and robustness of the national industrial sector."

José Ricardo Aguilar
Head of Legal/IP, IPN

UC IP Policy

Under UC's IP policy, the university owns intellectual property that is developed through research conducted using its facilities and resources. If the IP commercialised by UC generates income, the "net revenues" (after deduction of UC's out-of-pocket expenses for protection and licensing) are shared with the people who created the IP, with 55 percent going to the inventors and 45 percent to the university.

Although UC has a strong portfolio with a huge market potential, its TTO soon discovered the difficulties involved in commercialising such assets, whether through licensing or by selling direct to big players.

It therefore came up with a specific strategy to boost healthcare-related technologies into the market by enriching UC's innovation ecosystem through partnerships, with the goal of:

- Increasing synergies and collaboration with local infrastructures (*e.g.*, the IPN business incubator) to promote the launch of university IP-based spin-off companies
- Enabling researchers with an entrepreneurial profile and skills and competencies to create the conditions to explore their entrepreneurial paths
- Involving local and national private investors to leverage the early investment needed to bring the technology to a more mature stage, where it can become attractive to bigger, global investors

Whenever the UC TTO was called on to assess a possible patent submission from a research team, it started also to identify possible entrepreneurial profiles amongst the group, sharing with them the creation of a spin-off as an alternative path to the classic out-licence of IP to third party companies and supporting them to acquire new skills/competencies needed to move forward. As a result, researchers in a number of R&D units and departments started to talk around coffee tables about colleagues that decided to start-up companies and their achievements.

UC has a strong technology cluster on healthcare-medical devices and biotech, with over 300 active patents in 2020. Its portfolio is mostly composed of patents relating to healthcare, from a mix of very different scientific backgrounds such as ICT; mechanical, electrical, and chemical engineering; pharmacy; biotechnology; neuroscience, and, of course, medicine.

IPN Business Incubator

Instituto Pedro Nunes, the private non-profit association founded in 1991 by UC, is today the most successful business incubator in Portugal, responsible for multiple success stories in the field of tech-based entrepreneurship. It has become a powerful and diverse hub of support and networking to more than 300 companies, accounting for a combined turnover of around EUR 190 million, mostly from exports. These companies currently employ a total of more than 2,500 highly qualified staff and have a survival rate (number of companies still in operation five years after incorporation) of more than 70 percent.

IPN included P3D from its incorporation in its incubation programme, providing direct support to the founders in the early-stage phase of the company. Recently, IPN has expanded P3D's follow-up under its acceleration programme as a result of the proven success of the company.

Unitary Patent

The unitary patent will help UC address the challenge of patenting new inventions that are still at an early stage of research and development. Under the current system, the initial decision to validate a patent

in specific EPO member states means that the university has to decide early as to which national markets it might want to enter at a later stage. As a result, it may decide not to enter certain new markets due to the lack of patent protection, or to operate in them without it. The introduction of the unitary patent will benefit UC, since the university can then decide whether to enter new markets at any time, depending on the success of the technology or on new business opportunities in other EU markets, and not on where the patent has been previously validated. See Figure 3 and Table 1.

Some of the EP applications listed are still pending and no decision to grant has been taken. Granted patents may also undergo an opposition or appeal procedure, in accordance with the procedures laid down in the European Patent Convention, which could limit the scope of protection of the patent. All legal events are published in the European Patent Register and can be accessed via *www.espacenet.com*. ■

Available at Social Science Research Network (SSRN): *https://ssrn.com/abstract=4099737*

Further technology transfer case studies can be found at *epo.org/case-studies.*

Figure 3: Technology Transfer Timeline

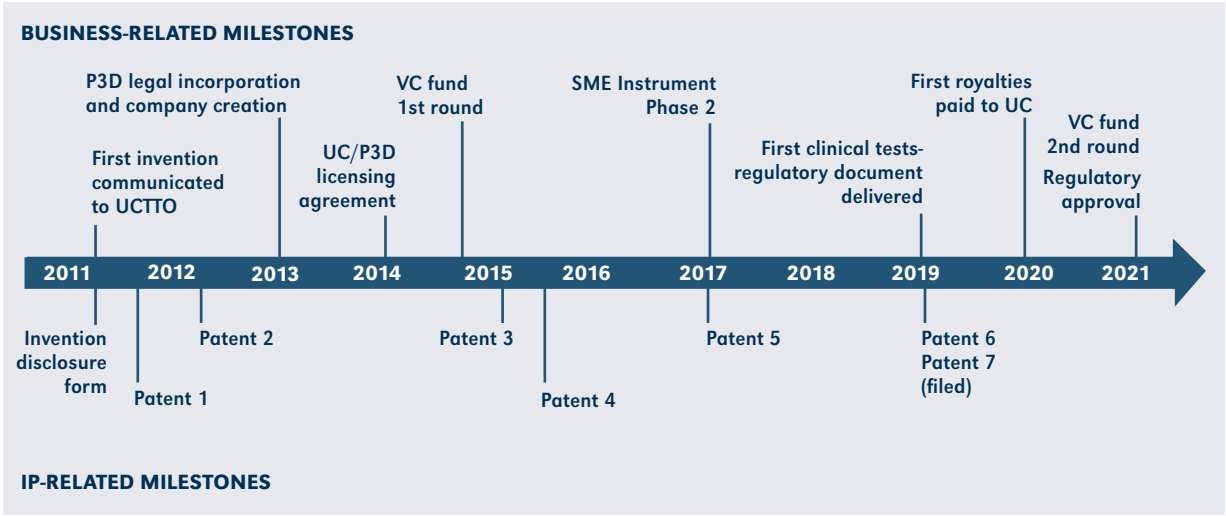


Table1. P3D's Patent Portfolio

EPO Patent Number	Title	Priority Date
EP2742484B1	Method and apparatus for automatic camera calibration using one or more images of a checkerboard pattern	25.07.2011
EP2904584B1	Method for aligning and tracking point regions in images with radial distortion that outputs motion model parameters, distortion calibration, and variation in zoom	05.10.2012
EP3273854B1	Systems for computer-aided surgery using intra-operative video acquired by a free moving camera	26.03.2015
EP3284252B1	Methods and systems for camera characterisation in terms of response function, colour, and vignetting under non-uniform illumination	13.04.2015
EP3596657A4	Systems and methods for 3D registration of curves and surfaces using local differential information	14.03.2017

Source of IP

João Pedro Barreto and Rui Melo

- Inventors, founders, and managers of Perceive3D

Tech Transfer Catalysts

Instituto Pedro Nunes business incubator

- Private non-profit association founded in 1991 by UC
- Supported more than 300 companies since 1995
- Combined turnover approx. EUR 190 million
- Over 2,500 highly qualified staff
- Survival rate (companies still in operation five years after incorporation) of more than 70%
- Supported P3D with its launch and in negotiations with VC funds

UC TTO

- Created in 2003
- Drafted and managed IP applications and enforcement (patents, trade marks)

IP Commercialisation

Perceive3D

- University spin-off established in 2013, headquartered in Portugal, specialising in surgical navigation systems for orthopaedics
- Partnered with a global implant manufacturer
- Turnover (2020) EUR 203,600 with 13 employees (5 PhDs plus 8 MsC)

Selected awards:

- Building Global Innovators (MIT Portugal Program) 2013, award granted by ISCTE and MIT Portugal
- Top 25 Portuguese StartUps (2017, 2018, 2019), award granted by ScaleUp Portugal
- SME Instrument Phase II (2017), comprising a co-financed grant of EUR 1.3 million
- "Bartolomeu de Gusmão" award (2018) from the Portuguese Patent and Trademark Office in the "Innovative Start-Ups" category

Editors: Thomas Bereuter, Yann Ménière, Ilja Rudyk
Collaborators: Jörg Scherer, Stephanie Weber (European IP Helpdesk), Anna Malec
Photos: Perceive3D

Sensors For Blades—Stress Reduction For Wind Turbines

By Christian Hackl

Encouraged by an IP-savvy university institute director with an entrepreneurial spirit and positive feedback from industry sponsors, a team of young researchers decided to bring their fibre optic measurement technology to market. Access to the university's patent portfolio and research facilities, together with the business experience acquired by one of the co-founders, paved the way to the creation of fos4X. The young company decided early on to focus on applications for wind turbines, and their patents turned out to be crucial in a market of mostly large players. The company was acquired in 2020 by PolyTech on the basis of its innovative technology and IP portfolio.

fos4X provides streaming analytics using fibre-optic sensors on the rotor blades of wind turbines.

A University Research Project

The five co-founders of fos4X—Lars Hoffmann, Mathias Müller, Thorbjörn Buck, Rolf Wojtech and Markus Schmid—all did their PhDs at the Institute for Measurement Systems and Sensor Technology at the Technical University of Munich (TUM) under Professor Alexander Koch. The team's research on optical sensors and their potential application in different industries included glass fibre sensors for use in medical technology (minimal invasive surgery, guided by robots) and space technology (shape reconstruction of antennas on satellites), as well as sensors for detecting lightning strikes on wind turbines.

The idea of starting a company arose shortly before Lars Hoffmann was due to complete his PhD. The research project he and his colleagues were working on was funded by the German Research Association for Power Transmission Engineering (Forschungsvereinigung Antriebstechnik e.V.), and representatives of some of the member companies of the association were accompanying the sponsored research projects as sparring partners. However, due to the financial crisis in 2008, there was no chance of finding investors prepared to finance a start-up with new and untested technology. After finishing his PhD, Lars left to join a management consulting company, but continued to meet up with his colleagues at the institute, who kept him informed about the latest research results.

■ Christian Hackl, Managing Director, TUM-Tech GmbH, Munich, Germany
E-mail: christian.hackl@tumtech.de

Thanks to Professor Koch, who is also a qualified European patent attorney, all the members of the research group had become aware of IP at an early stage and were quick to develop ideas about possible IP rights creation. This led to the first patent application in 2009. At the time, the technology worked well in the lab, but was lacking in robustness and was still too expensive. The research carried out by the team showed the limits of the technology and made it clear what further developments and testing were needed.

Funding and Establishment of the Start-Up

At their informal meetings, Lars and his former colleagues came up with the idea of applying for a German government start-up grant under the "EXIST" funding programme,[1] which covers living expenses, materials, equipment, and coaching for one year. However, to qualify for this grant, two requirements had to be met: first, there had to be at least one business-savvy person in the team, and second, the start-up would have to reach a deal with the university on IP access and on continuing to use the university laboratories.

Takeaway: Business Competence Is Key

It is essential for the founding team to have access to business competence. The technology transfer office cannot provide this, as it is not part of the start-up's operational team.

1. *exist.de/DE/Programm/Exist-Gruenderstipendium/inhalt.html.*

Having agreed that, should the grant application be approved, he would quit his job, Lars Hoffmann rejoined the team in 2010, soon after the formation of the start-up fos4X, thereby ensuring that the first EXIST programme requirement was met. The second requirement was met when fos4X signed a contract with the university which ensured that the company would profit from the IP rights originated at and held by the university. In 2012, an exclusive licensing deal with the university was concluded for the patent applications filed by TUM. The contract was negotiated on behalf of TUM by BayPat, a centralised technology transfer office working for 33 different research organisations in Bavaria.

Fostering IP Awareness and Technology Transfer at Universities

"I encourage all my research students to think about IP protection from the outset. Six successful start-ups are living proof of how important this is!"

Alexander Koch
Co-inventor, TUM Professor, and European Patent Attorney

Professor Koch is well-known for his technology transfer affinity. He has always been keen on co-operation with industry, with a view not only to gaining third-party funding, but also to identifying the potential industrial application of any research results, including the option of establishing start-ups. He places equal emphasis on the two "currencies" of academic research: publications and patents. Sometimes this is seen as a conflict—and if in doubt the emphasis is mostly put on the publications, but if it is done in a smart way, both publication and patenting can be combined by filing patent applications before publication.

Although the members of the founding team did not receive any structured training on IP during their regular studies, they were able to profit from Professor Koch's input on potentially patentable research results at weekly roundtable meetings with him. Professor Koch's experience as a European patent attorney even led to an agreement with the administration of the university that allowed him to bypass the usual channels and write patent applications himself. The fact that there have already been six start-ups from his institute proves how successful this approach has been.

First Steps

The success of their application for the EXIST grant meant that the team could continue to use the university labs for their initial development activities and to benefit from being part of Professor Koch's institute.

Following the publication of a university press release,[2] which was issued at quite an early stage in the product development process, the team received positive feedback from larger, established market players such as Siemens, Nordex, and Repower, who were very interested in this new technology, and in particular its application in wind energy, as this was a new solution to the major problem of the dynamic load monitoring of rotor blades and ice detection on wind energy converters. As a start-up, the fos4X team would have had a hard time making contact with the right people in the big companies, but the press release meant that the big companies came to them.

Takeaway: Patents Provide Credibility

Patents can work as an initial indicator of professionalism and competiveness when a young start-up with new technology becomes visible to established companies.

To further increase their visibility in the wind energy market, the team participated in a number of start-up competitions. Soon after, they were able to run the first tests of their sensors on test benches for rotor blades, and then, in the summer of 2011, the sensors were installed for the first time on a real wind powerplant.

In the summer of 2012, the team moved out of the university, but continued their co-operation with the institute, both in academic terms (*e.g.*, student involvement in company-supported master's and PhD theses) as well as funded joint research projects. They also kept their access to the university's technical infrastructure, including testing equipment. Not long after, they concluded their first contract with Nordex to supply measuring systems for active load reduction for large wind turbine installations.

Until 2016, fos4X's sensors were installed exclusively on existing wind turbines, mainly to detect ice formation on rotor blades and to measure their vibration and acceleration. This was a small market niche with good profit margins. Additional income was generated by a number of individual projects, such as the examination of blades in test benches and the application of sensors in the automotive industry.

Financing Growth and Preparing for Exit

Although it had always been the founders' aim to develop a platform technology with possible applications in different industries, it was only once the company changed its business strategy to focus primarily

2. *www.ei.tum.de/mst/forschung/faseroptische-messsysteme/.*

on wind energy applications that they could scale up their business and produce high-quality, competitively priced products.

Despite the first products being installed at customer sites in 2011, it was not until 2016 that fos4X finally got its first high-volume contract for standard equipment of all rotor blades of a certain wind turbine manufacturer. This was due to stringent safety requirements in the wind energy market, requiring a lot of tests and certifications. Nevertheless, fos4X successfully managed to continue raising money for growth throughout this time.

Takeaway: Solid Patent Protection Combined With Early Turnovers Help Secure Financing

Solid patent protection is a prerequisite for many investors looking to invest in technology start-ups. However, cash-flow-generating activities at an early stage can help to provide funds until market introduction and are also positive signals to investors.

Financing Milestones

- 2011: EXIST programme funding
- 2012: Pre-seed (convertible loan)
- 2013: Seed (first share capital investment)
- 2015: Series A1 financing
- 2017: Series A2 financing
- 2018: Series B financing (EUR 8.5 million), alongside a strategic re-positioning

The funding and financing allowed fos4X to grow to around 100 employees, resulting in a revenue of EUR 11 million in 2020, when the company was acquired by PolyTech, a Danish manufacturer of products and systems for the wind power industry. PolyTech is now integrating fos4X and continues to develop its intelligent sensors and software solutions. IP was an important factor in the negotiations leading to the acquisition. fos4X had an impressive IP portfolio and a highly professional IP and innovation management system. Its IP manager and innovation manager are now responsible for these activities in PolyTech, ensuring that the whole group can benefit from their experience and expertise.

The Technology

The main problem that the initial research addressed related to wind-induced stress on the mechanical compounds of wind turbines, which is critical for the elements of the construction and for its lifespan. This is why a methodology or technique was needed to monitor this stress and lower it.

The state-of-the-art sensors back then were electrical. However, this type of sensor can be destroyed if lightning were to strike the rotor blades. Also, they can only measure up to 0.3 percent of the deformation, whereas the materials used for wind rotor blades (GFK, CFK) are subject to elongation that is 10 times greater than that of steel when yield stress is applied. This means that they cannot be used to measure elongation in these materials. Another reason why electrical sensors are not ideal for application in wind turbines is the number of load changes—several million—they can measure over their lifespan. However, wind rotor blades can experience up to several hundred million load changes over their lifetime, so electrical sensors cannot cover the entire lifespan.

The solution was to change from electrical to optical sensors that send out white light (whole spectrum) in a glass fibre fixed to the rotor blade. After hitting a fibre Bragg grating (inscribed in the optical fibre) only light with a certain wavelength is reflected and measured. A load applied to the rotor blade will change the wavelength of the reflected light. By measuring this shift in the wavelength, the load applied to the blade at this area can be measured. Only a small number of sensors (between two and five) are needed per blade, with the sensors themselves being easy to install.

Figure 1: Blade Load Monitoring On Wind Turbine Rotor Blades

The Market

The market for wind turbines is global, with five major producers based in Europe and the US (Siemens, General Electric, Vestas, Nordex, and Enercon), as well as several large players in China. Over time, all the top ten companies worldwide have become customers of fos4X, with the highest sales figures being recorded in Europe. Since the foundation of fos4X's Chinese subsidiary, there has also been a marked increase in sales in the Chinese market, with somewhat close to EUR 5 million in sales to Chinese companies in 2020.

There are a number of competitors in the field of sensors for rotor blades and software for controlling wind power installations, but they have traditionally been active in different industry segments with different customers. fos4X was able to provide end-to-end solutions, from sensor to wind turbine connector, at

competitive prices. Of all the major players, only one failed to choose fos4X, as, being a young company, it scored low on company stability.

While patents provided fos4X with protection against competitors and copycats in all the main markets, the situation was different in China, where it couldn't solely rely on patent protection, and where excellent customer service and high speed are important. On one occasion, the company noticed an identical clone of one of their sensors being showcased by a competitor at a trade fair in China. fos4X used the available legal remedies, but as it was already promoting its next generation of sensors at the same event, the illegal copies did not affect its business.

Takeaway: Fencing Off Copycats

Timely IP protection and enforcement of IPRs, complemented by short innovation cycles and operational excellence, are the best shield against copycats.

Managing IP

In addition to the exclusivity of the licence for the university-owned patents, which gave fos4X early access to the technology, the deal included the option for a transfer of ownership for these basic patents to the company, which was duly exercised in 2018, making the company even more attractive for investors.

Following the decision to focus on wind energy applications in 2016, fos4X re-evaluated its patent portfolio. It was decided to sell one patent, which was considered non-core to the business, but of potential interest to the railway industry. Backed by discussions with manufacturers of railway equipment that were approached by fos4X, a joint feasibility study was conducted with one of the interested companies. However, it would have taken a long time for significant earnings to be realised—too long for a start-up with totally different expectations regarding return on investment and active in a different business sector. So, the two parties agreed on a business case with respective cash flows and, based on these discounted cash flows, a price for the patent. This one-off payment was important for fos4X, coming as it did at a critical time after some of the co-founders had left the company, making it difficult for fos4X to get additional funding from investors. The benefits of the patent sale in 2016 encouraged fos4X to accelerate its patenting activity and helped to convince investors of the importance and benefits of the increased patenting activity.

Takeaway: Monetising IP

While core IP has strategic value and should be prioritised, the transfer of non-core IP provides an opportunity for rapid monetisation. See Figure 2.

Patent Portfolio for the Digital Future

In addition to the optical compounds, the applicable software has become increasingly important for manufacturers of wind turbines and their customers. fos4X's software applications calculate input variables for the control and operation optimisation of wind turbines using sensor data fusion, classical model-based methods, and methods of machine learning. Today, fos4X employs more software developers (about a third of the workforce) than hardware developers, which has resulted in a rise in software-related inventions, for example for control processes. In its R&D activities, fos4X placed great emphasis on applications of its technology and the integration of hardware with software components. This did not mean a change in IP strategy but led to more patent applications and patents on computer-implemented inventions.

fos4X's patent portfolio continued to expand as its new software solutions grew in importance. At ac-

Figure 2: Retrox Dashboard

quisition, fos4X had a portfolio of nearly 200 patents in about 80 patent families. Patents helped to secure technical leadership and defend the company's position. By constantly monitoring the patent activities of relevant third parties it was able to file a notice of opposition whenever necessary.

Under its patenting policy, the company always started with a PCT application, followed by a European application claiming protection in the main countries in Europe, as well as validations in China and the US. Where a particular patent was less important, protection was secured in Germany only. A dedicated decision-making group consisting of the CEO, the CTO, and the full-time IP manager met biweekly to discuss IP-related issues. A structured process was in place along the innovation pipeline, starting with the selection of employee ideas. Employees did not have to write full invention disclosures for all of their ideas, only for those that received positive feedback. Decisions on which ideas to develop further, what should be discussed with the external patent attorney, where to validate a patent, how to handle competitors, and which cost-related factors to take into consideration were discussed at these biweekly meetings. See Table 1.

Some of the EP applications listed are still pending and no decision to grant has been taken. Granted patents may also undergo an opposition or appeal procedure, in accordance with the procedures laid down in the European Patent Convention, which could limit the scope of protection of the patent. All legal events are published in the European Patent Register and can be accessed via *www.espacenet.com*. ■

Available at Social Science Research Network (SSRN): *https://ssrn.com/abstract=4099738*

Further technology transfer case studies can be found at *epo.org/case-studies.*

Figure 3: Technology Transfer Timeline

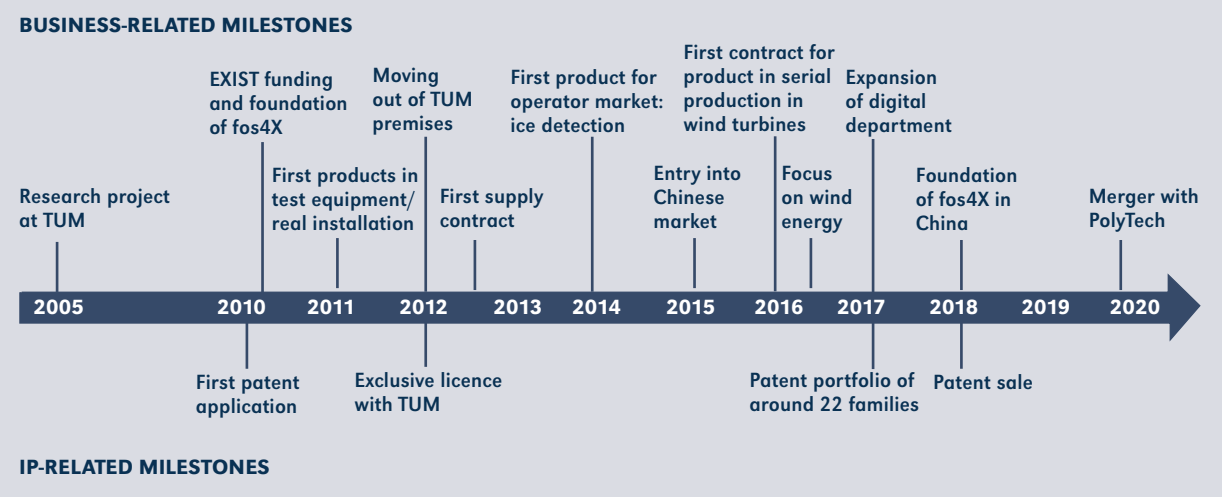


Table 1: fos4X's Patent Portfolio

EP Patent number	Title	Priority Date
University as applicant		
EP2475971A1	Device for reading out a spectrally selective optical measuring sensor and measuring device	09.09.2009
EP2855930B1	Method for installing sensors in rotor blades and installation device	05.06.2012
EP2898216B1	Method and device for monitoring operating states of rotor blades	18.09.2012
EP2856096B1	Optical measuring system with polarisation compensation as well as corresponding method	05.06.2012
fos4X as applicant (example)		
EP2856097B1		
EP3717318A1	Method of compensating optical fibre measuring systems and optical fibre measuring systems	05.06.2012

Source of IP

Alexander Koch

- Professor, TU Munich, R&D project leader and co-inventor
- European patent attorney, drafts patent applications himself

Lars Hoffmann

- Former PhD student, co-founder of fos4X, re-joined the team after having gained business experience

Mathias Müller, Thorbjörn Buck, Rolf Wojtech, Markus Schmid

- Former PhD students and co-founders of fos4X

TU Munich

- Public research university established in 1868, where the IP was created
- Gave fos4X access to university infrastructure, including laboratories, and issued press release soon after its foundation

Tech Transfer Catalysts

BayPat

- A centralised technology transfer office working for 33 different research organisations in Bavaria
- Helped to negotiate the contract for TUM

German Research Association for Power Transmission Engineering

EXIST funding programme for start-ups

- Provided initial funding

IP Commercialisation

fos4X

- University spin-off formed in 2010
- Concluded an exclusive licensing deal with the university for the patent applications filed by TUM
- Offers professional fibre optic measurement technology and measurement solutions for wind turbines
- 100 employees and around EUR 11 million revenue in 2020 together with a patent portfolio of nearly 200 patents in about 80 patent families.
- Acquired by PolyTech in 2020

Editors: Thomas Bereuter, Yann Ménière, Ilja Rudyk
Collaborators: Jörg Scherer, Stephanie Weber (European IP Helpdesk), Anna Malec
Photos: fos4X

Changing The 3D Printing Landscape

By Peter Karg

The development of a long-term technology transfer strategy allowed the Technical University of Vienna to jointly build IP in additive manufacturing with its industry partner, Ivoclar. Balancing the allocation of usage rights by application field led to the commercialisation of the research results by Ivoclar and the university's two spin-offs, Lithoz and Cubicure.

Cubicure's Additive Manufacturing Process Hot Lithography

From a Promising Material to Complex AM Machines

In the early 1990s, Professor Jürgen Stampfl from the Technical University of Vienna's Institute of Materials Science and Technology started researching additive manufacturing (AM). More commonly known as 3D printing, AM constructs three-dimensional objects from 3D model data. At the time, AM technologies largely produced prototypes for plastic and metal objects with specific geometrical shapes.

Stampfl soon realised that AM might offer additional potential if it were extended to ceramic materials. Up until the early 2000s, the industrial manufacturing of ceramics using 3D printing processes was carried out using raw materials from the coatings industry. These coatings were designed for other purposes and lacked the necessary requirements for massive ceramic components. Therefore, in 2002, Stampfl teamed up with Professor Liska from TU Vienna's Institute of Applied Synthetic Chemistry, a specialist in photopolymer materials, to search for suitable materials. They initiated what later became one of TU Vienna's most successful technology transfer cases.

The team started to work with state-of-the-art AM machines, which were made to process low viscosity materials. However, these systems could not effectively process the ceramic slurries, due to their high solid loading with ceramic particles and the resulting high viscosity. As a consequence, the research team and its two PhD students, Johannes Homa and Johannes Benedikt, concentrated on developing the AM machines, as well as new materials. The improved AM machines could process lightweight, hard ceramics with high melting points, thereby opening up a whole new sphere of advanced applications.

■ Peter Karg,
Head of Service Unit
Research and Transfer
Support,
TU Wien,
Wien, Austria
E-mail: peter.karg@tuwien.ac.at

Advancing Prosperous Co-Operation

To finance their research, the team looked for a sponsor and co-operation partner who would be interested in filing a joint research proposal supported by public grants. Ivoclar Vivadent, an international dental company based in Liechtenstein with whom Liska had previously carried out R&D projects, was identified as a potential candidate.

Takeaway: Industrial Partner

Building up a network of trusted partners is essential for technology transfer at any level. The creation of technical solutions to overcome complex problems often requires an interdisciplinary approach. Application-driven R&D needs industrial sponsors to engage in joint R&D projects.

Ivoclar was eager to learn more about Liska's and Stampfl's ideas to combine photopolymers and AM technologies to produce ceramics. They proposed a research collaboration, building on the university researchers' work on an AM method for polymerisable material. Before starting the collaboration, the researchers first consulted TU Vienna's Technology Transfer Office (TTO). After assessing the technology, the TTO experts recognised the commercial potential of the researchers' background IP. They saw a strong business case and a broad range of possible applications far beyond Ivoclar's core interest of dental applications.

As a private sponsor, Ivoclar nevertheless requested an exclusive right in their core business area to keep investing in the technology development. The challenge was therefore to design an R&D collaboration contract that would satisfy Ivoclar's interests, while allowing TU Vienna to seize other opportunities. The solution was to grant Ivoclar exclusive rights in all project outcomes for its core business area of dental applications, while TU Vienna retained all commercialisation rights for other application areas. The agreement gave TU Vienna enough control over the IP to commercially exploit the project results outside of the dental field. This allowed TU Vienna to turn research into as many applications as possible.

Takeaway: Control Over Commercial Exploitation

In third-party funded projects, the TTO's IP management system must secure control over the allocation of usage rights in order to increase the chances for broad commercial exploitation of academic technologies in as many applications as possible.

The Devil Is in the Detail

"With a technology transfer, it is important not to get tempted by quick wins, sacrificing long-term benefits."

Jürgen Stampfl
Professor at TU Vienna, co-inventor, and co-founder of Lithoz and Cubicure
Managing Director and Chief Science Officer (CSO) of Cubicure

The first agreement between TU Vienna and Ivoclar related to AM and photopolymer technology research, kicking off a co-operation that is still ongoing to this day. At this initial stage, it was crucial for both parties to define the scope of Ivoclar's exclusivity for dental applications for joint research results. A lack of clarity in this respect would undermine the freedom to operate required to pursue commercialisation plans outside the dental field. TU Vienna would then reserve the right to grant licences to third parties for all other areas of application.

Ivoclar, as the private sponsor, agreed to pay all costs for this and any following R&D projects that were not covered by public grants. Therefore, all agreements between TU Vienna and Ivoclar secured not only funding for TU Vienna's R&D activities but also performance-based payments, such as turnover share and fixed milestone payments from Ivoclar in the event of patentable inventions and their commercial exploitation by Ivoclar.

The pair also agreed that Ivoclar should be provided with a share of third-party income if TU Vienna successfully secured licensing in non-dental application areas. This ensured that both parties should benefit from a commercial exploitation outside of Ivoclar's core business.

In addition to its financial contribution, Ivoclar also provided intellectual support. In fact, all 20 patent families filed to date are based on joint inventions between Ivoclar and TU Vienna. The TTO's assessment of the initial invention disclosure showed that more tangible data and further research results were needed to obtain the strongest possible patent protection. The pair then agreed to jointly develop the IP.

Although Ivoclar bears all patent-related costs, both parties jointly own the IP and decide on the patent filing strategy and the countries in which to protect the inventions, keeping each other's strategic goals in mind.

Technical Breakthrough and the First Spin-Off

In 2011, after securing the required IP rights, Johannes Homa, CEO, Johannes Benedikt, CTO, and Prof. Jürgen Stampfl created the spin-off company Lithoz.[1] One year earlier, TU Vienna's research team had made an important technical breakthrough: they achieved the same density and strength with their 3D-printed ceramic parts as the ones manufactured using conventional subtractive production methods. The technology had reached market readiness, offering all the advantages of AM, such as cost and time reduction, and moreover a freedom-of-design approach not known before in the ceramics sphere. Certain geometrical shapes, for example lattice structures, could not previously be manufactured with this kind of material, and prototyping and production of single pieces also became much easier. This became the basis for Lithoz's future success.

Lithoz negotiated a licence agreement with TU Vienna to produce AM machines and related material for high-performance ceramics for biomedical applications, technical applications (machinery, electronics, semiconductors) and ceramic casting cores for turbines. Under the licence agreement, TU Vienna agreed not to grant any other licences for the relevant patent families to third parties. Early-stage payments can be a financial risk to deep tech start-ups before they reach the market, so TU Vienna relied only on turnover-based royalties as compensation.

1. See complementary case study about Lithoz in the EPO SME case study series at *epo.org/case-studies*.

"Licence agreements with your home university are the essential legal basis for any academic spin-off, and a university's TTO has to be a reliable, fast-acting, and pragmatic partner facilitating the spin-off's success."

Johannes Homa
CEO Lithoz

Lithoz

Today, Lithoz is a global market and technology leader in the field of AM of high-performance ceramics, currently employing over 110 people at its headquarters in Vienna and its subsidiary in the US. Lithoz continues to perform R&D to further develop its AM technology. Besides the eight patent families licensed from TU Vienna, Lithoz has also filed four of its own patent applications covering new AM machines, processes, and materials. This is also to Ivoclar's advantage, which benefits by having a business partner familiar with the technology, and which is a potential licensee for Ivoclar's dental technology. See Figure 1 and 2.

Creating New Business Opportunities

Not long after Lithoz was founded, Stampfl and Robert Gmeiner, a PhD student, realised that the AM technology might work for other materials as well as ceramics.

Encouraged by Lithoz's rapid success, Stampfl and Gmeiner decided to form another spin-off company, Cubicure, in 2015. Again, they negotiated a licence agreement with TU Vienna and agreed upon provisions similar to the one with Lithoz. The agreement covered patent families that were not licensed to Lithoz and some of which were jointly developed with Ivoclar. In order to avoid competition with Lithoz and Ivoclar, the licence targeted the production of non-ceramic materials and related AM machines.

"TU Vienna was relatively quick to establish a professional TTO. Once the time was ready for the next generation of 3D-printing technologies, a variety of successful start-ups was able to benefit from the professional IP management offered by the TTO."

Robert Gmeiner
Managing Director (CEO) and Chief Technology Officer (CTO), Cubicure

Similar to Lithoz, Cubicure aimed to strengthen its patent portfolio through a co-operation with Ivoclar. Being able to rely on a strong patent portfolio early on was important during investment rounds and strategic research projects with industrial partners.

Takeaway: Access to a Patent Portfolio

A broad IP portfolio in terms of the number of patent families, claimed technologies, and geographical scope provides the core basis for young spin-off-companies seeking funding and partnerships, and accessing markets.

Cubicure follows a similar business model to Lithoz. Its business model focuses on developing and selling

Figure 1: Lithoz 3D-Printed Patient-Specific Medical Implants

Figure 2: Lithoz Entry-Level 3D-Printer

Lithoz entry-level 3D printer for high-performance ceramics for use in labs for the manufacture of prototypes and small-scale series production.

AM machines and material. The main difference is that Cubicure deals with additive manufacturing of high-performance polymers for industrial applications, while Lithoz's focus is clearly on ceramics. Indeed, Cubicure even benefits from having Lithoz as a business partner that is familiar with the technology but is not a competitor.

Cubicure

Cubicure develops photopolymers with thermomechanical properties resembling those of engineering thermoplasts. Since 2017, Cubicure has offered the specially developed and patented 3D-printing plant Caligma 200 and associated materials on the market. Cubicure aims to create AM technology for high-quality 3D prints for an industrial production environment.[2] Its team has grown to 35 employees with a 200 m^2 chemical laboratory and a 800 m^2 office and workshop space within the Tech Park Vienna in Austria. See Figure 3 and 4.

Role of the TTO

The TTO supports researchers with its IP management capabilities, including licensing and legal services, facilitating access to funding, and industry co-operation. Even before formal IP was created, the tech transfer strategy secured financial support for TU Vienna from Ivoclar, as well as funding by public research grants while retaining rights for non-dental application areas. TU Vienna's and Ivoclar's patent management teams jointly decided which IP should be protected. Both were involved in the patenting process and in the decision about the geographic scope of patent protection, always keeping each other's strategic goals in mind. The TTO's tasks also included negotiating, drafting, and supervising all contracts with Ivoclar, Lithoz, and Cubicure.

Figure 3: Patented Hot Coating Technology

The patented hot coating technology enables the safe use of elevated temperatures during the polymerisation process. A heated plate carries thin layers of the photosensitive material into the processing area, where a laser selectively cures it in a layer-by-layer approach.

Figure 4: Cubicure's Caligma 200, The Hot Lithography Production Unit

TU Vienna, Lithoz, and Cubicure are more than just partners in patent licence agreements. In addition, they collaborate on various R&D projects aimed at strengthening both companies' positions in maturing markets, as well as TU Vienna's know-how and research capabilities in AM.

Public funding agencies, such as the Austrian Research Promotion Agency FFG or the Vienna Business Agency, help to finance such joint R&D undertakings, leveraging the funds committed by the industry partners. This helps finance additional PhD student positions and research material, as well as to significantly scale the project beyond the initial investment.

Third-party projects can bolster a technical university's reputation. Ivoclar is an important R&D partner for TU Vienna in the area of AM. The relationship also allows the university to take a long-term perspective on research. This makes the co-operation attractive from a commercialisation, as well as from a scientific point of view. As such, it attracts talented researchers and helps to acquire additional grants from public funding agencies.

Long-term relationships between academia and industry need to be maintained by defining essential yet realistic goals, while at the same time keeping each

2. In 2020, StartUs Insights analysed 236 stereolithography start-ups from all over the world in a study to evaluate their industry 4.0 potential and Cubicure was selected as having one of the four best available solutions (see *www.startus-insights.com*).

other's fundamental business interests in mind. TU Vienna's TTO played a fundamental role in considering the latter, always trying to achieve a fair balance between sometimes conflicting interests in contract negotiations.

Takeaway: Managing Long-Term Relationships

Long-term business relationships are crucial for successful technology transfer. Understanding, considering, and defining each party's requirements helps to build the trust needed to establish and maintain such relationships.

Technology Transfer at TU Vienna

A) TU Vienna's TTO

TU Vienna's Technology Transfer Office, R&TS (Research & Transfer Support), was founded in 2004, following the implementation of the Austrian University Act 2002. The act enabled universities to claim rights for employee inventions and to file and commercially exploit patents based on such inventions.

R&TS' core mission is to support TU Vienna's researchers, research groups, and institutes in R&D-related activities, especially third-party funded research projects, IP protection, and usage. As a publicly funded institution, R&TS strives to help researchers turn their research into useful products and services to benefit the public. Therefore, it is important to define each party's IP-related needs at each stage of a technology transfer and to consider those needs in contractual arrangements. This allows each party to secure its necessary IP position. At the same time, R&TS may also support the creation of patent applications and patents granted solely for the purpose of supporting researchers in their efforts to acquire public or private third-party funds: patents are an excellent way for a university to prove the applicability and commercial relevance of its research activities.

There is a strong interaction between local and Austrian technology transfer offices, including TU Vienna's R&TS, via the knowledge transfer centres (WTZ) launched by the Austrian Ministry of Science, Research and Economy in 2014. WTZ is a partnership between all Austrian universities and affiliated partners. Its goal is to promote interaction between TTOs and foster co-operation with other academia, industry, and society in order to optimise Austria's knowledge transfer activities.

B) Patents at TU Vienna

Using patents to protect knowledge has become increasingly important for TU Vienna. Each year, TU Vienna is granted about 30-35 national and international patents, not counting patents generated in the course of contract research and filed by the university's partners. Developing a patent portfolio makes competences in its main research fields more visible. In an increasingly competitive environment, this strengthens TU Vienna's international positioning as an excellent research institution. Securing IP also increases TU Vienna's attractiveness to its industrial partners. An extensive patent portfolio is used as a marketing tool to initiate new research collaborations. The industry increasingly gives preference to those research partners whose scientific findings are protected by patents, as this also strengthens their position vis-à-vis competitors. Additional funding is required to further develop patented technologies to make them market-ready. On the one hand, co-operation enables further development of the technology and, on the other hand, the emergence of new basic research ideas, which in turn lead to further research work and projects, eventually leading to job creation. This value chain "from basis to application" enables the newly generated knowledge to be passed on to society.

C) Patent Management at R&TS

R&TS patent managers support the entire patenting process and help inventors to market their technologies. After clarfiying the ownership structure, they examine the patentability and marketability of the inventions. The following criteria are also taken into account when deciding whether to claim or release an invention:

- The possibility of proving patent infringements
- The commercial value of the technology
- The presence of a prototype
- The implementation time until market readiness
- Investment costs up to market readiness
- The interest of the inventor in participating in the marketing process

The decision about the territorial scope of protection depends on market research results. Despite numerous registration strategies, TU Vienna prefers the following procedure in most cases: (1) European or Austrian priority registration; (2) international (PCT) application (within 12 months after the priority application with the EPO as search authority); (3) further national or regional patent applications (30/31 months after the priority application).

Patenting research is not a goal in itself but is intended to provide an incentive for potential business partners to implement these research results

and thereby increase the willingness to invest in the respective technology. That's why a usage rights strategy is combined with the patenting of scientific results. In many cases, the researchers already have contacts within the industry. After many years of work, the researchers are familiar with the companies engaged in R&D in their field and already know which technology might fit to which company. In such cases, researchers often take over the management of the usage rights and R&TS staff accompany the entire process, especially negotiations and contract drafting. In other cases, R&TS patent and licensing managers look for interested parties within industry or present the technologies concerned at fairs, conferences, or similar events. Working with the inventors, they create a technology offer describing the main features of the patented technology and carry out detailed company and market research. Often, this approach requires a high level of technology readiness, and additional R&D efforts are needed before a successful deal can be concluded. Occasionally, the exploitation of the patented technologies is outsourced to specialised market facilitators, provided that their expertise and network increase its chances of success.

D) Spin-Offs

About five to ten spin-offs are generated at TU Vienna each year, with figures rising slightly over the last few years. TU Vienna is open for any kind of co-operation serving both parties' requirements. In particular, it appreciates R&D collaboration, whether contract research or public-funded R&D projects, as they strive for a deeper understanding and further development of the research carried out at TU Vienna and raise questions for further basic research activities, which could lead to further spin-offs or research activities. TU Vienna is also flexible about handling IP with its spin-offs: it grants, restricted or unrestricted, non-exclusive or exclusive licences based on both parties' needs. In rare cases, IP might be sold or transferred. If the IP allows no other applications than the one for the spin-off's business case, the contract includes an option to acquire the IP that can be executed at a determined price. Initially, start-ups are usually not in a financial position to buy IP at an appropriate market price, but often exercise the option once they scale up. If, however, agreement on market terms for a licence or for an IP transfer cannot be reached, TU Vienna can take an equity stake in the company in addition to favourable licence terms for the spin-off.

E) Incubators

In terms of entrepreneurship support, R&TS intensively collaborates with two incubators: TU Vienna's in-house incubator innovation incubation centre (i^2c) and INiTS, a limited liability company owned by TU Vienna, the University of Vienna and the Vienna Business Agency.

INiTS is Vienna's high-tech incubator. It supports academic institutions in fulfilling the targeted use and transfer of academic knowledge into society. It offers entrepreneurship training for university staff and supports research assistants in applying for the FFG Fellowship Programme,[3] which assists in the commercial exploitation of research results and offers participation in the SCALEup international incubation programme, where promising business models are developed with selected high-tech start-ups. Here, academic institutions are supported in technology commercialisation and the establishment of new spin-off companies. Lithoz is one of the programme's over 250 alumni. See Figure 5.

Some of the EP applications listed are still pending and no decision to grant has been taken. Granted patents may also undergo an opposition or appeal procedure, in accordance with the procedures laid down in the European Patent Convention, which could limit the scope of protection of the patent. All legal events are published in the European Patent Register and can be accessed via *www.espacenet.com.* ■

Available at Social Science Research Network (SSRN): *https://ssrn.com/abstract=4099744*

Further technology transfer case studies can be found at *epo.org/case-studies.*

3.The Spin-off Fellowships Programme of the Federal Ministry of Education, Science and Research (BMBWF).

Figure 5: Technology Transfer Timeline

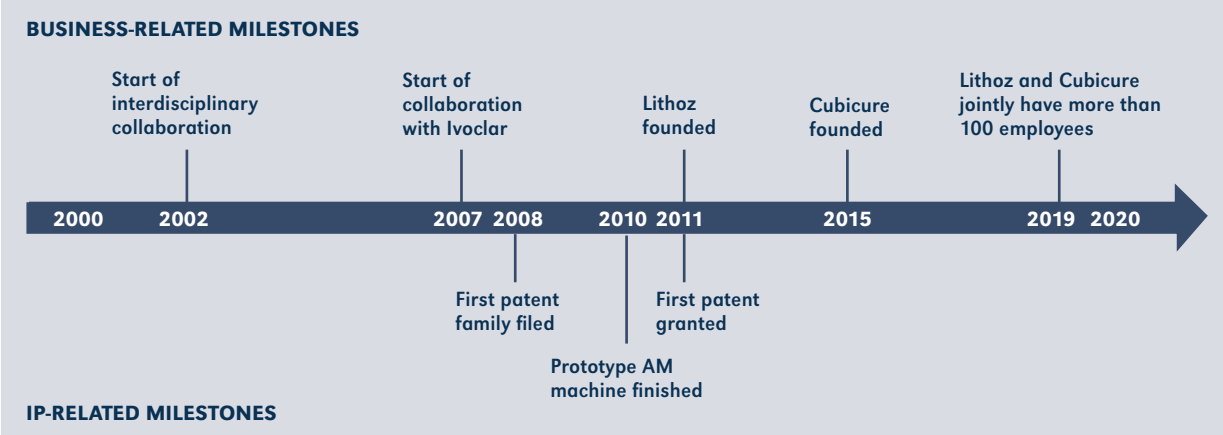


Table 1: Cubicure's patent portfolio

EP Patent Number	Title	Priority Date	Applicant
Owned by Cubicure			
EP3418033A1	Method and device for lithography-based generative production of three-dimensional forms	19/06/2017	Cubicure (AT)
EP3632941A1	Resin composition	01/10/2018	Cubicure (AT)
EP3284583A1	Method and device for lithography-based generative production of three-dimensional moulds	18/08/2016	Cubicure (AT)
EP3842864A1	Systems and methods for lithography-based additive manufacturing of three-dimensional (3D) structures	23/12/2019	Cubicure (AT)
EP3842865A1	Systems and methods for lithography-based additive manufacturing of three-dimensional (3D) structures	23/12/2019	Cubicure (AT)
Licensed by Cubicure			
EP3023226A1	Stereolithography device with a heating device	19/11/2014	Ivoclar Vivadent (LI); TU Vienna (AT)
EP3292157A1	Sulfonic acid ester as regulator in radical polymerisation reactions	07/05/2015	Ivoclar Vivadent (LI); TU Vienna (AT)
EP2875934B1	Device for processing of photopolymerisable material for building up a moulded body in layers	22/11/2013	TU Vienna (AT); Ivoclar Vivadent (LI)
EP3071394B1	Device for processing photopolymerisable material in order to construct a shaped body layer by layer	22/11/2013	TU Vienna (AT); Ivoclar Vivadent (LI)
EP3166569B1	Composites with controlled network structure	11/07/2014	Ivoclar Vivadent (LI); TU Vienna (AT)
EP3396455A1	Light-curable composition	28/04/2017	TU Vienna (AT)

Source of IP

Jürgen Stampfl

- Professor, TU Vienna R&D project leader and co-founder of Lithoz and Cubicure
- Sold his shares in Lithoz to invest in Cubicure as Managing Director
- Received the Houska prize in 2013 and 2019

Johannes Homa,

Johannes Benedikt

- Former PhD students and co-founders of Lithoz

Robert Gmeiner

- Former PhD student and founding director of Cubicure

TU Vienna

- Acquired more than EUR 89 million private and public third-party funds for R&D activities, including more than EUR 16 million from the EU in 2020
- 30-35 national and international patents are granted for TU Vienna each year

Tech Transfer Catalysts

Technology Transfer Office R&TS

- Founded in 2004 with the implementation of the Austrian University Act 2002
- Supported researchers with IP management capabilities, licensing and legal services, funding
- Negotiated financial support for the TU Vienna from an external partner, Ivoclar
- Involved in the patenting process and in negotiating, drafting, and supervising all contracts with Ivoclar, Lithoz, and Cubicure

IP Commercialisation

Ivoclar Vivadent

- An international dental company based in Liechtenstein
- Developed IP jointly with the university, signed IP contract on research collaboration in 2007
- Owns exclusivity on joint research results in their core business: dental field
- Covered all costs for joint R&D projects with TU Vienna and bears all patenting-related costs
- Owns IP jointly with TU Vienna

Lithoz

- University spin-off formed in 2011 from technology developed in collaboration with Ivoclar
- Has an exclusive licence agreement with TU Vienna for producing AM machines and related ceramic materials for non-dental applications
- Employs over 110 people at its headquarters in Vienna and its US subsidiary

Cubicure

- Formed in 2015 as a second university spin-off from technology developed in collaboration with Ivoclar
- Licence agreement targeted the production of non-ceramic materials and related AM machines
- Its technological core deals with AM of high-performance polymers for industrial applications
- 35 employees in Austria

Editors: Thomas Bereuter, Yann Ménière, Ilja Rudyk
Collaborators: Jörg Scherer, Stephanie Weber (European IP Helpdesk), Anna Malec
Photos: Cubicure Gmbh, Lithoz GmbH

Licensing-Based Business Models

By Bowman Heiden and Thomas Bereuter

Abstract

This article describes a framework of licence-based business models for technology-driven companies and highlights some of the crucial issues in tailoring licensing agreements to the needs of the chosen business model.

1. Introduction

Why license? Well, there are many reasons. Fundamentally, licensing is a way of providing access to technology in exchange for money or other benefits, such as access to other technology (known as cross-licensing).[1] Rather than assigning technology to a seller at an agreed price, licensing allows parties to share success and risk and, in most cases, to avoid having to put a price on the technology, which is often problematic.[2] Due to globalisation and the increasing complexity and convergence of technology, companies are pushed to rely more on open innovation—which includes greater collaboration with external partners to gain access to technology—and to commercialise their technology broadly, thereby sharing success and risk.[3]

This is particularly true for enabling technologies that have many applications across different markets. Thus, it is possible to set up a business model that is built entirely on licensing or, more typically, a business model that combines licensing with the licensor's own R&D and production. In this way, a company may be open to licensing in certain areas and within a certain scope and have licensing as a part of its business model, while also commercialising a part of the technology itself. It is important for technology companies to understand how they can use licensing to improve both the development and commercialisation of their technologies.

1. Licence-Based Business Models

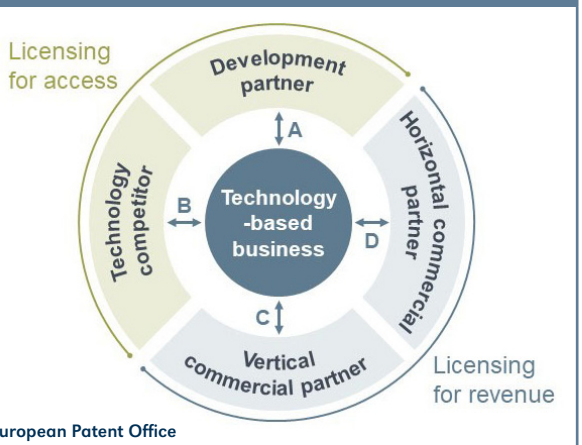
The diagram in Figure 1 below provides a simple framework of basic licence-based business models for technology-driven companies. The company is positioned in the context of a value chain with upstream development partners, downstream commercial partners (*i.e.*, vertical market actors) and horizontal competitors and commercial partners. The diagram presents the key potential relationships available to technology companies on the technology market, including two main market interfaces:

- **Development**—this includes the development partners and co-opetitors[4] through which the licensor seeks to gain access to the technology it needs to develop its value proposition. In general, licensing for development/access serves to reduce the cost or increase the speed of development, or to reduce the legal risk for the company via enhanced freedom to operate (FTO).
- **Commercialisation**–this includes the vertical and horizontal partners that will further commercialise the licensor's technology across the main vertical application and markets as well as other, complementary applications and mar-

■ Bowman Heiden,
Co-Director,
Center for Intellectual Property (CIP),
University of Gothenburg,
Gothenburg, Sweden
E-mail: bowman.heiden@gu.se

■ Thomas Bereuter,
Innovation Support Programme Area Manager
European Patent Academy
European Patent Office
Munich, Germany
E-mail: tbereuter@epo.org

Figure 1. Licence-Based Business Models For Technology Companies



European Patent Office

1. *https://www.upcounsel.com/cross-licensing-agreement (accessed 22.03.2022).*

2. LESI, IP Valuation Business Briefing, May 2020, *https://www.lesi.org/publications/business-briefings* (accessed 22.03.2022).

3. Wim Vanhaverbeke, *Managing open innovation in SMEs, Cambridge University Press*, 2017, ISBN 9781139680981.

4. A combination of co-operator and competitor used to denote entities that usually engage as competitors but may also co-operate to achieve potential win-win situations.

kets. In general, licensing for commercialisation can help companies generate revenue in areas where direct participation on the market for the product or service concerned is problematic (*e.g.*, due to high entry barriers). It also provides a solution for companies that do not have the capacity to pursue all available options.

The four main licensing-based business models (A-D) shown in Figure 1 are the following:

A. Access to Technology

In this licensing model, the licensor works with development partners to gain access to key technology resources and/or capabilities that are not present within its own business or are too time-consuming, costly, difficult, or risky to develop internally. Licensing in necessary technologies can help to reduce costs, reduce lead times, and enhance value propositions. This type of licensing is also a primary technology transfer method for university-based start-ups, which often license in IP from their source institutions. There are various technology transfer case studies[5] that focus on this particular aspect. Two examples are the university spin-outs Cubicure (Austria), an additive manufacturing company, and Blubrake (Italy), which develops an anti-lock braking system (ABS) for e-bikes.[6]

B. Freedom to Operate

In this licensing model, the licensor seeks to gain access to the IP of potential competitors. Instead of accessing technology, the focus of a Freedom to Operate (FTO) business agreement is typically on licensing IP rights (*e.g.*, patents) to mitigate the risk of infringement or in response to a threat of invalidation of the company's own patents. This is typically a contentious agreement resulting in the exchange of money and/or the mutual cross-licensing of IP rights. If the licence delivers technology resources or knowledge, see model A. If it results in a net payment to the technology company, see model D. For an example of how a *de facto* cross-licensing agreement secured freedom to operate, see the case study on the French digital communication company Webdyn.[7]

C. Licensing vs. Production/Services

In this licensing model, the licensor seeks to commercialise technology as a primary means of generating revenue in full or in part. The technology company could license its technology exclusively to one other company in return for royalties on the sale of products/services utilising the technology—a model typical of the life sciences industry. For an example, see the case study on Dermis Pharma, a Turkish company that develops medical products.[8] Other options include granting non-exclusive licences to multiple actors within the same market, as is typical in ICT (a strategy applied, for example, by Spanish telecommunication technology provider Fractus)[9] or granting an exclusive licence to specific actors across different geographies, as many SMEs do, or a specific field of use in the case of platform technologies. As mentioned above, this licensing model can be combined with a technology company's own direct commercialisation on some markets and licensing on others (*i.e.*, a hybrid approach), as practised by the Austrian biotech company Marinomed.[10] Note that the sale of technology components or materials to downstream actors can also benefit from technology licensing covering usage, rights to further development, and associated trade marks.

D. Complementary Licensing

This model is similar to model C but focuses on generating revenue as a secondary means of commercialising a technology. This can include the licensing of technologies that are non-core to the company or in fields of use that are beyond its projected commercial roadmap. See, for example, the strategy of Swedish technical textiles developer and provider Oxeon.[11] This model can be useful as a means of generating revenue to support growth or of providing proof-of-concept evidence for use on other markets. As an alternative to licensing, a company can also sell non-core IP. For an example, see the case study on German company fos4X.[12]

2. Tailoring When Licensing

The cost and complexity of negotiations are widely documented as key obstacles to the collaborative exploitation of new technologies.[13] While master agreements have been published[14] that allow companies

5. *www.epo.org/technology-transfer-case-studies*.

6. See *www.epo.org/technology-transfer-case-studies#oxeon* and *www.epo.org/technology-transfer-case-studies#blubrake*.

7. See *www.epo.org/sme-case-studies#webdyn*.

8. See *www.epo.org/technology-transfer-case-studies#dermis*.

9. See *www.epo.org/sme-case-studies#fractus*.

10. See *www.epo.org/sme-case-studies#marinomed*.

11. See *www.epo.org/technology-transfer-case-studies#oxeon*.

12. See *www.epo.org/technology-transfer-case-studies#fos4x*.

13. See for example EPO (2019) Market success for inventions, Munich, European Patent Office. This study shows that the cost and complexity of negotiations was the second most important challenge in collaborative exploitation of patented inventions for European SMEs.

14. An example is included in the IP Agreement Guide, *https://www.ipag.at/en/model-contracts/*.

to get an understanding of the anatomy of a licensing agreement, in practice licensing agreements are typically tailored to the particular deal supporting the business cases of the parties. The following sections present some initial considerations in the form of example questions that could serve as a basis for checklists facilitating the negotiations.

2.1. What Are Your Licensing Objectives?

It is important to clarify your objectives in entering a licensing relationship with a licensee.

Checklist:

What do you want to achieve or obtain?

- cash
- access to someone else's technology
- further development of the technology
- avoid losing freedom to operate

What are you willing to give up?

- control
- risk distribution (warranties and indemnification, milestone payments, minimum royalties)

What are the risks associated with licensing?

- non-use of the technology
- excessively high or low royalties limiting partners' motivation
- invalidation of patents
- loss of trade secrets

What are the opportunities associated with licensing?

- How can the risks be mitigated and opportunities maximised?

It is equally important that you understand the objectives of your intended licensee.

Checklist:

- How has your intended licensee built its own internal business case for this licence? Why does the intended licensee want a licence?
- Are you sure you understand the win-win relationship?
- What investments may the licensee have to make and commit?
- What does this mean in relation to the licence terms?
- Which countries are relevant and realistic for the licensee?
  - Markets
  - Production and services
- Which applications are of interest to the intended licensee?
- Is it important for the licensee to have the right to extend protection, *i.e.*, for a PCT application in the national phase, or to have the right to have a patent assigned in case the licensor chooses not to maintain a patent?
- Does the licensee want to have the right to enforce the patent if the licensor chooses not to?

Licensing agreements often result in complex and long-term contractual relationships and may require quite close collaboration at times, especially if know-how or trade secrets are licensed. It is crucial, therefore, to establish a high level of trust between yourself and the licensee and carefully consider if you and the licensee are a good fit.

Checklist:

- Will the licence create more value for both of you than either of you could create on your own? Increase the "size of the cake" to be shared by looking for synergies.
- How are you and the licensee related in the value chain?
- Can you trust the licensee?
- What measures have been taken to ensure permanent mutual trust (regular meetings, progress reviews, etc.)?

2.2. What Exactly Are You Licensing?

It is important to clearly define the licensed object, *i.e.*, formulate exactly what the licensee obtains access to. From a technology perspective, the licensed object may primarily consist of a patent or a patent application (in full or in part; we will discuss this in more detail in Section 2.3, Scope) and technical know-how not included in the patent or patent application. These items will be our main focus. Additionally, the licensed object may consist of copyrights, software, databases, design rights, trade marks, biological materials, etc.

The licensed object should be matched to the technology and market situation. It is not at all self-evident that a company should license its entire patent portfolio, or even an entire patent family, so these decisions require serious thought. For example, if one patent from a package is not technologically relevant for the licensee, it does not make much sense to provide access to it. Nor is it necessarily a good idea to grant a licence to patents covering geographical markets where the licensee does not have any kind of activity. However, know-how is less bound to specific geographical areas.

Patents and patent applications are fairly easy to refer to, since they have official numbers that may be cited. Know-how is more difficult to cover in the form of a patent claim. In our experience, there are two

main ways of handling know-how: a) make a list of documents containing know-how in an appendix, or b) define know-how by reference to its subject matter. For example, all know-how necessary to optimise the technology package. This should ideally involve collaboration between a technical expert and a lawyer. Also note that while the licensee might well be able to create the know-how itself, it is often more cost-efficient and time-efficient to obtain a licence, enabling both companies to benefit from the research already done. The licence might also include an R&D co-operation component regulating technology transfer and further development.

Licensing know-how additionally requires a high level of trust between the licensor and licensee since the know-how may well constitute a trade secret of the licensor. Violation of the confidentiality provision in the licensing agreement could result in the know-how losing its status as trade secret—with potential consequences for the licensor's business. There are also various reasons to keep a patent application secret until it is mandatory to publish it, so confidentiality is also important in the preliminary phase. Below are several key recommendations regarding the licensed object.

Checklist:

- Be very specific about what the licensed object includes (and what it does not include). While it may be tempting to include all intellectual property and all intellectual assets you own, this may not be the best option; Also, the more you include, the fewer alternatives remain open. This is not to say that one should always be on the look-out for another licensee, but rather that options should be excluded for a reason and not by oversight.
- Identify any technical assistance that may be required for any transfer of know-how, or any optimisation of a patent.
- Consider the geographical limitations of the licensed object. For example, if you own a patent in one country, you cannot automatically also license it outside that country. However, you may be able to license attached know-how more broadly.
- If you intend to license trade secrets, first make sure to establish a high level of trust between you and the licensee. Furthermore, impose a standard procedure that includes good practices to ensure that the know-how remains secret and make sure there are also sufficient incentives for the licensee to keep it secret. Trade secrets have the potential to keep the licence alive after the patents have expired or if patents are not granted or invalidated—of course typically at lower royalties than with valid patents.
- Consider further developments. Should they be included in your definition of the licensed object?
- Also consider further developments effected by the licensee. In the case of a non-exclusive licence, this might involve a back-licence so that subsequent improvements can be made available to the licensor and other licensees.

2.3. What Should the Scope of the Licence Be?

Experience has shown that merely distinguishing between exclusive and non-exclusive licences is too simplistic a model. Whether or not a licence should be granted exclusively or non-exclusively depends on many factors, such as the sector, the technology concerned, etc. For example, a licence as a part of a technical standard package in the telecommunications industry (where the entire patent package is licensed, on pre-defined terms) is very different from a one-off licence for a specific patent. Nevertheless, the scope of the licence can be limited in many different ways so that even if a licence provides exclusivity, this may still result in a narrower scope than a broad non-exclusive licence. Several parameters can be combined in different ways to add up to the scope.

Checklist:

- **Exclusivity:** What degree of exclusivity is provided? Is it a non-exclusive licence, an exclusive licence, or a sole licence?
- **Actions**: What should the licensee have the right to do with the licensed object (*e.g.*, manufacture it, sell and distribute it, etc.)?
- **Geography**: What geographical territory is the licensor providing access to?
- **Application**: What applications and/or fields of use does the licence cover? For example, you may have a patent that can be used both for pets and for humans, but the licensee might be focused on one only.

So, for example, if a licensor suggests "a non-exclusive licence to use patent X worldwide," this is problematic for different reasons. For one thing, it fails to define exactly what the licensee can do with the licence or which applications it covers.

Compare this with "an exclusive licence to patent X to manufacture Y products intended for pets in country Z."

Below are several key recommendations regarding the scope of licensing:

- Be very specific about the scope of the licence. Consider all alternatives with an open mind—do not assume that a non-exclusive licence is necessarily best suited to your situation, or the most attractive to the licensee. For example, a non-exclusive license may not be attractive enough if the licensee needs to make further investments. Also, keep in mind that once you grant a non-exclusive licence, you limit your opportunities to grant an exclusive license. Consider what the licensee needs for its internal business case.
- An exclusive licence should ideally be tied to milestones of some sort, such as a certain number of products sold. If the milestones are not met within a certain time frame, then either the licence should be turned into a non-exclusive licence, or the licensor should have the possibility of terminating it altogether. Another option is to define incremental minimum royalties to be paid.
- If exclusivity is granted, it is wise to consider competition law issues, in particular when the licence could result in a relatively large market share.

Conclusion

Technology owners have several options to develop business models that benefit from licensing opportunities. This is facilitated by the diversity of means to set up tailored contractual arrangements allowing them to create win-win relationships. However, specific challenges may arise, for example when innovative technologies have no ready-made market as they themselves create new business opportunities. An additional effort is required to achieve the intended commercial impact while the technology itself is being further developed and refined. This applies in particular to platforms or enabling technologies with multiple applications.

To give a concrete example, a company called WoodWelding[15] had invented a method for using ultrasonic waves to infuse thermoplastics into wood and other porous materials. The technology created a near-instant, very stable bond that could be used to attach hardware or fuse pieces of an assembly without using adhesives or fasteners. So, while the inventors had come up with an intriguing technology, they had trouble positioning it in the market due to the numerous potential fields of use.

The typical advice in such a situation is to find the "killer application" in an industry with low entry barriers, focus on that application and then reinvest the earnings to explore other options. In line with that, the most market-ready applications must be identified. In addition, in order to determine where the technology can be applied first you need to understand the market: what are its size and growth potential, who are your potential partners, is the market ready to take up new technologies, what is the potential for market penetration?

The company Oxeon, already mentioned above, followed exactly that route, and combined selling its own products with licensing them for non-competing applications (model D). In contrast, WoodWelding focused on licensing (model C) and, for each selected field of use, decided to grant an exclusive licence to a single player in order to motivate that partner to invest in the co-development of market-ready solutions. This model requires a unique field of use to be defined for each licensee.

Since each improvement to the platform technology can potentially benefit licensees in multiple fields, it was decided to include a kind of cross- or back-licence. As a result, each co-development agreement had the potential to improve the situation for each licensee but also avoided potential future freedom-to-operate challenges from new inventions down the value chain.

Because this licensing model provided multiple revenue streams early in the company's life, it supported bootstrapping. In other words, it enabled the licensor to finance further R&D efforts, IP portfolio management, and the acquisition of new licensees with the revenues it generated rather than with third-party risk capital.

Many companies and technology transfer offices struggle with similar problems. A licensing approach like the one applied by WoodWelding makes it possible to unlock untapped value. A prerequisite for such an approach is to establish and maintain a strong IP portfolio based on the initial invention and to add patents that protect follow-on inventions, different fields of use, and related technical developments. A key business asset in such an approach, moreover, is broad geographical protection that covers all key markets and production sites. ■

Available at Social Science Research Network (SSRN): *https://ssrn.com/abstract=4099753*

Disclaimer

Any opinions expressed in this article are those of the authors and not necessarily those of the European Patent Office.

Tailored licensing agreements can be complex as many different, non-obvious options must be considered and compliance with national and international regulations is crucial. Therefore, experiences described in this article should not be interpreted as legal advice. We recommend involving specialised lawyers in the implementation of an intended licence transaction.

15. Gerhard Plasonig, Pernilla Kvist, Martina Serafini & Evan LaBuzetta, "Collaborating For Growth: The Novel Cross-Licensing Model That WoodWelding SA Used To Break Into New Markets Globally," *les Nouvelles* 107-110 (2015), June issue.

Build-To-Sell Powered By Intellectual Assets: A High-Growth Technology Business Perspective

By Juergen Graner

Abstract

Owners of high-growth technology businesses should decide at an early stage whether they are developing their company for continuation as an independent organization (build-to-grow) or for an exit (build-to-sell). The choice of one pathway over the other has a huge impact on the strategic decisions made when building a successful business.

The three key intellectual assets—technology, brand, and operational excellence—are dominant value drivers for an exit deal in a build-to-sell process. Developing a sound portfolio of intellectual assets over many years before the exit will not only provide the business owners with an increased exit valuation, it will also give the company a sustainable competitive advantage in the event a planned exit does not take place or is delayed.

When a build-to-sell choice is made, a dedicated board function should have the prime responsibility for the salability of the business, allowing the CEO to remain focused on the growth of the business. Continuous management of the exit process years in advance and for some time after the exit transaction is crucial for ultimate exit success.

1. Introduction

Most owners of high-growth technology businesses will, at some point in their life, be faced with the decision to sell their company. There are numerous reasons for wanting such an exit. The biggest challenge is that when the possibility arises, the vast majority of business owners are not prepared for this milestone in their life as entrepreneurs. They are often driven by the process of an exit, instead of driving it proactively with a professionally managed build-to-sell strategy that optimizes the business for the best possible deal. As intellectual assets generally need years to be established, and are often the key value drivers for an exit deal, this calls for a process that starts many years before an intended sale. Moreover, it is also important to ensure management continuity for some time following the exit transaction. Business owners should decide early on whether they intend to follow a build-to-grow or a build-to-sell strategy and then develop their company accordingly.

2. Build-to-Grow vs. Build-to-Sell

Build-to-grow and build-to-sell are two fundamentally different strategies open to the business leader when building a company.

The **ultimate goal** when employing a build-to-grow strategy is to continue the business in perpetuity. On the other hand, a build-to-sell strategy has the clear goal of selling the business at a certain point in the future. Key strategic decisions are made with this goal in mind and differ if the time horizon is one to three years, three to five years, or five to ten years. For example, it would make no sense to invest in building a large new factory with a one-to three-year exit time horizon, since the construction work alone would take two years, and the potential purchasers may not even be interested in an additional manufacturing facility. Anything significantly below a 12-month time horizon tends to be a patch-to-sell approach with limited options for creating value.

When asked whether they would like to sell their company, many business owners reply with, “I am willing to sell if the right offer comes along.” However, from a marketing strategy perspective, this is a fundamentally flawed statement. No marketing expert would ever say that they will think about the customer only once their products or services are market-ready. Successful marketing starts with the customer in mind, way before the product or service offering has been finalized.

If a business in build-to-grow mode wants to succeed in selling its products or services, the sole **business driver** will be the customer’s needs. By contrast, a business following a build-to-sell strategy has two business drivers: first, the needs of customers who actually buy the products or services, and second, the needs of potential buyers of the company. Opting for build-to-sell therefore requires a business to cater to two different customer groups that are not necessarily aligned.

To secure continuation over a long period of time (often many generations) under a build-to-grow strategy, it is generally helpful to expand the **scope** and diversify into different markets. Some markets change direction more frequently than others. Market change is inevitable, however. Sometimes a whole industry might be endangered by unforeseeable external factors. A good example of this is the recent coronavirus crisis, during which the hotel industry was seriously impacted without prior warning. A company with some level of diversification would have been much better prepared to sustain such a crisis. However, with the sudden increased demand for toilet paper in many countries, who could have known that being in the

toilet paper business would have been a good crisis hedging strategy for a hotel business? When opting for a build-to-sell strategy, on the other hand, it is better to focus on and adopt a specialization pathway as potential buyers are generally in the market for something very specific. As a rule, the more an acquisition target fits into a clearly defined box, the easier it is to find buyers who are prepared to pay a premium for it. Moreover, a specialized business is usually easier to integrate, since the new owner does not have to spend months or years disposing of add-on elements that were acquired but do not fit the acquirer's strategy.

Figure 1. Build-To-Grow vs. Build-To-Sell Strategy

	Build-to-Grow Strategy	Build-to-Sell Strategy
Ultimate Goal	Continuation	Exit at time X
Business Driver	Customers	Customers and Acquirers
Scope	Diversification	Specialization

As described above and shown in Figure 1, opting for a build-to-grow versus a build-to-sell strategy has a significant impact on how the business is developed and what strategic decisions are made. When building a company, settling on a strategy and deciding when to transition to a build-to-sell strategy is key at an early stage. This does not mean that the strategy cannot be re-evaluated every year. However, it is better to have a clear understanding of where the journey is heading from the start. Hope is simply not a good business strategy.

2.1 Build-to-Grow Strategy

The most common reasons for adopting a build-to-sell strategy are:

Family Legacy

When the intention is to pass the business on from one generation to another within a family, the obvious strategy is build-to-grow. To be effective, this strategy needs to ensure a proper handover to the next leadership. Companies that are successful with a family legacy business generally have a well-defined process of how future CEOs develop their skills and abilities in non-affiliated companies. This ensures higher respect for the successor and offers an opportunity to bring a new way of thinking into the company from the outside.

Lifestyle Business Choice

For some reason, a lifestyle business often has a negative connotation in the management education realm as a business that is not pursuing maximum growth. However, there is nothing wrong with running a business with the primary goal of job satisfaction and providing the funding required for the owner's lifestyle. It is a perfectly good choice and generally the route to follow when the owner employs a build-to-grow strategy, provided growth is actually desired. In addition, a lifestyle business does not necessarily mean a small company.

Going Public

While the strategy of developing a company to become a publicly listed entity through an IPO could be considered a separate strategy type (build-to-IPO), for the purpose of this article it is classified as a build-to-grow strategy rather than a build-to-sell strategy. Generally, the purpose of an IPO is to ensure the continuation of the business with the opportunity of getting easier access to funding for planned growth. When a company is primed for an IPO, one key preparation is establishing highly professional operation and management systems that are adequate for a listed entity.

■ Juergen Graner,
Founder and CEO,
Globalator,
San Diego, California USA
E-mail: office@globalator.com

2.2 Build-to-Sell Strategy

The most common reasons for adopting a build-to-sell strategy are:

Investor Requirement

High-growth technology businesses often have such significant capital requirements that bootstrapping (building a company without external equity financing) is not an option. Moreover, since debt funding is limited by the collateral that a business owner can put up, most high-growth businesses require equity funding. The majority of equity financing comes from funds with a limited lifetime (usually 10 years). Therefore, they need to cash in on their investment to realize a positive return on investment at some point. This means that equity funding generally comes with the requirement for a build-to-sell strategy and a time frame dictated by the remaining life of the fund providing the money.

Personal Risk Reduction

Sooner or later, many long-term business owners realize that their wealth is trapped in their company. At the same time, even the most successful businesses will fail at some point due to internal or external factors. At an all-hands meeting in November 2018, Jeff Bezos told his employees *"I predict one day Amazon will fail. Amazon will go bankrupt... We have to try and delay that day for as long as possible."*[1] With that realization, it is logical that many first-time business

1. See article on CNBC online on 15 Nov. 2018—*https://www.cnbc.com/2018/11/15/bezos-tells-employees-one-day-amazon-will-fail-and-to-stay-hungry.html*

owners in particular will want to "cash in their chips." Some will become serial entrepreneurs, starting one business after another. Others will simply retire, enjoy life and/or become angel investors. In general, selling a high-growth technology business is a positive, life-altering experience for entrepreneurs as it allows them to do what their investors do: diversify their risk.

Big Cash-Out

There are few ways of achieving a major cash-out event, besides inheritance (not everyone is born into a wealthy family), marriage (not everyone wants to look for a spouse with the right monetary background), and luck (the chances of winning the lottery are not considered to be very high). One opportunity is to become an entrepreneur and sell the business. Apart from either already having or developing the skills needed to be an entrepreneur, employing a proactive build-to-sell strategy from the very beginning can significantly increase the chances of a big cash-out event.

3. The Anatomy of a Successful Exit

Most business owners make the mistake of treating the sale of their business as a situation to be tackled when the time is right. In many cases, however, some unforeseen event triggers the exit process. Such events include the proactive approach of a potentially interested party, the unexpected deterioration of the owner's personal health due to stress, and the slowdown or even decline of business growth due to market changes. The problem with all these triggers is that they start forcing the unprepared owner into a short-term exit process. Investment bankers, M&A advisors, and business brokers jump to the rescue, start the transaction phase and try their best to close a deal. Nonetheless, their job is neither to develop a business nor to ensure its integration with the new owner, but simply to close the best possible deal under the given circumstances. A proactive build-to-sell process starting at least one year before a business is sold (the earlier, the better) and managed from within the company is the best insurance for business owners to optimize their value, retain control, and drive exit opportunities, instead of being driven by them. In reality, a successful exit transaction is not an event but a journey, where value is accumulated during the development phase, captured during the transaction phase, and secured during the implementation phase (see Figure 2).[2]

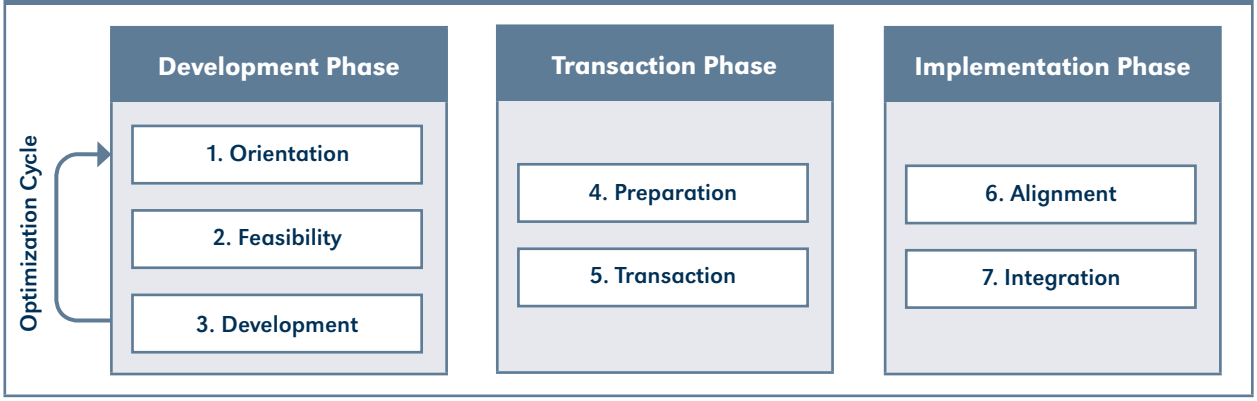
3.1. Development Phase

The first step when embarking on a build-to-sell strategy is understanding the expectations for the end of the journey through an **orientation process**. The owner has to define what they want to get out of the exit and what the expected timing is. For some owners, financial gain alone is key; others consider it vital that their employees and/or the established brand have a future after the business is sold. The personal exit timing might be determined by a certain age of the owner or by a targeted market position, achieved by the company to optimize the sales price. Expectations are as different as people and no two situations are alike. This becomes even more complicated if there is more than one owner, because all expectations need to be aligned first to define a solid build-to-sell strategy.

When the expectations for the exit are clear, a **feasibility process** submits these and major strategic decisions to a reality check. Feasibility discussions may already take place during the orientation phase and sometimes a negative feasibility check can bring the process back to this phase. One example is if the company decides to make one or more acquisitions to achieve a size that is attractive to potential buyers. It may be necessary to verify the availability of such targets and the funding of the acquisitions. A significant acquisition in a one- to three-year build-to-sell process might not be feasible but could realistically be managed in a time-frame of three to five years.

2. See also the article, "People as Enablers," co-authored by Juergen Graner, *les Nouvelles*, June 2020.

Figure 2. A Successful Business Exit Transaction



Once a strategy has been determined and evaluated through a feasibility process, the actual **development process** can begin. This is where the real value is added to the business. It is also the point where a list of potential buyers is drawn up and their needs analyzed to understand what kind of company would attract enough potential buyers who fulfill the expectations of the owner(s). Alliances might be formed with potential buyers to get on their radar. Licensing deals might be made to strengthen the intellectual property portfolio or close gaps in the freedom-to-operate status quo. Spin-offs might be established to create the possibility of serial exits or enable the owner to sell one part of the business and keep another. Acquisitions might be made to enhance the growth of the company. Business units that do not contribute to the value of the business from a buyer's perspective might be discontinued or sold. In fact, this whole development phase is where the ultimate value is either created or lost. It is also when the intellectual asset portfolio (see Section 4 below) needs to be established since all key intellectual assets (technology, brand, and operational excellence) take years to build. Once the development process begins, a regular optimization cycle should be maintained to re-evaluate whether what was determined in the orientation process is still valid, and whether the development strategy needs adapting.

3.2. Transaction Phase

A business with a proactive build-to-sell process in place is not only able to start the transaction phase when the time is right, it is also well prepared to deal with unexpected events that might trigger an exit. The starting point of this phase is usually the development of an information memorandum, which is a sales document that allows potential buyers to declare their interest in an acquisition. The **preparation process** also includes a more detailed analysis of potential acquirers. While a well-prepared business has already maintained a list of potential buyers throughout the development phase, this is the time to expand that list and possibly disqualify potential contenders. It is also the time to decide whether not only strategic buyers but also private equity funds might be considered as potential acquirers. Private equity funds can be a great option for smaller businesses that still need to be built further for a successful sale, but where the owner already wants to cash out. In many cases, these funds prefer to buy only a portion of the business, provide some needed growth capital, and keep the owner on board until a full exit takes place at a later date.

Once all preparations are complete, the actual **transaction process** can begin. One important decision is whether to adopt a broad or a narrow approach. A broad approach has the advantage that every potential buyer is invited to a structured process. The disadvantage of the broad approach is that the whole industry will find out that the company is for sale. This can limit the continuation of the business should the exit process be stopped for any reason and the company continue as a standalone entity. The reason for this is that players in the industry may well be reluctant to work with a business that might be sold in the next attempt. The narrow approach has the advantage that knowledge of an intended sale can be limited to a few selected companies, avoiding backlashes if the business continues without an exit. The downside is that the limitation to fewer targets might miss a potential buyer for the best possible deal. In the end, there are many shades between approaching hundreds of companies versus only one; making a conscious decision, based on a clear analysis of advantages and disadvantages in each particular case, is key.

3.3. Implementation Phase

Once the deal is signed and the transaction concluded, the implementation phase can begin. Unless the acquisition was made by the buyer to operate the business without any significant changes or to close down the acquired entity, this is where things often start to go wrong. Integrating a business is an art in itself. According to an article in *Harvard Business Review*, 70 to 90 percent of acquisitions are abysmal failures.[3] The main reason why successful implementation matters, not only to the buyers but also to the sellers, is that earnout payments (see Section 4) can represent a significant portion of a deal and depend on the success during or after the implementation phase. Another "soft factor" is that most owners want to see the business continue, and many find it important to secure the future of their trusted employees. A solid build-to-sell process that was established years before the transaction phase and ensures the building of a business ready for integration with a potential acquirer will make the acquisition more attractive for the buyer and create a win-win situation for both seller and buyer. For this to happen, a business embarking on a build-to-sell strategy should establish an in-house function at the board level that has the responsibility for overseeing the development phase towards an exit, the transaction phase, and that continues to stay involved during the initial **alignment process**, ensuring a sustainable success of the transaction.

When the alignment process has determined how the future joint business will work, the **integration process** kicks in. This is where the build-to-sell board function starts fading out to ensure the handover to the new business owner runs smoothly. If the process was managed correctly, the seller will not only receive

3. See article "M&A: The One Thing You Need to Get Right." by Roger L. Martin, *Harvard Business Review*, June 2016

the adjusted purchase price but also most of the escrow holdback and the maximum achievable earnout payment (see Section 4 and Figure 3). Generally the seller's goal is the perfect deal that ensures the best possible financial return for the seller, a business performing above expectations for the buyer, and a secure future for the employees of the company. While it will not always work perfectly, choosing a proactive build-to-sell process favors the best possible outcome.

4. The Role of Intellectual Assets for the Exit Deal

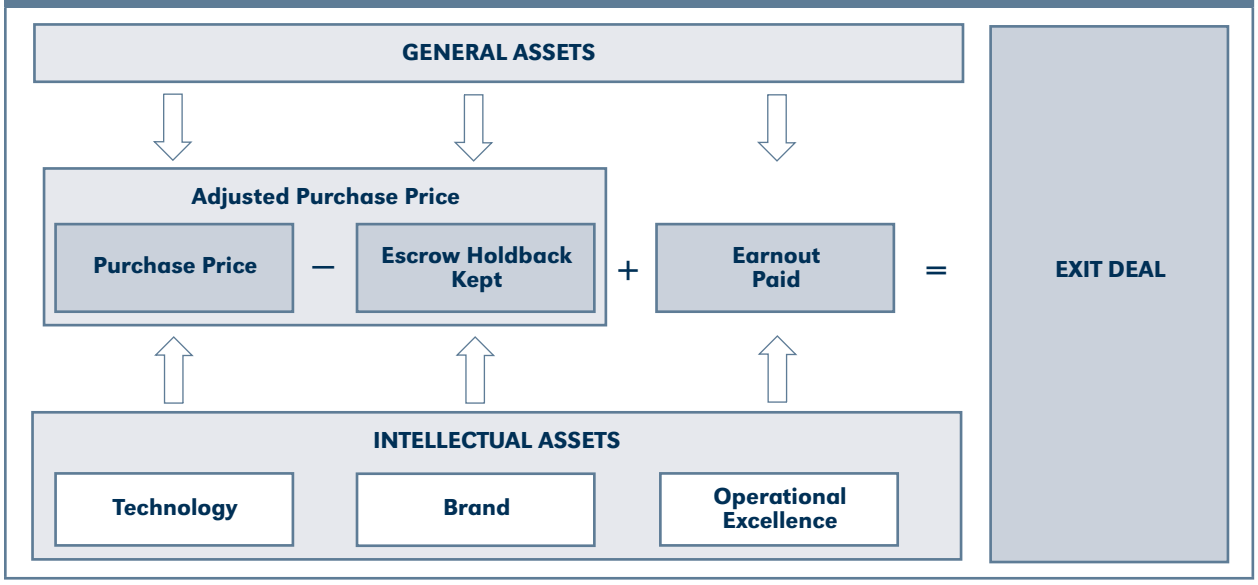
Intellectual assets are of fundamental importance for a successful exit deal. Since they cannot be established at short notice prior to a pending exit, the process of building a sound intellectual asset portfolio must begin many years beforehand, during the development phase (see Section 3). As mentioned above, the ideal exit deal ensures that, in addition to the initial payment at closing, the buyer releases the majority of the escrow holdback and the seller receives the maximum possible earnout payment from the performance of the business under the new ownership (see Figure 3).

For the purpose of this article, the **purchase price** is the overall price that the buyer is willing to pay to acquire the business. In case of an equity deal, the buyer receives full ownership in the seller's company (provided they buy 100 percent of the business, although in some cases the buyer might only acquire a certain percentage). In the event of an asset deal, the buyer purchases only specific assets of the business.

As a rule, however, the purchase price is not the amount that the seller will receive once the deal is closed. In most cases, the buyer will require the seller to provide binding promises (contractually fixed under representations, warranties, and indemnifications) that certain assumptions about the business are correct. One simple example is that the inventory actually represents the value claimed by the seller. To secure these promises, the buyer will ask that a certain portion of the purchase price (depending on the industry and the risks perceived by the buyer) be deposited in an escrow account as an escrow holdback, managed by an escrow agent. This escrow holdback is subsequently released either to the seller or to the buyer, based on contractually defined terms and timelines. The initial price paid is thus the **adjusted purchase price**, calculated as the agreed purchase price minus the **escrow holdback** deposited in an escrow account, ownership of which is only determined throughout the escrow period.

Companies that have been set up for high performance under new ownership through a solid build-to-sell process and supported by a strong intellectual asset portfolio have the potential to benefit from an additional earnout agreement. An earnout provides supplementary payments over and above the agreed purchase price for achieving defined performance criteria. In most cases, these performance criteria are based on sales performance. However, along with countless other options, they could also include certain milestones in a product development process. While the escrow holdback has the potential to reduce the agreed purchase price, the **earnout paid** adds to it. The tricky part about receiving earnouts is that, by this point, control over the performance has shifted to the new owner, and any success depends not only on the right preparation on the part of the seller, but also on the cooperation of the buyer. While certain requirements may be put in

Figure 3. The Ideal Exit Deal



place by the seller to enable earnout performance, the main driver here is business logic combined with management support from the seller's team.

The following example from the life sciences industry illustrates the possible impact of escrow holdback and earnout on the actual amount received by the seller (parameters depend on the individual situation and the industry). With a purchase price of $50 million, plus a 20 percent escrow holdback and a $20 million earnout, the difference between a worst-case scenario (all the escrow holdback is kept by the buyer and no earnout is paid=$40 million exit deal value) and a best-case scenario (the entire escrow holdback is released to the seller and the full earnout is achieved = $70 million) would be $30 million. This translates to a 75 percent higher overall exit price if the business was well prepared in a build-to-sell process and the implementation phase went according to plan. Intellectual assets are major contributors to and increase the likelihood of a higher purchase price in the first place and a higher overall exit deal.[4]

4.1. Impact of General Assets

General assets typically include customers (expressed in revenue), cost structure (expressed in gross margin and profitability), established contracts, equipment, inventory, work in progress and team members. As the foundation of any business valuation, they have a substantial impact on the purchase price because they are relatively easy for the acquirer to evaluate in a due diligence process. Since an escrow agreement needs clear trigger points to determine whether the seller or the buyer receives the retained funds, general assets also have a huge impact on the escrow holdback. While general assets may serve as the foundation of an earnout (*e.g.*, equipment with significant spare capacity enables the sales team to sell more products), their impact on it is usually low. See Figure 4.

Figure 4. General Assets

	Purchase Price	Escrow Holdback	Earnout
General Assets	High	High	Low

4.2. Impact of Technology Intellectual Assets

Strong technology intellectual assets (IA) combine the technology intellectual property mainly secured by patents and trade secrets with the know-how of the team.

For a company with a strong technology portfolio, the impact of technology on the purchase price can be significant, especially when it gives the business a sustainable competitive advantage. For example, patent-protected technology with a clear enforcement and freedom-to-operate position that allows the company to exclude competitors for a relevant period of time increases value as the current performance and growth pattern is more likely to continue.

The impact of technology on the escrow holdback tends to be low, as it is relatively difficult to find trigger points that would provide an escrow release payment to one of the parties. One example in which technology might have an impact on the escrow holdback is a pending patent lawsuit that could threaten a business' technology foundation where winning or losing patent litigation could determine the payout of an earmarked holdback.

From an earnout perspective, technology can have a high impact on an agreed earnout. This is especially true if, for example, the company owns platform technology that has been tried and tested in only one market segment, but could be used to access one or several other markets. It could be part of an earnout payment based on future sales in those new markets, provided the buyer agrees to enter those markets shortly after the deal is completed. See Figure 5.

Figure 5. Technology Intellectual Assets

	Purchase Price	Escrow Holdback	Earnout
Technology IA	High	Low	High

4.3. Impact of Brand Intellectual Assets

Strong brand intellectual assets (IA) combine the brand's intellectual property secured by trademarks with the ownership of customer mindshare, where individuals associate the brand with certain attributes.

A strong brand almost always has a powerful impact on the purchase price although the brand value is generally higher in business-to-consumer than in business-to-business focused companies. This is interesting as, in most cases, the seller's brand will be replaced with the buyer's brand. However, having a strong brand, where the task is not finding new customers who have positive associations with it but transferring existing positive associations to a new brand in a controlled step-by-step process, is still of great value to a buyer.

Since a brand is generally easy to assess in a due diligence process, the impact of the brand on the escrow holdback is almost always low. One situation in which an escrow holdback might be impacted by the brand is when the acquired company does not own a

4. For more information on intellectual assets as value drivers for strategic transactions, see also the article, "Transactions Powered by Intellectual Assets," by Juergen Graner, *les Nouvelles*, June 2020.

registered trademark with an uncontested status and there is reason to believe that the brand might actually violate existing trademark rights of another company.

Earnouts are usually based on future sales performance. Since great sales performance builds on a strong brand that has been established over many years, the impact of the brand on an earnout is generally high. Moreover, the value increases if the buyer can use the seller's brand to expand the product portfolio quickly by targeting the seller's existing customers with their own products. See Figure 6.

Figure 6. Brand Intellectual Assets

	Purchase Price	Escrow Holdback	Earnout
Brand IA	High	Low	High

4.4. Impact of Operational Excellence Intellectual Assets

Strong operational excellence intellectual assets (IA) allow a company to consistently outperform others and combine the operational excellence intellectual property secured by the operational systems with a culture that enables operational excellence.

Interestingly enough, operational excellence rarely has a direct impact on the purchase price from a valuation perspective. The reason is that it is very difficult to prove the actual level of operational excellence in a company in a common due diligence process. Nevertheless, since operational excellence serves a company in a build-to-sell process during the development phase (see Section 3) and can ensure high sales growth, a high gross margin, and fast product time-to-market, it has a significant intrinsic value affecting the purchase price.

Generally operational excellence does not have a major impact on the escrow holdback. Although some buyers might try to link the potential loss of key employees to an escrow trigger point, the truth is that this issue is better served with a special tie-in contract, retaining key employees for a certain period of time with defined bonus payments. Moreover, it would be very difficult to define escrow payment release trigger points for underperformance in terms of operational excellence.

Operational excellence really shines when it comes to the earnout. A business developed for a sale through a solid build-to-sell process will have established at least a certain level of operational excellence and it is easier to be integrated into the company structure of the buyer. Consequently, when the former CEO steps down and a new CEO takes over, a business with operational excellence will continue to perform: this performance secures the earnout payments. However, it is important that the seller still has someone in place to manage the transition carefully and ensure a smooth handover. This role is ideally performed by a person or a team that has been managing the build-to-sell process since the development phase and is therefore very familiar with the company. See Figure 7.

Figure 7. Operational Excellence Intellectual Assets

	Purchase Price	Escrow Holdback	Earnout
Operational Excellence IA	Low	Low	High

5. Conclusion

Intellectual assets are a significant contributor to the exit deal value and need to be established over many years during the development phase of a business (see Figure 8 for an overview of the impact of different assets on the exit deal value).

The secret to the success of an optimized exit is understanding that different assets have a different impact on the three key factors of an exit deal: purchase price, escrow holdback, and earnout. General assets have the highest impact on the adjusted purchase price (the purchase price minus the escrow holdback deposited in an escrow account) and very little impact on an earnout. Technology and brand intellectual assets generally have a high impact on the purchase price and very limited impact on the escrow holdback but are the key drivers for an earnout. Operational excellence is an inconsequential outlier in the intellectual asset class as its impact on the purchase price is more intrinsic. On the other hand, it is usually the most important driver for earnouts.

Therefore, an owner of a high-growth technology business should ensure that a proactive build-to-

Figure 8. Overview Of The Impact Of Different Assets On The Exit Deal Value

		Purchase Price	Escrow Holdback	Earnout
General Assets		High	High	Low
Intelletual Assets	Technology	High	Low	High
	Brand	High	Low	High
	Operational Excellence	Low	Low	High

sell process is initiated at an early stage, developing a solid portfolio of intellectual assets to secure the value of the business. In the event an exit does not materialize for any reason, these intellectual assets will continue to be the backbone of the sustainable competitive advantage that the company has built. In any case, a business cannot go wrong with a strong intellectual asset portfolio.

Furthermore, if a business owner opts for a build-to-sell strategy, they should establish a build-to-sell function at board level in their company that is tasked with guiding the company from the development phase through the transaction phase and into the implementation phase. The business owner should focus on managing day-to-day operations with a steady eye on the customers, while the build-to-sell function's prime focus is the company's salability. ■

Available at Social Science Research Network (SSRN): *https://ssrn.com/abstract=4099758*

Author

Juergen Graner, member of the HTB Task Force at EPO and the HGE Task Force at LESI.

Acknowledgement

Reviewer and editorial support was provided by Patrick Monroe, Yasmin Law, Adéla Dvoráková, Ilja Rudyk and Thomas Bereuter.

Leveraging Innovation Through Collaboration: IP Challenges And Opportunities For SMEs In The Context Of EU-Funded Collaborative Research Projects

By Jörg Scherer, Dr. Eugene Sweeney, and Stephanie Weber

Abstract

European Research & Innovation (R&I) funding programmes, in particular Horizon Europe, offer great opportunities for start-ups and small and medium-sized enterprises (SMEs) to leverage external knowledge through collaboration. There is a multitude of reasons why small businesses participate in EU funding programmes. Besides seeking grants to finance Research & Development personnel, SMEs consider collaborative R&I projects an ideal "Open Innovation" (OI) environment to jointly develop new technologies, products, or services. However, such multi-partner collaborations bring together very different partners from academia, research, and industry with varying motivations and interests. Collaborative R&I projects showcase a mix of plans and pathways to use project outcomes beyond the project, thus resulting in a higher complexity for Intellectual Property (IP) management strategies and good practices to meet the needs and expectations of all partners involved.

This article provides an overview on the IP strategy framework and related rules, procedures, and best practices in European R&I funding programmes.

In particular, the article underlines key IP challenges that typically occur in SMEs in pre-competitive collaborative R&I projects (typically up to Technology Readiness Level 6), thus stimulating and improving the effectiveness of collaborative innovation. To this end, the article presents first observations and results from a pilot IP support service provided by the European Commission specifically designed to help European SMEs to efficiently manage and valorise IP in EU-funded collaborative R&I efforts: the so-called "Horizon IP Scan."

This article provides insights to support partners, especially SMEs, to design and effectively manage IP assets in multi-partner R&I collaborations.

1. IP Strategy Framework

1.1 Overall IP Management and Exploitation Strategies in a Collaborative Research & Innovation (R&I) Project Funded Under Horizon Europe.[1]

Collaborative projects bring together partners with different company cultures, business mindsets, interests, and strategic objectives. Different partners also bring different background knowledge and IP for use during the project and, if needed for commercial exploitation, after the project ends under agreed terms and conditions. Results from collaborative projects are often built on the combined knowledge of several partners, so are jointly created and jointly owned; therefore, it is important for the partners to agree on appropriate and shared strategies for their management, protection, and exploitation. Beneficiaries in a collaborative Horizon R&I project must make best use of all relevant knowledge and IP to maximise the benefits from the collaboration and to develop and successfully commercialise innovations that enhance competitiveness and growth. This includes, of course, the outputs from the collaborative project itself, their own existing knowledge and IP, and potentially also that of the other partners, and third parties.

Effective management of all of these intellectual assets is crucial; particularly those results which are developed collaboratively, and jointly owned. Equally important is the need to consider the strategic value of protecting these results in order to support their commercial exploitation, potentially by several partners. Participating in collaborative work requires acceptance of the need to share, and may require a cultural shift in the collaborating organisations to achieve this. But collaborating is about more than just sharing. The nature of collaboration means there are also interdependencies between partners, and long-standing ties can be built between the partners and other stakeholders. These interdependencies and new relationships may lead to other benefits, such as future commercial collaborations, and access to new markets or fields of use.

1.2 Challenges of Collaborative IP Management—with a Particular Focus on SMEs

A key challenge in Horizon collaboration projects comes from the different alignments of different part-

1. Horizon Europe is the EU's key funding programme for research and innovation with a budget of €95.5 billion. The programme facilitates collaboration and strengthens the impact of research and innovation in developing, supporting, and implementing EU policies while tackling global challenges.

ners' cultures, business objectives, and approaches. In collaboration projects, all the partners have various interests, spanning from research to commercial exploitation. This is particularly the case for universities and research organisations who are driven and rewarded by publishing their findings, compared to SMEs and industry who are driven by increasing their competitiveness and growth, and where publishing too soon, before adequate protection has been secured, could have adverse consequences for them.

Open approaches for sharing knowledge and obtaining knowledge from others can stimulate the development of innovations. It is the basis of collaboration and should be embraced, especially since no one has a monopoly on invention. Whilst consortium partners are a good source of knowledge and ideas, the increased focus on Open Innovation and Open Science practices in EU-funded collaborative projects, which involve multiple actors, introduces major challenges in addressing appropriate and systematic management of the knowledge flows between partners, and the protection of the IP to support individual and shared business strategies.

However, defining an appropriate framework to organise and manage these collaborative innovation activities, whilst at the same time maintaining control over the dissemination and commercial use of the knowledge, can be very challenging for SMEs. SMEs must, therefore, fully understand the potential contributions from the consortium partners; and vice-versa, to be clear about what they bring to the project and how they can benefit themselves. Knowing and matching expectations among consortium partners is a pre-requisite for developing the trust and credibility necessary for the exploitation of collaborative project results. Expectations, needs, contributions, benefits, risks, etc., need to be discussed and understood alongside a clear collective purpose, vision, and a concrete picture concerning expected outcomes.

Joint ownership is a particular challenge when addressing management, dissemination, protection, transfer/licensing, and exploitation of research results. It is important that these issues are appropriately addressed, taking into account the different interests and objectives of all partners, whilst ensuring the commercial objectives of the SMEs are also met. Even in case of exclusive ownership, with one partner acquiring the full ownership of the project results to be exploited through exclusive licenses or assignment, specific provisions need to be put in place in order to ensure access rights to results for other parties, and appropriate remuneration for the exploitation of the acquired project results in order to safeguard all interests of the parties involved in the project. Any assignment or exclusive licence requires the permission of all partners and will need to sort out cost/revenue sharing, reversion rights, etc.

1.3 The IP Framework: IP-Related Rules, Requirements and Options for IP Management in Horizon Europe Projects

The European Commission has established rules concerning ownership, protection, access rights, dissemination, and exploitation of project results, which establish guiding principles for IP management in Horizon Europe. IP rules are mainly defined in the Grant Agreement (GA)[2] and the Consortium Agreement (CA). The Grant Agreement contains "default rules" applicable to IP management, which will be further specified by project consortia in the CA, while the GA takes precedence.

■ Jörg Scherer,
Managing Director,
EURICE—European Research, and Project Office GmbH,
St. Ingbert, Germany
E-mail: j.scherer@eurice.eu

■ Dr. Eugene Sweeney,
Director,
Iambic Innovation Ltd.,
Abingdon, United Kingdom
E-mail: es@iambicinnovation.com

■ Stephanie Weber,
Head of Communications & Marketing
EURICE—European Research and Project Office GmbH,
St. Ingbert, Germany
E-mail: s.weber@eurice.eu

Beneficiaries in Horizon Europe projects need to comply with specific IP provisions laid down in the Grant Agreement,[3] such as:

Obligation to protect: Each beneficiary must examine the possibility of protecting its results and must adequately protect them, for an appropriate period and with appropriate territorial coverage, if a) the results can reasonably be expected to be commercially or industrially exploited, and b) protecting them is possible, reasonable, and justified (given the circumstances). When deciding on protection, the beneficiary must consider its own legitimate interests and the legitimate interests (especially commercial ones) of the other beneficiaries.

Obligation to disseminate: Horizon follows the "Open Science" approach that focuses on spreading

2. The General Model Grant Agreement aims to ensure coherence and simplification among all funding programmes under the EC's Multiannual Financial Framework (MFF) 2021-2027.

3. For further information on the IP framework in EU-funding programmes, see "Your Guide to IP in Horizon 2020" and the guide on "Successful Valorisation of Knowledge and Research Results in Horizon Europe," both published by the *European IP Helpdesk*.

knowledge as soon as it is available using digital and collaborative technology. That is why beneficiaries are requested to make their scientific publications available as Open Access publications, and grant access to their data as open as possible and as closed as necessary. It should be noted that Open Access in Horizon Europe does not interfere with the protection of research results, as it is common practice that the GA/CA specifies notification rules for any planned publication as well as rules and procedures with regard to the right to object.

Obligation to exploit: All beneficiaries in Horizon projects should be fully aware that they must, up to four years after project completion, take measures aiming to ensure exploitation of its results (either directly or indirectly; in particular, through transfer or licensing), by: a) using them in further research activities (outside the action); b) developing, creating, or marketing a product or process; c) creating and providing a service; d) using them in standardisation activities or other use scenarios such as to inform policy or for educational purposes. Hence, exploitation is by no means limited to commercial exploitation.

Rules and procedures related to ownership/joint ownership: In collaborative projects, particular emphasis should be given to establish rules and procedures for ownership (and the management of ownership—including protection strategies) of key project results. The GA states that results are owned by the beneficiary that generates them. However, due to the strong collaborative work, two or more partners may jointly contribute to an individual result of IP. In these cases, the IP is jointly owned. The joint owners should therefore agree on the terms of the joint ownership through a Joint Ownership Agreement. Moreover, consortia are requested to prepare a "Results Ownership List" to clarify ownership of project results and to help improve the process for exploitation of these by project partners and, where relevant, third parties. As a minimum, the list should include details of whether the result has single or joint ownership, the name of the owner(s), the country of establishment of the owner(s), and whether the results will be exploited by the owner(s).

Rules related to access rights with regard to background and results: The implementation of any collaborative project requires the use of pre-existing IP (background) resulting from work carried out prior to the project, and belonging to one of the partners. Thus, within the CA (the agreement between the partners) project partners need to create a list of background IP that they will bring to the project, as well as specific IP they wish to exclude access to. Moreover, in order to avoid any IP infringements and guarantee a proper technological project implementation, project partners have to warrant the ownership of their background IP and formally agree that other parties can access it for the purposes of the project. The CA further specifies that consortium partners have access to the background/results of other partners in case they need this knowledge (IP) to implement their own project tasks or to exploit their own results. Table 1 provides an overview on the access rights regime in Horizon Europe.

1.4 Drafting the Consortium Agreement

Although not exhaustive, the following essential IP-relevant points should have been discussed when drafting the CA: confidentiality, background selection, use of IP generated parallel to the project (sideground), ownership/joint ownership of results, legal protection of results (IPR), access rights, and procedures for dissemination of results. The CA provides the legal framework for IP management, including a detailed section with specific innovation-related clauses on ownership, access rights, decision making procedures, publications, and IP-related workflows and responsibilities (*e.g.*, assessing, capturing, monitoring of IP) within the project. Besides multilaterally agreed rules governing the rights and obligations of the collaboration within the consortium, the agreement should include reference documents for Material Transfer Agreements and background IP of all consortium partners. If necessary, this document should be amended and updated throughout the project.

The basic principle to follow when drafting these IP provisions should be to provide a flexible and efficient mechanism to support the cooperation between partners to ensure appropriate protection and maximum use of results, as well as their timely dissemination.

Table 1. The Access Rights Regime In Horizon Europe

Purpose	Access to Background	Access to Results
Implementation of the project	Royalty-free, unless otherwise agreed by participants before their accession to the GA	Royalty-free
Exploitation of project results	Subject to agreement, access rights shall be granted under fair and reasonable conditions (which can be royalty-free)	

Usually, in Horizon 2020/Europe projects, the CA is drafted on the basis of existing model agreements such as the DESCA[4] model agreement template.

1.5 Overall IP Management Approach in Collaborative Horizon Europe Projects

In order to comply with the mandatory Open Science requirements of Horizon Europe, whilst safeguarding the rights of the consortium partners to protect their IP to support the effective commercial exploitation of the project's results, an appropriate IP strategy should be defined.

IP and innovation management measures should ensure that exploitable results will be captured, assessed, and appropriately protected, in order to support their commercial exploitation, whether at the individual partner level, as a group of partners, or collectively for the consortium as a whole. In order to achieve the impacts of the project most efficiently, exploitation activities combine established work processes for anticipatory innovation planning to capture, protect, and assess Key Exploitable Results (KERs), including strategic support and very concrete measures to support "Go-To-Market" strategies. The selection of measures ideally matches the level of maturity of results, paving the way to a quick introduction of products and services to the market. A systematic follow-up of impact pathways for KERs should be implemented to maximise the understanding of specific IP topics relevant to the consortium; develop concrete exploitation plans based on the IP status, legal, and other issues; as well as plan concrete steps towards market-oriented exploitation.

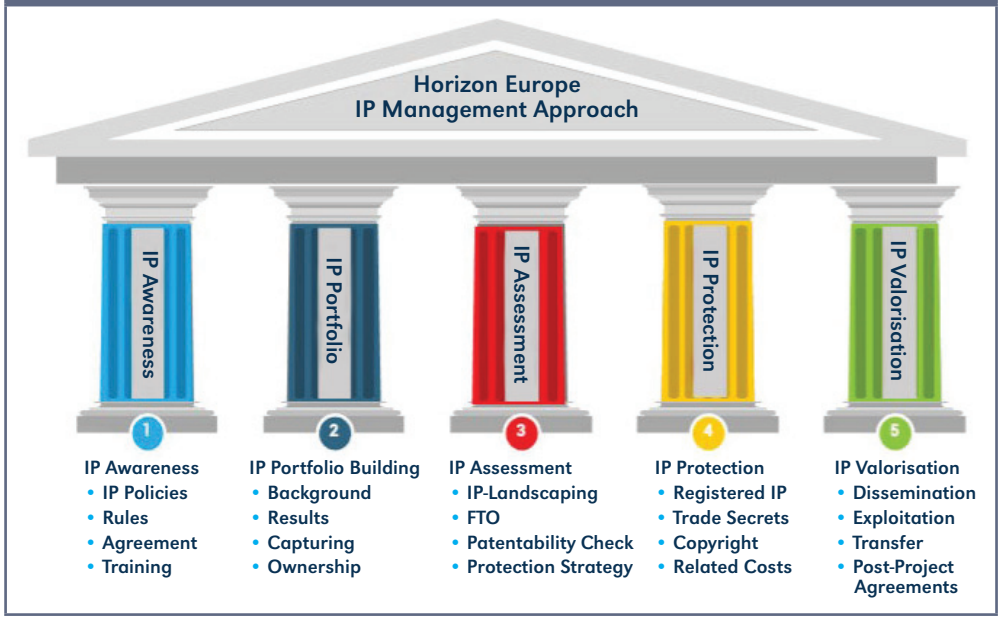
At each stage of a project, the IP issues that need to be addressed are different. For example, at the start of a project it is important to agree on which existing knowledge is to be shared and under what terms and conditions, both for use during the project and after it ends. As the project progresses and results are produced, the results need to be captured and assessed before decisions can be made about ownership, management, and protection. Only then can dissemination and exploitation begin. Towards the end of the project, as all the expected results become available, planning the future exploitation pathways becomes even more important, since in collaborative projects the main exploitable outputs usually consist of a bundle of results, each developed by the partners individually or jointly. These "bundles" of IP, their management, and their protection may be different for different territories or fields of use. For SMEs, whose objective is commercial exploitation of the results to build or grow their business, the ongoing management and protection of the IP they need must continue beyond the end of the project. This is illustrated by the so-called "5 Pillars of IP Management" as shown in Figure 1, which reflect the different stages of a collaborative project and at which different challenges related to IP management may arise.

2. Horizon IP Scan—a New Support Service for SMEs Involved in EU-Funded Collaborative R&I Projects

2.1 Rationale Behind the Horizon IP Scan Service

The Horizon IP Scan service[5] is a new (pilot) service

Figure 1: 5 Pillars of IP Management



4. DESCA (Development of a Simplified Consortium Agreement) is a comprehensive Model Consortium Agreement that offers a reliable frame of reference for project consortia. DESCA enjoys broad support within the EU framework programme community.

provided by the European Commission and managed by the European Innovation Council and SME Executive Agency (EISMEA) launched in March 2021. The service helps European SMEs involved in EU-funded collaborative research projects to efficiently develop and implement strategies to manage and valorise IP in collaborative R&I activities. This should in turn facilitate the exploitation of jointly developed innovations. The advice and recommendations provided by local IP experts are intended to help the SMEs to develop a cooperative way to manage intellectual property created in collaborations.

The service follows the general principle of IP pre-diagnosis and covers different steps such as preparation work, a visit (or online-meeting), and the provision of a report. The service may either be provided for a single SME or, preferably, a group of SMEs involved in a collaborative research project. All SMEs requesting the service will receive an individual IP review by an individual expert—resulting in an individual report. In addition, if applicable, the service will conclude in a joint discussion with all SMEs within the collaboration that requested the service.

In general, IP pre-diagnosis services aim to support SMEs in identifying intangible and intellectual assets and to make an objective assessment whether protection—and if so what type of protection—would support commercialisation activities, taking into account the business strategy of the company. It may also be most appropriate to make the asset open (deliberately put in the public domain), and grow the business through added-value products or services.

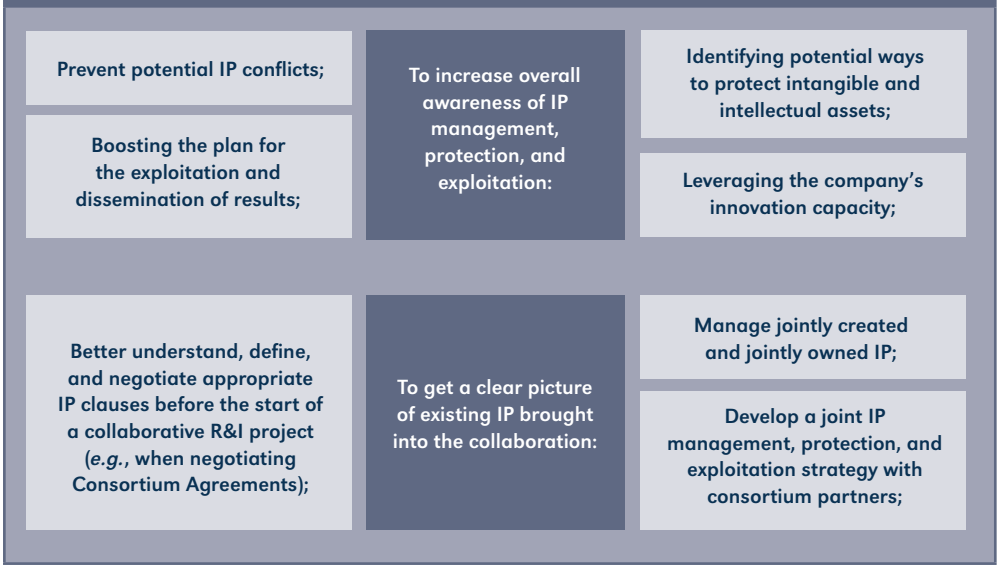
IP pre-diagnosis allows a firm to gain a clear picture of its IP assets, to ensure that it is able to manage its own IP, and develop an effective management plan or strategy to run and grow the business. As a common principle, IP pre-diagnosis is expected to take a holistic view on the SME's IP awareness and practices ("the big picture") and follow a capacity-building approach. The service aims to raise general awareness of IP-related issues and identify areas for improvement with respect to IP strategy development and management.

Horizon IP Scan follows an adapted IP pre-diagnosis approach tailored to the needs and challenges of SMEs involved in collaborative R&I projects. The service is aimed at improving the valorisation of research and innovation results by enabling the smooth cooperation of various project participants with shared and (potentially) jointly developed and jointly exploited intellectual property. Another particularity is the grouping of several SMEs from a given project to receive a joint report and de-briefing session, addressing findings and recommendations regarding collaborative IP management.

Horizon IP Scan is implemented at the early stage of the project implementation and is not only about how an SME survives in a collaborative project and avoids losing their intellectual assets or their competitive position; it is much more about developing new value propositions and enhancing their competitiveness and growth. The Horizon IP Scan service can help SMEs involved in collaborative projects to identify and address the key issues related to strategies and methods for company and collaborative IP management, protection, and exploitation, ensuring these are aligned to the company's own business objectives and those of their collaboration partners—maximising the impact and benefits of the collaboration for all parties involved! The benefits for SMEs are outlined in Figure 2.

The brief analysis reflects on IP expert reports as

Figure 2: Benefits For SMEs



5. The primary objective of Horizon IP Scan is to facilitate the exploitation of jointly developed innovations. For this purpose, the service will support SMEs in defining strategies and appropriate measures to a) give access to existing IP, b) to protect, c) to share, and d) to exploit IP created during research and innovation collaborations. For further information, please visit *www.horizon-ipscan.eu*.

well as the self-assessment questionnaires and satisfaction surveys collected from the SME applicants. It covers the main challenges faced and recommendations made by the experts.

2.2 SME Applicant's Profile

As the Horizon IP Scan service is still in its ramp-up phase, the survey considers service provisions for a first wave of 104 SMEs applying from 28 different European countries. Over 90 percent of the applications have been received from micro-sized (0-9 employees) and small sized (10-49 employees) companies. Health- and biotech-related applications count for 34 percent of total applications, followed by applications from the ICT sector with a share of 26 percent. Together these three technology fields accounted for 60 percent of all service requests. Other technical fields are energy, physics, chemistry, engineering, and materials. Besides the "expected" deep-tech sectors, the Horizon IP Scan service has also proven to be very attractive to SMEs in the field of business consultancy. See Figure 3.

2.3 Main Motivation for SMEs to Apply and Key IP Issues Addressed

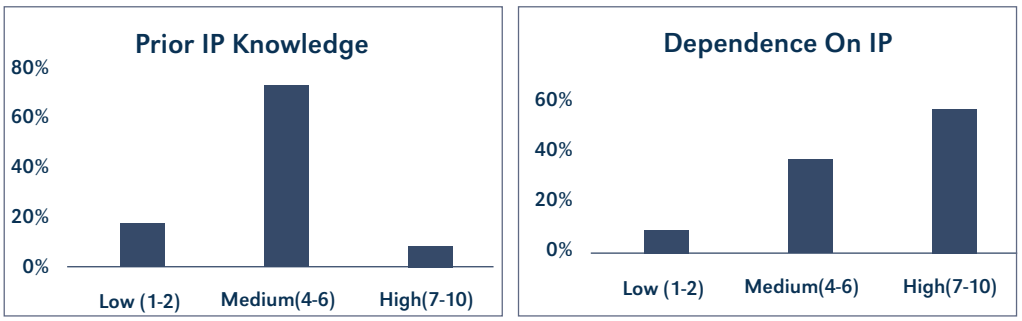
The aspects listed below are not in priority order, but reflect the main motivations to call for the IP advisory service:

- Applicants need support in the identification and management of different types of IP ownership. In joint ownership situations, SMEs would like to have a clear overview on how to agree: (a) the relative contributions to the IP generated; (b) the allocation of IP management responsibilities; and (c) fair and reasonable shares of costs and revenues. SMEs asked for strategic advice regarding the management of access rights beyond the project duration.
- SMEs would like to be aware of the best ways to protect and manage the intellectual assets generated, while understanding the full range of protection options—including secrecy. They want to ensure all the IP rights linked to the project are correctly addressed and that potential risks associated to IP are minimised.
- SME beneficiaries have a high interest in understanding the rationale and benefits of various IP protection strategies, particularly in different territories.
- Applicants request feedback on their existing IP management, decision-making hierarchies, and organisational roadmaps. Additionally, they want to be more informed about IP/knowledge management systems and their use. This includes best practices how to deal with publication strategies in line with the individual interests of the consortium partners.
- Applicants seek to learn more about the relevance of background IP shared among the consortium partners for the project and how it can add value to follow-up IP valorisation strategies and exploitation pathways in accordance with the technology readiness level and the maturity of the sector.
- SME beneficiaries have a high interest in assessing the economic value of IP protection to support commercial activities.

2.4 Main Weaknesses of IP Management Capabilities Identified

- Knowledge and intellectual assets brought into the collaboration ("background") are not well defined or sufficiently protected.
- Responsibilities for IP management are usually not efficiently shared. Segmenting those responsibilities between too many partners usually causes inconvenience and complications.
- There is a lack of knowledge concerning Horizon IP rules (*e.g.*, regarding ownership of the results and obligations regarding IP dissemination, protection, and exploitation).
- Possibilities to shape IP provisions in the CA according to the specificities of the collaborative project (and in line with the overall framework provided by the GA) are not being fully explored.
- Appropriate systems and processes for managing knowledge flows between partners and related

Figure 3: Level Of Intellectual Property Awareness/ Dependence Of Company Activities On IP



mutually agreed strategies for protection and exploitation of project outputs are missing.

- There are no clear guidelines on open science approach (*e.g.*, pre-publication procedures) on the one hand and its relationship with IP protection on the other hand (*e.g.*, the requirement to retain ownership of copyright in scientific publications).
- The full scope of IP protection measures and strategies is not grasped (*e.g.*, usually only patent filing is foreseen). The strategic use of other protection measures is rarely considered; for example, formal IP rights, trade secrets, or contractual agreements.
- The importance of confidentiality is not well understood. The partners do not always pay sufficient attention to maintaining the secrecy of important data or confidential information when dealing with third parties.
- A thorough understanding of the different types of IP and the rationale for their use is lacking, including a lack of understanding of the value of IP management tools and databases (*i.e.*, Espacenet, TM view, etc.).
- Beneficiaries have a misperception of the open innovation concept. SMEs tend to consider it as a knowledge leakage with a detrimental effect on their business. Potential business opportunities offered through collaborative innovation processes are not sufficiently exploited.

3. Conclusions

The authors fully underline—from their own experience and studies—the results of a recent EC study[6] considering the question whether IP is an enabler or a barrier to collaborative R&I projects. This article clearly highlights that intangible and intellectual assets in many forms are key enablers of collaboration. SMEs seek to share and gain access to different forms of IP through collaboration in order to pursue their business goals. While the forms of IP may differ, there is no evidence that it acts as a barrier to collaboration.

First insights gained from the Horizon IP Scan service delivery demonstrate a lack of capabilities, best practices, and adequate tools to leverage the benefits of collaborative IP management mechanisms.

Major deficits are linked to poor valorisation strategies specifically within the collaborative setting, resulting in missed opportunities with regard to successful and impactful exploitation of project outcomes.

However, SMEs show an increasing interest in gaining a better understanding of using IP management strategies and practices within R&I collaborations to help their businesses grow and remain competitive. ■

Available at Social Science Research Network (SSRN): *https://ssrn.com/abstract=4120501*

6. EC Study, 2021: Building stronger intellectual property strategy capabilities; Supporting SMEs to succeed with open innovation.

Licensing And Intellectual Property Organizations Meetings

For more information on LESI Meetings, go to *www.lesi.org*

2022

October 17-19
2022 LES USA & Canada Annual Meeting
San Francisco, California USA

2023

April 30-May 2
LES International Annual Conference
Montreal

Notice: Meetings are a hybrid mix of in-person and online in response to the COVID-19 Global Health Crisis. See the website for webinars and online education courses.

International Past-Presidents

1974	J. Gay	1990	J. Portier	2006	P. Chrocziel
1975	M. Finnegan	1991	F. Noetinger	2007	R. Grudziecki
1976	B. Hedberg	1992	A. Mifune	2008	C. Fukuda
1977	M. Okano	1993	L. Evans	2009	A. Liberman
1978	D. Smith	1994	O. Axster	2010	P. O'Reilley
1979	J. Gaudin	1995	N. Jacobs	2011	A. Lewis
1980	J. Stonier	1996	J. Brown	2012	J. Malackowski
1981	S. Heijn	1997	S. Layton Jr.	2013	K. Nachtrab
1982	W. Poms	1998	R. DeBoos	2014	Y. Chua
1983	H. Hodding	1999	P. Mandros	2015	A. Michel
1984	F. Pombo	2000	H. Goddar	2016	J. Sobieraj
1985	M. Ariga	2001	E. Shalloway	2017	P. Bunye
1986	L. Mackey	2002	T. Sueur	2018	P. Hess
1987	P. Hug	2003	M. Jager	2019	F. Painchaud
1988	D. Ryan	2004	J. Gulliksson	2020	F. Nicolson
1989	K. Payne	2005	W. Manfroy	2021	A. Yap
				2022	J. Paul

Dana Robert Colarulli, LESI Executive Director
Tel: +(202) 841-0276 E-mail: dana@lesi.org

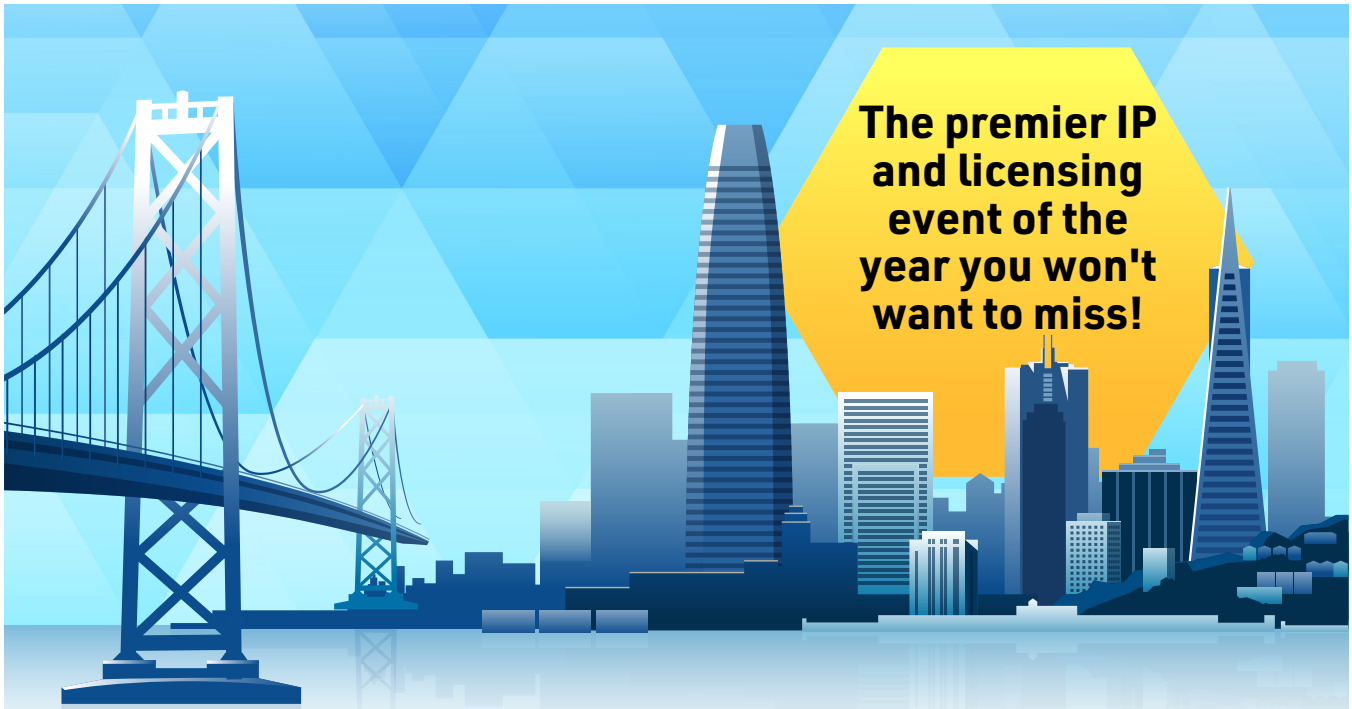
David Drews, Editor
9320 Chesapeake Drive, Suite 110, San Diego, CA 92123
Tel: +1-858-603-8825 E-mail: editor@lesi.org

Carla J. Blackman & Anita Morselli-Zakrajsek
Design Interface Inc.—Design & production

LESI Committee Leadership — *www.lesi.org/committeeleaders*

Industry	Chairs	Vice Chairs
Consumer Products	Matteo Sabattini Gary Ma	Jens Matthes Guido Quiram
EEMC	Ningling Wang Dallas Wilkinson	Ia Modin
High Tech	Keith Lutsch Hemang Shah	John Carney Lakshika Joshi Taruna Gupta
IUGT	Orakanoke Phanraksa Anna Saraceno Peter Ling	Cairan He Shiva Loccisano
Life Sciences	Richa Pandey Joanne van Harmelen	
Professional		
Copyright Licensing	Johan Du Preez George Hwang	Yuko Tsuda
Dispute Resolution	Tilman Müller-Stoy	
Patent & Tech Licensing	Madelein Kleyn	Qinghong Xu Mihaela Bojin Claudia Tap
Trademarks, Designs and Merchandising	Simon Chalkley	Charmaine Koo Lionel Tan Javier Fernández-Lasquetty Quintana Barbara Berdou
IP Valuation	André Gorius	Anke Nestler Andrea Vestita Jon Ander Gómez Martha Laura López Orué Mike Pellegrino Véronique Blum Fernando Da Cruz Vasconcellos
Women in Licensing	Pam Cox	Eszter Szakács
Regional		
Americas	Paula Mena Barreto Jeff Whittle	Renzo Scavia Hilton Sue Mariana Gonzalez Cédric Sikandar
Asia-Pacific	Bienvenido Marquez Duncan Ferguson	Chikako Hashimoto Rosita Li Chalermpol Tuchinda
European	Alexander Haertel	
LESI Management Committees		
Audit	Jim Sobieraj	
Awards	Patricia Bunye	Madelein Kleyn
Communications	Jean-Christophe Troussel	Bruna Rego Lins Shayne Phillips
Education	Natalie Raffoul Martin Schneider	Thomas Adocker Danie Dohmen Sung-Pil Hwang Bruna Rego Lins
External Relations	Patricia Bunye Arnaud Michel François Painchaud	
Investment	Jim Sobieraj	
IP Maintenance	Janet Pioli Rinaldo Plebani	
Legal	Emmanuel Gougé Russell Levine	
Long-Range Planning		
Meetings	Thomas Adocker Laura MacDonald Alexander Haertel	Sue Muggleston Bob Held Georgina Busku
Membership	Hector Chagoya Cortes Alexander Cizek Guillermo Criado Yorikatsu Hohokabe David Swain	
Nominations	Audrey Yap	
Publications	Bruno Vandermeulen	
YMC	David Swain	
Ad Hoc Committees		
Global Technology Impact Forum	Mark Wilson Omer Hiziroglu	
LESI Innovation Trends (LIT) Task Force	André Gorius Tanja Sovic Bayani Loste	

Notes:



LES 2022 Annual Meeting

COMMERCIALIZING INNOVATION

LICENSING EXECUTIVES SOCIETY USA & CANADA

OCTOBER 16–19, 2022

San Francisco Marriott Marquis

For the first time since 2019, join us in-person for the LES 2022 Annual Meeting! The event will feature distinguished keynote speakers, fireside chats, 30+ sessions, numerous networking opportunities to connect with colleagues and much more!

EARLY BIRD PRICING

LES/LESI Members: $1,395

Register by June 30, 2022 and save $200!

REGISTER NOW