DEEP TECH TO MARKET

THOMAS BEREUTER AND ILJA RUDYK

High growth? High impact? In a book about how today's winners are lining up their IP, Thomas Bereuter and Ilja Rudyk report on four EPO case studies that highlight the IP experiences and insights gained through adapting early-stage, high-risk technologies for everyday use

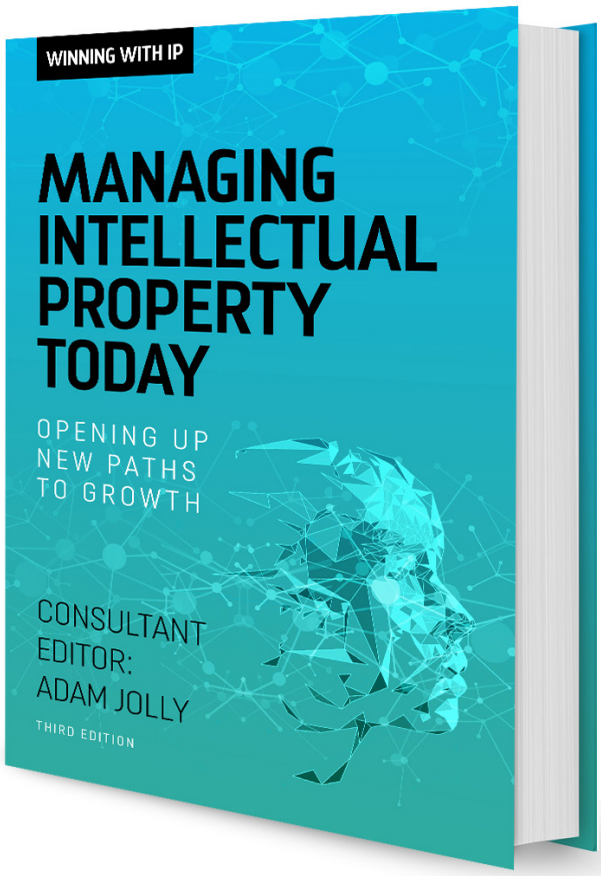
Giving e-bikes the brakes to match their speed. Connecting wind turbines to the internet of things. Creating more freedom to design for 3D printers. Taking augmented reality into the operating theatre.

All involve the adaptation of deep tech. It's a daunting task to turn such complex breakthroughs into applications that can be used at scale. Most early-stage technical solutions can't simply be licensed or brought to market. Intensive work is required in terms of their design, engineering and approval. Supply chains have to be created, entry barriers to the market overcome and regulatory tests passed.

Spin-outs of research organisations lay the groundwork for commercialising such early-stage, high-risk technologies. They create a clear framework for developing intellectual property as a technology advances or for following up a unique sales proposition in a market that is yet to be developed. Often run by ambitious postgraduates, they combine an understanding of the underlying science with the adoption of an industrial and commercial mindset, often facilitated by partners.

For seed investors or funders, a spin-out's IP package acts as a main guarantee for taking the technology to a stage where it can appeal to a more mainstream financial audience without the risk of copycats taking over.

In a new series of case studies from the European Patent Office, four ventures in deep tech have shared the challenges they have overcome in reaching the market and highlighted the lessons they have learnt when adapting research for use in real life.



NOVARO PUBLISHING

Newsdesk Global
Independent Book Publishers

Drawing on the knowledge and experience of 24 top-level IP performers, including the academy of the European Patent Office, this book discusses how IP is opening up new paths to growth, highlighting the impact of transformative technologies, such as artificial intelligence, the metaverse, Industry 4.0, net zero and personalized medicine. It gives a series of lessons and insights into how today's winners are managing their IP to create a powerful and flexible system for breaking into new markets, trading at a premium and building up future value.

Further details: www.novaropublishing.com/managing-intellectual-property-today/

The rewards for resolving such challenges can be both high impact and high growth. Most accidents on e-bikes happen when braking. In an energy crisis, it is best to minimise the damage that ice and lightning cause to wind turbines. 3D printing took its time to embrace alternative materials and widen its application range to everyone. An ageing society benefits if knee replacements don't require follow-up surgery to put them right.

Smarter by design and co-operation

Four million Europeans are now buying e-bikes a year, even if safety remains a concern. Most accidents happen when braking. What if anti-locking technology could be transferred from motor sports? This was the inspiration for a spin-out from one of Europe's largest technical schools, Polimi (Politechnico di Milano), in collaboration with an incubator of deep-tech companies, e-Novia.

Their common goal was to use the next generation of artificial intelligence to create an open system for the design of braking systems that could be fitted inside the frame of each manufacturer's e-bike. Riders would then experience better traction and better balance when caught out by the speed or the weight of their e-bike.

It's an ambitious and complex structure for upgrading how e-bikes are made, which relies on IP that is secure enough to break into the market and flexible enough for partnerships with manufacturers. Polimi secured the rights to the anti-locking technology and licensed them to the spin-out it created with e-Novia in 2015, Blubrake, whose first product appeared in 2021 after six years of further research and development.

Unusually, Blubrake took its time to file any patents of its own, initially preferring to operate under confidentiality. Its policy is to protect technology for close-to-market applications and manage its IP in close step with its technology road map.

Blubrake differentiates itself by co-designing solutions with e-bike manufacturers, as opposed to the proprietary models that its competitors offer. As a supplier, it would risk losing the value of such partnerships without the close management of the IP it has developed. On the basis of this balanced model, Blubrake raised €5.2m in 2021 to fund the next stage of its growth.

From platform to focus and exit

An early exploration by five entrepreneurial postgraduates into the potential for adopting optical sensors as a platform technology for industries such as rail, space and medical led to the creation of a more tightly focused spin-out, fos4X, in 2012.

One of the advantages of operating under the umbrella of a university such as TUM (Technical University of Munich) is that it has the reach to generate early feedback about where demand really lies. In a response to a press release about the progress of their work, some of Germany's leading industrial players identified wind turbines as the most pressing challenge that optical sensors could solve.

Fos4X switched its focus to finding a better solution to managing the millions of load switches that a wind turbine will experience in its lifetime. The electrical sensors that were being used struggled to respond in adverse conditions, such as lightning and ice. Fos4X's combination of light sensors and smart materials promised more resilience and accuracy.

The founders were well prepared to break into the market: TUM encourages its postgraduates to think about the potential for starting a company during their research and treats patents as a currency of equal value to publications. The supervising professor is even a European patent attorney and has experience with a total of six spin-outs.

On this basis, fos4X was able to build a case for four years of funding before making its first significant sale. Although it started under an exclusive licence from TUM, it exercised an option to buy all related IP in 2018.

By 2020, when fos4X was acquired by Polytech, a Danish manufacturer of products and services for the wind industry, its sales had reached €11 million and it had a portfolio of 200 patents in 80 patent families. Its capabilities in IP and innovation were one of its main attractions as an

acquisition target: the fos4X managers responsible are now occupying similar roles for all of Polytech.

Usage rights for multiple innovation paths

Two spin-outs are being scaled up within a cluster of 3D printing companies around the Technical University of Vienna. The origin of these two ventures lies in a series of questions that Professor Jürgen Stampfl started asking in 3D printing's early days as a technology in the 2000s. In particular, could its use be extended more creatively to other materials, notably ceramics and then industrial polymers?

First, he had to team up with colleagues in chemistry to develop the materials and then find an industrial partner to further explore machinery for a novel use of 3D. He formed a partnership with Ivoclar, a dental specialist, which continues to flourish today.

Together, they have created 20 patent families which they jointly own. Ivoclar has kept all the rights for dental applications, covers the cost of any research not publicly funded and pays the IP bills. TU Vienna retains all the other usage rights and shares the royalties with Ivoclar.

The two spin-outs that have evolved from this platform are partly managed by postgraduates and Professor Stampfl. Lithoz, which prints 3D ceramics for biomedical and industrial applications, now employs 110 people. A more recent spin-out, Cubicure, is working on innovations in 3D printing for industrial polymers. Each spin-out operates under a separate set of licences for materials and machines from TU Vienna, although both have started to file their own patents, continuing the cycle of innovation that began at the university.

"It's appealing for our students to have the chance to apply research in an industrial setting," says Professor Stampfl. "Such partnerships depend on recognising the value of an industrial mindset. You have to step back from being an innovator and recognise that it's not easy to raise money, manage safety or hire people. So in the beginning, it's about innovation. Later on, it's about implementation and operation."

"We want to give our industrial partners all the rights they require and retain all the other rights, so we don't cut off future development and we can work with other partners."

Disruption in the operating theatre

Letting surgeons track the progress of their operations on their mobiles: it's an approach that is about to take hip and knee replacements to a new level of reliability. Ten years ago, however, few in medical imaging were giving much thought to the potential of augmented reality (AR). Operating theatres remained their own safely contained, expensively fitted world.

An entrepreneurial professor at the University of Coimbra in Portugal, João Barreto, took a more disruptive view. He and a research student, Rui Melo, started investigating image processing for keyhole surgery.

What if you could remove any distortions in the video feeds to give surgeons a more accurate view and then overlay clinical information on their screens? Through AR, they realised they could create a navigation system for surgeons that bypassed much of the existing infrastructure on which operating theatres relied.

At the time, such thinking was seen by established companies as too early and too high risk to license. So in 2013, a spin-out, Perceive3D (P3D), was created with seed funding from a public agency, Portugal Ventures. A clear line was drawn with the university regarding IP. P3D gained an exclusive licence to the technology, assumed responsibility for all IP costs and agreed to pay royalties to a set limit.

In markets as competitive as medical imaging, patents often represent the best chance of breaking in. As P3D was developing a technology from scratch, its policy was to "patent the roots not the branches". Its aim was to cover a broader scope of applications with fewer patents.

For now, P3D's focus is on the market for keyhole and open surgery. Its IP allows it to pursue a twin-track business model, licensing its technology in some fields and developing applications in its own niches. In 2022, it released its navigation system for hip surgery in partnership with a

leading implant manufacturer. In parallel, it is launching its own branded product for knees.

Unusually, the founders have involved themselves in drafting the patent claims, both to give themselves room to diversify and to retain any future value for investors. Ultimately, their vision is to bring AR to all of surgery and open up the potential for many more applications.

Pointers for high-growth IP

Each of these case studies draws on the insights and experiences of multiple actors involved in adapting research for real-world uses. Taken together, they form a series of IP pointers that matter most along the path to high growth. These options and lessons emerge in full in each of the EPO's case studies. Here are some of the highlights.

- Put ventures in the hands of ambitious postgraduates and create an ecosystem of support to get those ventures off the ground.
- Encourage researchers to treat publications and patents as twin currencies of comparable value.
- When developing a platform technology from scratch, retain the core IP to create the potential for further spin-outs.
- When commercialising an early-stage technology, first operate under confidentiality, then line up the IP in close-to-market applications.
- Licensing works well when a technology is ready for the market; spin-outs are a better option when more proof and advancement is required.
- Patents create a sustainable point of entry to established markets dominated by major players.
- Create a clear IP framework between universities, research partners and spin-outs that allows for an ongoing partnership and a clear regulation of ownership and use rights for investors.
- Recognise the balance between innovation and implementation. Universities work in three-year cycles exploring the new; industrial partners accumulate decades of experience and practical know-how.
- IP is instrumental to the financial fate of a spin-out at two particular points: when lining up a continuous stream of investment, particularly in the early stages, and when determining an exit value in the event of a trade sale or flotation.
- To ingrain an active sense of IP as an asset, encourage spin-outs to draft their own patent descriptions and brainstorm about potential claims, before having them revised and completed professionally.
- An active IP culture encourages the early disclosure of inventions and forestalls the risk of losing novelty and inventive steps to incremental publications and other disclosures.
- Design platform IP to allow the option of pursuing two business models. You can then license your tech to different industries while exploring your own niche applications.
- Keep IP protection in step with your technology road map, so you develop the ability to keep capturing new sources of innovation and value.

For the full versions of the case studies that the EPO has published about high-growth, high-impact technology transfer, see: epo.org/ case-studies.

Thomas Bereuter is innovation support programme area manager at the European Patent Academy of the European Patent Office in Munich. **Ilja Rudyk** is senior economist at the European Patent Office in Munich.