

Creating a virtuous circle in technology transfer -The case of KU Leuven

A report for the Medical University of Warsaw



SCIENCE|BUSINESS

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This report constitutes general guidelines on the technology transfer process, based on KU Leuven's experience, that could be easily implemented in the development strategy of Medical University of Warsaw. It was commissioned by the Medical University of Warsaw as a contribution to the EU Project BASTION (From Basic to Translational Research in Oncology), a multidisciplinary science project to extend the research potential of the university and reduce the time from scientific discovery to clinical application.

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I. Overview

“A good technology transfer office is an essential part of a good university. Today, you can’t do without one.”

—KU Leuven Rector Rik Torfs

Leading research universities around the world are becoming powerful engines of innovation. The most successful institutions generate tens or even hundreds of millions of euros in annual income from collaboration with industry, patents, licensing and spin-offs. Much of that income is channelled back to researchers creating a virtuous circle for the university. At the same time, the universities that succeed at technology transfer contribute tangible benefits to society by stimulating innovation and economic growth.

Building a successful technology transfer operation, however, requires significant time and investment. Many universities have rushed to create technology transfer offices (TTOs) without the proper structures, funding or expertise. Disappointed, after four or five years, they give up before the benefits start to flow.

KU Leuven’s technology transfer office, Leuven Research and Development (LRD), founded in 1972, is one of Europe’s oldest and most successful TTOs and a leader in translational research. In 2014, LRD generated total revenues of €204 million for the university, capping more than a decade of sharply increasing returns. Its success is linked to best practice, and also to the strong conviction of the university leadership that technology transfer is a core function of a research university. This paper, based on interviews with senior university officials and LRD management, technology transfer professionals and a medical technology entrepreneur, highlights the lessons learned by KU Leuven over more than four decades and offers guidelines for successfully launching a university TTO today.

II. Best practice - Guidelines for setting up a TTO

1. Engagement

Start at the top. University leaders should send a signal that they are embracing technology transfer as a core role of the institution and engage with academics to build consensus.

2. Autonomy

Structure the TTO as an autonomous unit of the university with the power to make legal contracts.

3. Funding

Dedicate sufficient budget for at least three full-time equivalent professionals to set up and launch the TTO.

4. Expertise

Hire professionals who understand industry and have experience in technology transfer. They should be facilitators and dealmakers who have experience bridging the university-industry divide.

5. Incentives

Design incentives that channel the rewards of engaging with industry back to university researchers.

6. Industry collaboration

Focus first on industry collaboration to learn how it works. Don't rush to develop spin-outs without first learning how to work with industry.

7. Service mentality

Provide excellent service to academics in every aspect of technology transfer.

8. Catalyst role

Actively engage with professors and industry. And connect researchers within the university. Innovate on the job. Avoid the role of rubber-stamping projects.

III. The Leuven Research and Development story—a model of successful technology transfer

“One out of every three euros of KU Leuven’s total research funding is provided for by the tech transfer office.”

- LRD General Manager Paul Van Dun

When KU Leuven launched its technology transfer office, Leuven Research and Development (LRD) in 1972, it was rare to see European academics collaborating with industry, and KU Leuven was no exception. Its rector and a handful of professors with experience in industry had a vision of the benefits a TTO could bring the university, and led the way.

In setting up a technology transfer office, it’s important to do two things, says KU Leuven Rector Rik Torfs: “You need to convince researchers there is nothing wrong in taking in their own hands the development of technology. That’s one element. And you have to maintain unity throughout the university so everyone is convinced of the fact that technology transfer is positive for the university as a whole.”

That is a delicate balancing act, says Torfs, “because the university is a house with many rooms and everyone has to feel at home. You have to do both things: Stimulate those who are in a position to do technology transfer and also reassure everybody that this will enrich and not impoverish the university.”

KU Leuven’s leaders struck that balance from the beginning, creating a strong foundation for LRD’s growth and success. Today, KU Leuven ranks among the world’s most productive universities in technology transfer. Between 2005 and 2014, industry contracts, licensing and patents generated nearly €1.4 billion in

revenue for the university. The university also has nurtured and taken a stake in 105 spin-outs, that raised €675 million in external capital over the past decade, including seven initial public offerings. Eighty-seven spin-outs are still active employing some 4,200 people.

Forty years on, KU Leuven’s belief in the importance of technology transfer has become mainstream: Governments around the world are championing innovation and the development of new technologies to address societal challenges as a top policy priority. “Now it is generally recognised that a university has not two missions but three—education, research and transfer of knowledge,” says Torfs. The transfer of knowledge is a social task, making sure that what comes out of the university is of benefit to society.

Technology transfer is also increasingly important to universities as the collaboration of science and industry accelerates breakthroughs in fields such as nanotechnology, material science, energy and translational medicine. Drugs invented in Leuven and now on the pharmaceutical market include tPA (Genentech), Jetrea (Thrombogenics), and Tenofovir (Gilead). “It is imperative to have a technology transfer office,” says Torfs. “If you don’t do that, it may be that fundamental research (in some fields) won’t function well anymore...and the university risks isolation,” says Torfs.

At the core of LRD's success is the creation of a well-funded, expertly staffed organisation, with its own financial service and its own legal service, dedicated to serving the academic community. "We stand with one leg in the market and one in academia. You can't run a TTO the way you run a faculty or department. So it's a strange thing in a university. That's one thing KU Leuven understood early on," says LRD General Manager Paul Van Dun. LRD has statutory autonomy, as does the University of Leuven Hospital. "That's very important for people in industry," adds Van Dun. "There's consistency and continuity. We can stick to what we say."

Maintaining a balance between the three goals of the university is key, says Torfs. Of course we are proud about our LRD division and we want to foster it ... There is of course a risk of neglecting fundamental research. There should be no contradiction. Some people say it should be A or B but that's not the case. It's a matter of a good equilibrium."

10 steps to a successful TTO launch:

There is no one-size-fits-all model for structuring and growing a successful TTO. Each university must adapt best practice to its own culture and legal structures, say technology transfer experts at KU Leuven. By studying successful models, a university can begin to shape an approach that is best suited to its academic community, research strengths and history.

The operating principles and strategies listed below have guided the creation of LRD's structure and technology transfer practice, contributing significantly to its success.

1. Start at the top with strong commitment by university leaders

The cornerstone of a successful university TTO is the strong personal endorsement and support of its rector or president. Academics typically are not inclined to collaborate with industry and promoting technology transfer involves a significant change of culture as well as a reorientation of university priorities and funding. University leaders must signal that the role of the university is broadening, address academics scepticism and actively win buy-in before a new TTO is launched.

A newly created TTO is unlikely to succeed without a committed rector, says Van Dun. "No matter how good the research, how much money you have, no matter how much industry is interested, if you do not have full endorsement from the top of the university, creating a successful TTO will be very difficult," he says. "And I really mean really difficult." Van Dun traces the success of LRD to a series of rectors who had successfully worked with industry and believed technology transfer should become a core activity of the university.

Universities without any technology transfer experience will likely face opposition to the notion of launching a TTO. How should its leadership respond? "First of all never close a path when there is even a small chance [there] can be some agreement for the future. Remain open minded," advises Torfs. "Second, create trust—first of all within [the] institution so that you don't alienate a percentage of the university while trying to foster technology transfer. And third, don't be afraid. You need courage for the first and excellent communication for the second."

Many professors and researchers underestimate the potential use of their research simply because they don't think about technology transfer, Torfs says. University leaders can promote a shift in behaviour by helping academics understand that a technology transfer office will help them reap the benefits of their own research efforts without losing it or selling it to big companies or entrepreneurs for almost nothing. "That's indeed something [that] should be fostered by helping academics valorise their breakthroughs," he says.

Once the TTO is established, it should seek out eminent professors who have experience collaborating with industry and create a couple of initial success stories, which will help establish credibility, understanding, and interest among researchers. In 1972, LRD set to work with a cadre of distinguished KU Leuven professors who were leaders in their fields. Together with the strong backing of university management, the engagement of prominent, highly respected professors and their initial success stories helped reduce academics' scepticism and galvanise interest in technology transfer. "Make sure a couple of well-respected professors set an example – it doesn't have to be a huge financial success," says Van Dun.

Over the course of time, KU Leuven's leaders have intervened repeatedly to evolve its structure and funding. During the 1990s, as KU Leuven's revenue stream from technology transfer started to rise significantly, university management took the opportunity to reinforce the LRD's autonomy and funding. "For this institution, tech transfer is not only something that has been going on for more than 40 years, it is really embedded in this institution," says Van Dun.

Reflecting the importance of technology transfer at KU Leuven, university management recently revamped its categories for evaluating and funding research projects across all fields, from a system with many categories to a simple three-tiered approach: fundamental research, applied research (where basic research and possible applications meet) and the valorisation of research. "People can be in only one of those three levels. It's much simpler than in the past," says Torfs. "It's very helpful."

Previously, projects were judged on their size and a complicated patchwork of additional conditions. The underlying idea of the new structure is that it is based on the stage of research, says Torfs, from basic research to valorisation with an intermediate level. "That helps people to see more clearly what they are doing."

2. Dedicate sufficient funding

Technology transfer can generate an enviable stream of income for a university and increase its financial autonomy. But getting to that stage requires significant investment and time. A newly founded university TTO may not reach breakeven for 8-12 years, Van Dun says, and some may take even longer.

Even if a TTO is lucky enough to sign several licensing contracts, for example, licences typically take years to deliver significant income. "Our most successful licenses in terms of revenues today, are based on inventions [in the] 1990s," Van Dun says. "You might have licensing fee or milestone payment up front. But the big money kicks in when the product is on the market." Of course, the delay generating real returns can be particularly long in the case of translational medicine.

As a result, a university committed to developing a TTO must dedicate part of its budget to the task. Inevitably, that means channelling funds away from research and education to tech transfer—a very difficult debate at a time when budgets are under pressure. “You cannot do tech transfer and hope that industry brings in the money,” Van Dun warns. “That’s not how it works. It has never worked that way. We are fortunate here that after 40 years...the operation is self-supporting.”

During the first 10 years of LRD’s operation, KU Leuven granted it a budget to hire several seasoned technology transfer professionals and set up an autonomous operation. “If we had to survive with a percentage of the income we produced back then, we would not have had enough of a working budget,” says Van Dun.

Insufficient funding will undercut the initial success of a TTO as qualified business development talent is in high demand and expensive. At the same time, a small staff will be limited in the number of researchers it can ably serve, risking a mismatch with high expectations. A TTO can take a passive approach or proactive approach. It can wait for principal investigators to come to the TTO with an invention disclosure or mandatory legal intervention. Or it can seek out researchers and help them increase the value of their ideas or invention in the market, considering different valorisation options. In the proactive approach, external support can help optimise the process, says De Wachter.

Tempting as it may be, universities should avoid relying solely on government subsidies as a main source of financing a TTO. Government funding is unlikely to be sufficient and can fluctuate or dry up completely, leaving a young TTO in the lurch. Over the years, LRD has received

government subsidies but they were simply added to the working budget of the university, which remained constant. So government funding allowed LRD to expand its staff and services at a faster clip.

A second disadvantage of relying on government funding entirely is the loss of independence. “First the university must make structural investments to set up a TTO,” says Torfs. “You also need autonomy from the government. That’s often forgotten. Governments should leave the university alone when they want to invest in tech transfer.” Governments may seek to stimulate tech transfer—but their efforts are often insufficient. It’s also better for the university board to provide sufficient funding and autonomy to the TTO to develop technology transfer itself—in the way it deems best, KU Leuven experts say.

Many universities make the mistake of expecting technology transfer to quickly become self-funding, paving the way for disappointment. “That’s where a lot of tech transfer programmes fail,” Van Dun cautions. Rectors and governments that invest in TTOs want to see results within their period in elected office, which typically is 4-5 years. “A new TTO cannot have significant results in 4-5 years unless you already have a lot of things on the plate just ready to sign off,” Van Dun says.

A case in point: Several Central European universities which launched TTOs amid strong enthusiasm several years ago now are suffering from unrealistic expectations and waning support, Van Dun says. University managers are beginning to doubt the TTO mission and wonder whether they hired the right people. “That’s not fair,” says Van Dun. “You cannot expect results in 4-5 years.”

Annual revenues from technology transfer at KU Leuven first reached €20 million in the mid-1990s, more than 20 years after LRD's founding. Today, the path may be shorter, says Van Dun, but much will depend on the engagement of university management and researchers, and the expertise offered by the TTO staff.

Today, revenues generated by LRD enable KU Leuven to be less dependent than other Flemish universities on government funding—another advantage. “It gives us more autonomy vis-à-vis the government and it stimulates the professors,” says Torfs, “because for them, technology transfer is useful and profitable.”

3. Ensure autonomy and flexibility

Many universities regard technology transfer as an administrative function—an office where academics must go to “get permission” to work with industry, Van Dun says. LRD is successful in part because its aim from the beginning was to help professors collaborate with industry—and it was given the autonomy to bridge two very different worlds.

“We stand with one leg in market and one in academia. You cannot run a TTO the same way you run a faculty or department,” explains Van Dun. “A TTO is a strange element in the university environment. That's something this university understood early on. We have two entities with statutory autonomy – LRD and the university hospital. “The university said rightly, running a hospital is different than running a university. The same goes for tech transfer. We operate [in a] very autonomous way.”

LRD is a one-stop shop covering every aspect of commercialisation and industry collaboration as well as financial, human resources and legal services. “That means

everything is done under one roof here,” says Van Dun. LRD's autonomy helps in collaborating efficiently with industry. “If a company that had contact with us six years ago and contact today, they know we operate in [a] consistent way. There's continuity and consistency, which is very important. We can stick to what we say,” says Van Dun.

LRD's independence allowed it flexibility to adapt to a changing external environment and opportunities. “If I would have made a job description of my own job 10 years ago, probably only 30 percent would still be valid today. You see so many opportunities, and if the TTO is autonomous, you have the ability to jump on them. We've set up several schemes here in [the] university, several joint structures with other parties which were not in our job description. But when we saw the opportunity, we said we have to do something.”

Rigid structures above all can undermine a TTO's ability to best serve academics. “That's in my eyes the difference between a successful and less successful tech transfer office. As soon as you reduce your job to rubber stamping—namely the TTO is the office that has to check agreements with industry, and get a rubber stamp—then you reduce it to a controlling function. And that's exactly the place where you do not want to be as a TTO,” says Van Dun.

“As soon as you are perceived by research community as an administrative office, you might as well the close the doors because you will not be able to do the job that way,” he adds.

Granting a university TTO legal and operational autonomy could create controversy. KU Leuven addressed that issue by ensuring that LRD's operations,

however independent, came under the umbrella of one university, says Torfs. “It doesn’t create conflict as long as it remains clear that LRD follow the global values of the university. The same is true for the hospital.”

4. Create a clear mission to serve

LRD was founded with a strong service culture, dedicated to helping researchers advance their work and reap benefits from it. That focus has played a key role in helping win over university researchers and promoting technology transfer at KU Leuven. “We give great service to the academics,” says Van Dun. “We are a service unit—the only reason we exist is because professors want to work with us.”

KU Leuven’s professors see the LRD as a place to go for help connecting with industry on every level and help advising them on the best way to do it. “They like to come to use because they know we can get things done,” says Van Dun. “We will help them quickly and facilitate their research. They look at LRD in a totally different way.”

In addition to technology transfer services, LRD helps professors with many tasks that do not directly produce income for the university but help academics advance their research. For example, LRD staff process 800 material transfer agreements a year which are legally required if a KU Leuven professor wants to use a cell strain or software developed in another university for an experiment.

“We have one person working from morning to evening dealing with only material transfer agreements. For us, it is very important to process them swiftly because it is very important to the professors. We don’t make a single penny

with it. That’s why we decided to offer the service—so they come to us. It helps to get them in our office and then we learn more about the work they are doing.

“Most researchers no matter how much they like us will not pick up [the] phone and tell us I am working on a certain topic. By being in regular contact with academics for a variety of things, LRD receives an automatic flow of vital information that increases their efficiency. It means we have early view and buy-in on what they [are] doing. [It’s an] important signalling function,” says Van Dun.

For Van Dun, one word sums up the role of a university TTO: “We are a facilitators. That is the culture of a successful TTO. We are the ones professors can go to. We are the ones that go to them to help them get the research to market. We make sure the benefits they get from bringing their research to the market can be reinvested in their research. That closes the loop.”

LRD staff also act as catalysts helping connect different KU Leuven departments with each other. In one instance, Van Dun’s team connected a KU Leuven biologist with the head of the intensive care unit of the university hospital after realising that neither one knew of the other’s work, but both were working on complementary research.

“We brought them into contact and they developed a joint research programme. For me that is also a way of tech transfer. Don’t forget, every university divided and subdivided in faculties and departments. Especially if you are sizeable university like ours – not all professors know each other let alone what research [is] going on. Tech transfer is one of [the] few functions within a university where you have overview on everything going on in the university.

“If we can connect the dots over barriers of departments that’s usually something quite liked by the professors because it advances their research. Again, in [the] short term, when doing so, probably this is not bringing in significant commercialisation opportunity. But it helps professors and maybe the outcome of their research is good and then there may be something that could be commercialised.

5. Offer incentives - A winning formula for academics

A clear factor in the success of LRD is the strong incentive KU Leuven created for researchers to engage in technology transfer. Eighty-three percent of the revenues generated by licensing, patents, collaborations or spin-outs flows back to KU Leuven’s academics to invest as they see fit in research-related expenses, including lab equipment, lab technicians or a new computer.

“You need to have an incentive for researchers to engage in technology transfer, especially in universities that have no tradition working with industry,” says Van Dun. In the case of KU Leuven, the funds are held in accounts owned by the university but the professor holds the authority for investment. “That is a very, very motivating factor,” he adds.

“It makes a huge psychological difference,” agrees former LRD Innovation & Investment Manager Hannes De Wachter, now managing partner of 3helix.be, an international technology transfer consultancy and business development company. “Consider the university as an umbrella with many virtual companies managed by its principal investigators (PI) in collaboration with the TTO. The PI is the virtual CEO of this company.

He is able to manage his own R&D funds, increase research staff, expand infrastructure and even pay himself a bonus.”

KU Leuven itself receives 17 percent of technology transfer revenues to cover overheads, half of which are channelled back to fund LRD’s operations.

At the same time, the LRD funding mechanism empowers professors to demand excellent service from LRD. In the mind of the professor, the revenues are generated on the basis of their research results. “That means, if we take part of the turnover, because it is our working budget, every single professor will look at us and say, “You get part of my money, make sure you help me because I’m paying you,”” says Van Dun.

“That’s an atmosphere I like. It keeps our people sharp—we cannot offer poor service to the professors because immediately there would be a broad level of complaint. It prevents our people from becoming, some kind of lazy civil servant who thinks he or she has a job for life,” he adds. “The professors really feel they are the ones who should be served.”

6. Hire experts with knowledge of industry and academia

Finding the right people to launch a university TTO can make the difference between success and failure. “Expertise is absolutely critical, especially when you are starting out,” says Van Dun. Above all, a TTO needs people who understand both industry and academia and who can talk to both professors and managers. Experienced, senior-level staff establishes a TTO’s credibility.

“You want researchers to develop an automatic reflex to contact the TTO as soon as they have something to commercialise,” says De Wachter. That reflex grows from trust.

By contrast, staffing a new TTO with people who have no experience in technology transfer is likely to prove disastrous. The first interactions between the new TTO and professors will establish its reputation on campus and negative feedback will severely undercut trust and credibility, says Van Dun. “Professors who dare to take the first step and explore tech transfer will never come back if they are served by people who are not capable. And they will spread the word that the advice the TTO gave was bad—that they drafted a bad contract or said things that were not true,” he says. “When you start out, you only have one chance.”

If trust is missing, researchers may simply deal with industry on their own. “That often results in sub-optimal valorisation or plain out damage control,” says De Wachter. “From a legal and financial point of view, contracts should pass through the TTO. You do this by providing good service”

Operating a professional TTO requires a bare minimum of three people, says Van Dun. Ideally the three should be experts who have worked both in academia and in industry, including a generalist who knows “a little bit about everything” including how to “negotiate with a company and how contracts are written.”

Two of the staff should focus on collaborative research broadly, including everything from small consulting agreements to setting up meetings with industry between a specific professor and a company. They should also visit companies and ask what is needed and

what kind of services the university could perform. Ideally, one would be a little more specialised, for example in medical technology if this is an important segment in your university.

LRD started with 2.5 full-time staff equivalents in 1972 and today it employs 85 people, of which roughly half are support staff and half are doing pure technology transfer. Ultimately, the investment in human resources will depend on the size of the university and the number of disciplines covered, Van Dun says. “It’s impossible to run an effective TTO for a wide variety of disciplines with one or two people.” KU Leuven, for example, has 1500 principal investigators.

The intellectual property (IP) and business development staff totals 10. All have had education in IP and several have backgrounds in medical technology and ICT. Their role is to identify deals and collaborative opportunities. They talk with researchers to understand what they are doing and with industry to understand where there is a possible fit.

LRD’s spin-out department has a staff of seven. Nurturing spin-outs is something the university and the government like to see, and it is time consuming.

LRD employs five legal experts and Van Dun insists all must have dealmaker skills. “Of course, they need to know the law. But I need negotiators and facilitators in the first place. And that’s the kind of person that will be respected and appreciated by the professors. They want to see deal makers who tell them how a collaboration can be structured and what is needed—someone who says, maybe if we twist the proposal this way, we can ask for a higher budget than the one you proposed.”

Roughly half of LRD's staff work on finance, structuring and administering collaborations and other issues such as material transfer agreements.

7. Walk before you run: focus first on collaborative research

Many tend to think about high-flying spin-outs as the ultimate aim of technology transfer, but the vast bulk of TTO activity at LRD and other highly successful TTOs remains collaborative research. And newly founded TTOs should focus on working with industry.

“Tech transfer does not start with creating spinoff companies. It starts with developing affinity with industrial partners,” says Van Dun, noting that it is far easier to start out with collaborative research than creating spinoff companies. “It doesn't make sense to create a spin-off company if a professor doesn't know how a company works, has never done consulting and has never worked with a company.”

Nonetheless, professors approach Van Dun from time to time and propose setting up a company based on their research. “If he or she never worked with industry before, a spin-out is suicide,” he says. “It is not a coincidence that only after 20 years, we created venture fund at KU Leuven.” Collaborative research also produces the greatest stream of revenue for LRD, says Van Dun.

8. Seek (or create) expert partners that will really make a difference

A university TTO can benefit from partnerships and networks but should build them selectively. The following LRD partners highlight relationships that have helped LRD develop successfully.

Leuven Inc. Innovation Networking Circle
(<http://www.leuveninc.com>)

KU Leuven cofounded Leuven Inc. in 1995 with another Leuven based technology institute, Imec, and several companies and financial institutions to help strengthen the bridge between researchers, high-tech entrepreneurs, industry and investors in the fields of micro-electronics, engineering, health and medical technology, ICT, life sciences food and materials.

“It was a private initiative,” says Van Dun. The co-founders hired one person to run Leuven Inc. full time and set up meetings between academia and industry.” Leuven Inc.'s Chairman is Koenraad Debackere, managing director of KU Leuven R&D. Board members also include a VC senior investment manager and the corporate research managers.

Leuven Inc. organises small events focused on specific research topics as well as seminars for up to 200 people. The small events, which draw 20-30 experts together from research and industry, are particularly productive, says Van Dun. “If you have couple of hours where industry and university researchers are talking together about a topic of common interest, the likelihood of getting a research contract at such a meeting is much higher than when there are 300 people in the room.”

Leuven Inc. also organises a monthly entrepreneurship café either in a university department or at a company, including an informal talk or a discussion on very specific themes such as stem cell therapy followed by a tour of the lab or facility and then an informal sandwich-and-beer happy hour. “We can see in reality that some of the contracts we conclude in

industry find their origin in these meetings,” says Van Dun. And it doesn’t require a lot of work to bring people together, he adds.

Leuven Inc., which has a board of seven founding members, did not seek or receive government subsidies and was profitable from its launch. “The aim of Leuven Inc. is to bring academics and industry managers in touch with each other. Almost all the creative input and work comes from the person who heads Leuven Inc. She is constantly chasing opportunities to put our research in the spotlight—that’s the kind of person you need,” he says.

“We believe in a bottom up approach—in getting people around the table with common goals,” says Van Dun. Networks organised only top down may have ambitious goals, he says, but “at the end of the day, it boils down to whether professors are really participating—whether there are 2 or 3 who like to work with each other,” says Van Dun. “Professors are not going to do research because there is a network. They will not reach out to industry because there is a network. Building networks is very useful if it builds on strengths that you already have, not the other way around. Sometimes [a] top down approach is too disconnected from what can be done on the floor.”

Professional technology transfer associations offer expert advice in setting up a university TTO, developing best practice, and training staff, says Van Dun, who has worked closely with ASTP-Proton over the years. All the new LRD employees attend ASTP-Proton’s three-day introductory training course, Fundamentals of technology transfer, which is organised twice a year.

ASTP-Proton
(<http://www.astp-proton.eu>)

ASTP-Proton is a not-forprofit European TTO association that seeks to establish and exchange best practices for knowledge and technology transfer and train professionals. It hosts seminars and offers a service to assess and help improve existing TTO operations. ASTP-Proton, the result of the merger of two EU TTO associations, also collects and publishes data and success stories. Proton was created in 2003 with financial assistance from the European Commission and became self-supporting in 2007. The next introductory course on the Fundamentals of Technology Transfer takes place September 23-25 and is in Leuven.

PraxisUnico
(<http://www.praxisunico.org.uk>)

PraxisUnico is a UK TTO professional network. Also the result of a merger, it focuses on best practice in the commercialisation of academic and public sector research. Services include workshops and seminars. Members include 120 universities, 60 corporate members, VCs, angels, patent agents and government agencies and charities that fund research.

Private third-party IP and business development partners—the virtual TTO
Creating a successful TTO is a long-term challenge and investment and business development activities require significant expertise. “Universities with limited resources may find it preferable to outsource business development by partnering with private companies that offer the services of a virtual TTO,” says former LRD Innovation and Investment Manager De Wachter.

One successful model is the UK-based IP Group Plc, which has invested in 90 university spin-outs from partner universities. Since its 2003 listing on London's AIM stock exchange, it raised €175 million of net proceeds and manages a pool of €120 million to invest in technology transfer at 12 partner universities.

While top tier universities have the resources to invest in a highly professional TTO, De Wachter says, others may lack the resources or the full endorsement of university leaders to commit sufficient funding. "Usually, there is a lack of resources at the beginning. This is the Catch-22. Everyone thinks they should go for technology transfer, but it's hard to get started given the long-term investment horizon and unknown return on investment. You need a minimum team of senior people with TTO experience, and this can be difficult and expensive," to do internally, De Wachter says.

Another element that can prove thorny in setting up a TTO is establishing legal autonomy to enter into contracts with industry, which is a key aspect of best practice. "This is an element where you can run into some walls in the university structure," De Wachter says. "In general, it takes a lot of customising and tailoring of the strategy to reach milestones in a university setting, just because of the way universities are managed and structured." There can be a lot of inertia, for example, if decision-making powers have to be reconsidered.

If university management is reluctant to establish an autonomous TTO, partnering with a private third-party IP developer may be an effective alternative. For one, implementing a decentralised structure for a university TTO is often challenging. "This is a strategy that most universities have a lot of difficulty embracing. It requires a

shift from central power to a decentralised model," says De Wachter.

"From a practical point of view, a TTO could spend a lot of time trying to implement a best-practice structure. Or, you could say, we are going to outsource this tech transfer activity...to capitalise on momentum and secure a minimum level of service quicker. A third-party TTO can provide business development resources, access to venture capital, and guarantees to ensure a minimum service level."

9. Set up a seed fund only after everything else is working

KU Leuven launched a university seed capital fund, Gemma Frisius Fund (GFF) in 1997 as a joint venture between the university, the KBC Group and BNP Paribas Group. The goal of the fund is to support the creation and growth of KU Leuven spin-outs.

Van Dun notes that the seed fund was set up 25 years after the launch of LRD. "Yes you need partners to create a seed fund," says Van Dun. But above all, you need an existing entrepreneurial ecosystem to attract co-investors. "It is not a coincidence that KU Leuven created a venture fund 20 years after it set up the TTO," says Van Dun. If we had tried to create a venture fund at end of 1980s or early 1990s, it would have been a failure—I'm absolutely sure. Because the company ecosystem was not yet there."

Instead of co-founding a seed fund, a university could also simply partner with an existing one: "If there's an opportunity to link with a seed fund, definitely go for it," says Van Dun. "But bear in mind that it's a Catch-22. VCs and angel investors are usually only interested if you have sufficient deal flow.

It's very difficult to get investors hungry to set up something with no track record or deal flow."

Van Dun advises universities with limited staff resources to invest in staff that will develop contract research as opposed to spin-outs. "It's much harder to do spin-outs. You need management capital and mature projects. Consulting and contract research much more within reach."

Once a university has established a vibrant start-up, reaching out to investor groups and venture capital networks is useful. "I try to attend meetings [with] people in [the] investment community. All the people in my office dealing with spin-outs have contacts with investors. If someone meets an interesting investor, we spread the word through out the office. So everyone is aware."

KU Leuven also has hosted for several years the Benelux Venture Forum – a private initiative connecting 60-70 high tech investors with early-stage companies, including a match-making event where young companies can present themselves in a speed dating programme and then engage in follow-on meetings.

LRD also is connected to the Business Angel network for the Flemish regional (Business Angels Netwerk Vlaanderen) and regularly sends projects for review.

10. Tout your success

Part of a TTO's role is marketing its achievements. "You need to tout every little success you have," says De Wachter. "Whether it's closing a licensing deal, helping win a competitive grant, or creating a spin-out, spread the news widely among various stakeholders in university, industry and university management."

Forty-two years after its founding, LRD still spends a great deal of time making its successes visible to KU Leuven researchers. That's because creating in academics a mentality open to technology transfer is "a trickle-down process that takes time," Van Dun says.

LRD's offices showcase successful KU Leuven inventions and technologies now on the market. "It doesn't have to be next Google or something that brought in a lot of money. We have those," says Van Dun. Just as valuable, he says, is a simple success that helps researchers realise, "Hey, that's something my well-respected colleague did. I can do that too."

IV. Conclusions

Bridging the world of academia and industry is not easy. Building a successful TTO requires individuals who believe strongly in its mission and have the skills and knowledge to see opportunities academics do not and negotiate the best deal possible. During the course of researching this paper, experts linked with KU Leuven repeated three intangible elements in setting up and running a TTO that are vital to success: flexibility, adaptation of best practice and long-term commitment.

A successful TTO must remain flexible because technologies, markets and opportunities are constantly shifting. LRD's role has changed over the years and its staff is continually seeking new opportunities. "If I would have made a job description of my own job 10 years ago, probably only 30 percent would still be valid today—because you see so many opportunities. If you can be autonomous as a TTO, you have the ability to jump on opportunities. You can create new things and explore new collaborations," says Van Dun.

The commitment of university leaders is critical. Changing attitudes is a long-term process. The TTO is a platform to enable technology transfer. But the most important input is the interest and motivation of academics to engage with industry. Without them, the pipeline for technology transfer is blocked. "You need your professors, you need the buy-in of researchers. That is the clay you have to work with," says Van Dun.

Today, four decades since the launch of LRD, KU Leuven's leaders continue to communicate about the role and value of technology transfer. "We have a long tradition in technology transfer and we continue stimulating it—one has to foster valorisation," says Torfs.

Technology transfer "done well" benefits society and adds to the lustre of a university. "Creating a good TTO is part of creating a good university, and a necessary part," Torfs argues. "Today, you can't do without it." Yet he insists on a broad and inclusive approach that doesn't promote one aspect over another. "When company sees university just as a business partner without additional wisdom, it loses its soul. What's important is to take care of the profile of the university as a whole."

V. Case study of a KU Leuven Spin-out: Qaelum N.V.

During his 10 years as a researcher in the field of quality control in radiology at the University Hospital Leuven, Jurgen Jacobs never imagined he would run a company. Even when he and a team of researchers developed software that could measure the technical accuracy of radiology devices and improve patient safety, no one thought about creating a spin-out to commercialise the breakthrough.

“Our idea was to give away the software to other hospitals to improve quality,” says Jacobs, a software engineer and computer scientist who led the research.

Jacobs is now chief executive of Qaelum N.V., a fast-growing three-year-old medical technology start-up that rapidly has become a European market leader in quality control for x-ray devices. Corporate partners include FujiFilm Medical Systems and Agfa. The company’s revenues are forecast to more than triple to €1.75 million this year after growing 46 per cent in 2014.

Qaelum’s successful launch highlights the role a well-run TTO can play in helping university researchers understand the commercial potential of their scientific breakthroughs. LRD, the 42-year-old technology transfer office at the KU Leuven, zeroed in quickly on the market opportunity, provided business development expertise and guidance—and helped Jacobs make the leap from academic to entrepreneur.

[The first encounter: technology transfer office as catalyst](#)

Jacobs’ first contact with LRD had nothing to do with starting a company. After Jacobs together with the team of Professor

Hilde Bosmans published their research results, they installed their new quality control software platform at University Hospital Leuven, and began giving away the software to other hospitals. Suddenly, a growing pool of users was clamouring for software support services and Jacobs found himself doing the work between 10 pm and midnight.

Stretched between his day job as a researcher and the exciting application of his work in a real-world setting, Jacobs proposed to the hospital’s head of medical physics and quality assurance, Professor Hilde Bosmans, that he work 1-2 days a week doing professional services for the growing field of users, to maintain and extend the software—and earn a bit of income for the department.

To make sure the services were structured to avoid legal complications, Bosmans set up a meeting with the TTO, whose staff quickly recognised the commercial potential of the ground-breaking software. Working 1-2 days a week on professional services made no sense, LRD staff told them, because the effort lacked scale. Jacobs should either take the technology global, they said, or remain a researcher.

“The most important thing LRD did was help us shift our mind-set,” says Jacobs. “We were giving away the product for free and offering to do some services on the side. They said, ‘Let’s go for a company that will be successful around the world. The globe is the market.’ The opportunities were much, much bigger than we imagined.”

In the summer of 2010, LRD encouraged Jacobs to take a crash course on becoming an entrepreneur to learn about

Qaelum N.V. at a glance

University of Leuven spin-out:	Qaelum N.V.
Founded:	November 2011
Launch of operations:	February 2012
CEO/Researcher-founder:	Jurgen Jacobs, former software engineer and researcher at University of Leuven Hospital exploring new approaches to quality control of x-ray devices
Employees:	2012: 3 July 2015: 16 Dec 2015: 20*
Product:	Software system for quality control of x-ray machines and mammography screening devices
Business model:	Software as service (pay by volume of use). Software measures and analyses patient radiation dose and compares those measurements against growing volume of data over time to improve the system
Revenues:	2012: €28,000 2013: €372,000 2014: €542,000 2015: €1.755,000* *estimate

business plans, start-up financing and intellectual property (IP) rights. For five months, he worked at the hospital during the day and spent his evenings writing a business plan for a spin-out. Every 3-4 weeks, he met with LRD to check on progress.

From manual audits to machine learning

Jacobs was keen to develop a new market for improved quality assurance in mammography screening—following a decade of research and testing quality assurance software. The potential market opportunity loomed large—the European Union was preparing a directive that would require every European country to

test mammography-screening devices and regularly report quality findings.

At the same time, Jacobs had been extending his software to other radiological devices and to patient radiation dose monitoring. He had incorporated machine learning in the software to assess the growing pool of patient data over time and generate new insights about different patient groups and optimum radiation doses. Building in intelligence enabled the software to interpret patterns in the errors it encountered.

Jacobs knew first-hand about the risk of exposing patients to a high radiation dose. When his son was born two months early in 2009 weighing 1.5 kilos, a junior radiologist told him hospital protocol required him

to do a computer tomography (CT) scan of the lungs of the two-hour old infant—even though the chest-x-ray showed no obstruction. Jacobs was alarmed by the risk of unnecessary damage to his son—from the CT scan’s high radiation dose and convinced the radiologist not to do the CT scan.

The experience with his own child galvanised Jacobs’ interest in patient radiation dose monitoring. Soon he and his colleagues began evaluating how many times children receive CT scans that are not needed or are scanned with completely wrong parameters and settings for a child. “That means you get beautiful images but potentially triple the dose of radiation needed,” he says. Further work led to the ability to do continuous monitoring of CT examinations, capturing all the data and training the system to look for patterns and generate warnings to operators if settings did not match the patient profile.

When Jacobs presented the idea of continuous monitoring of CT examinations at a conference, many colleagues were sceptical, given the volume of data involved. But Jacobs was convinced the effort would prove beneficial. “If you have so much data, you can train the system to look for patterns,” he said. “And that gives you insights.”

“That was a huge mind shift,” says Jacobs. “In the past, we monitored x-ray devices manually once every year and sometimes even every three years because the government said we had to do it. But if you do it completely automatically, you have a huge data set to do machine learning and analytics, and that gives you the basics to improve quality.”

By 2011, Jacobs’ software had the ability to warn hospital technicians that the x-ray dose was wrong. “Already, the concept was so new that it was a real selling point,” says Jacobs. Instead of giving hospital staff raw data, the software interpreted the data. Further development has made the software capable of automatically signalling to technicians the statistically correct settings for a given patient taking a given exam.

Sorting out intellectual property rights

The most difficult step in creating Qaelum was negotiating who owned the IP rights to the software and securing the rights for the company. Sorting out IP issues often is contentious, especially when many researchers have contributed to the innovation, and TTOs typically lead the process. LRD played a pivotal role, Jacobs said. Finding a solution that satisfied all of Qaelum’s stakeholders from researchers and hospital management to other university hospitals using the software took LRD’s legal staff nearly seven months.

“The diplomacy needed at that moment is crucial, and at that point in time the entrepreneur is not in a strong position,” says Jacobs. “It was good to have (LRD) in between and trying to find the best position for the researchers, the university and the other stakeholders.”

Because Jacobs was employed as a researcher by the University Hospitals Leuven, the task was more complicated. “We spend the longest time trying to find an equilibrium in writing the contract between university and hospital,” Jacobs said. Because he was employed by the university hospital, the technology had to be transferred by the university hospital. But since the hospital is part of

the university, the university also had to approve the IP agreement.

The previous distribution of Jacob's software for free created another challenge to sorting the IP rights. LRD and Jacobs agreed that Qaelum should buy out the technology from the university and hospital and own it outright instead of licensing it. But the hospital already had given software away to screening centres all over the country. "In our case, the biggest problem was that we had existing customers of the hospital who wanted to continue using the software. Because we were proposing to buy out the technology, there was a conflict. We had to figure out how other hospitals could continue using the software. LRD took on the role of diplomat, working to find a rights and payments agreement that satisfied all parties.

"LRD played a very objective role," said Jacobs. "If you don't have an objective party between investors and yourself as the technology expert, things can go very wrong ... LRD definitely made a difference."

Validating the technology

While the LRD experts were working on the IP issues, Jacobs set up a virtual company in the LRD incubator and began testing the market potential for Qaelum's software. The goal was to reduce the technology and market risks to the point where Jacobs could make a convincing pitch to KU Leuven's seed capital fund, Gemma Frisius.

To reduce the risk of launching the company with only one product—mammography quality assurance—Jacobs developed a second potential service on the same software platform: monitoring patient radiation doses.

Because the quality of x-ray devices degrades over time and can fluctuate, universities and hospitals must test them regularly—a process traditionally done by a physicist at periodic intervals—a subjective process with limited oversight. Qaelum's software service allowed hospitals to check radiation device quality and x-ray dose in real time, assessing the results against standard benchmarks and alerting hospital staff immediately to errors.

"LRD helped us see the full potential of the technology," said Jacobs, "and if you see the full potential to grow a business, you create a very different business plan."

Broadening the scope of the business was a smart move. Qaelum's management and its seed investors originally expected mammography screening to be the company's core product. But in 2011, as Jacobs and LRD were putting the final touches on the business plan, the implementation deadline for the EU directive was delayed, dampening the demand for mammography quality control services. So Jacobs switched Qaelum's product focus to patient radiation dose monitoring.

"In the business plan both businesses were taken into account," says Jacobs. "It was important that we had a 'Plan B.'"

Researchers often focus on a single product. "The risk is having a one-trick pony," says Hannes De Wachter, former LRD innovation and investment manager and current CFO of Qaelum.

A good technology transfer office grooms spin-outs to pivot and survive in fast-changing market scenarios. "You need to build in sufficient resilience in the IP, technology and business plan," De Wachter says.

Qaelum's Plan B entailed collecting all the information about radiation doses that a patient receives in the hospital and analysing whether the dose levels were correct. "If they was not, the software tries to understand why and how to correct future dosing," Jacobs says. The ability to analyse the findings and to develop insights from growing pool of x-ray data helped set Qaelum apart from the competition.

The quest for seed funding

Grooming spin-out founders to raise capital is another core TTO responsibility. "When you present the business case in front of a venture capital type of jury, things get serious," says De Wachter. "It helps in making the entire project very concrete—and the feedback you get is extremely valuable."

During the incubation period, LRD helped Jacobs obtain "gap funding" including a €100,000 proof-of-concept grant, to close the development gap and groom the spin-out for a pitch to investors.

With a well-honed business plan and cutting-edge technology that already was in use in hospitals, Jacobs search for a first set of seed investors went smoothly. KU Leuven's seed fund Gemma Frisius, the university hospital and a business angel together with four private individuals invested €500,000 in cash and the technology was valued at \$650,000, giving Qaelum a valuation at its launch of €1.1 million.

"If your idea and plan is OK, the money will always find you," says Jacobs. At the time of incorporation, the university's 42.5 per cent stake in Qaelum was worth €488,750.

Going to market

When Qaelum launched its services on the market in February 2012, it offered a novelty—one software platform for total quality monitoring (TQM) of all devices in the radiological department of hospitals and research labs. Its software-as-service approach was more cost-effective and more reliable than traditional manual quality evaluations. Qaelum's ability to compare this data to benchmark data in real time gave hospitals a baseline against which they could constantly judge the quality of their radiation department, says Jacobs.

Traditionally, x-ray departments did an evaluation once every three years. "We try to make the quality monitoring of radiology devices a commodity that is constantly done by software," says Jacobs. "We first do a baseline evaluation. If a hospital wants to try to improve patient safety and efficiency and do an evaluation every month, they can track the impact on quality."

Qaelum's novel approach to radiation device quality assurance and patient safety helped the company win together with consultancy Deloitte a €2 million two-year grant from the Flemish Research Fund for Industrial Science and Technology. The study focuses on improving the quality and safety of radiological devices, as well as healthcare economics and workflow.

"We don't collect data just for the data. We want to create understanding of the data. By combining analytical tools and other dedicated software solutions, we try to create insights and understand what the data really mean. That's how you can optimise quality and efficiency," says Jacobs.

Though Qaelum's market prospects looked good, Jacobs wasn't taking any chances. As soon as the company was incorporated, he sprinted to make sure the company had its own quality in order, including ISO certificates. "Because we had them, the big companies wanted to collaborate with us," says Jacobs. "We started from the beginning with huge focus on quality ourselves. If want to bring quality to hospitals, we have to be quality minded ourselves."

A first success came quickly. In the summer of 2012, four months after Qaelum's market launch, Jacobs signed a distribution contract with Fujifilm Healthcare to market its software platform together with Fujifilm's database for medical images (Picture Archive Communication System, PACS).

"We needed a PACS system and they wanted to differentiate their database from other systems," says Jacobs. While the alliance with Fujifilm, which has 10 per cent of the EU market for PACS systems, didn't create a huge revenue flow, it gave start-up Qaelum "gigantic credibility," says Jacobs. "Suddenly after four months we were at all the key radiology conferences in the booth of one of the major players."

The alliance with Fujifilm helped Jacobs clinch a second contract 2012 with all NHS hospitals in the UK involving an x-ray dose database of 2.6 million patients per year—the biggest available database of its kind. Both deals gave Qaelum a giant leap in market visibility. Without it, "you are a small spin off company with 2-3 people," says Jacobs, "and no one knows you or cares about you."

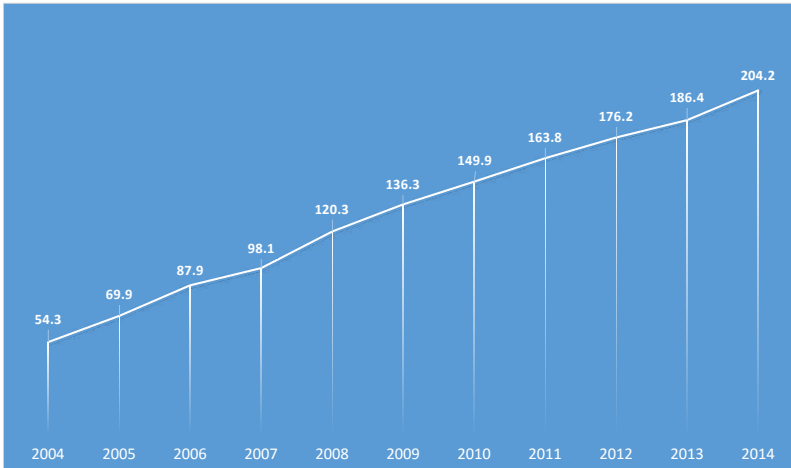
In 2013, Qaelum won a global distribution agreement with Agfa, a former competitor, and together with Agfa, Jacobs is now preparing to enter the US market. "We

are the only company that developed a complete and total quality monitoring tool," says Jacobs, whose rivals include giants such as GE, Bayer, Philips Healthcare and Siemens.

Today, three-and-a-half years since its launch, Qaelum's software checks radiation doses on 10 million patients a year across Europe - more than any of its rivals. "The reason to start a company is to make a difference," says Jacobs, an academic-turned-entrepreneur well on his way to achieving that aim.

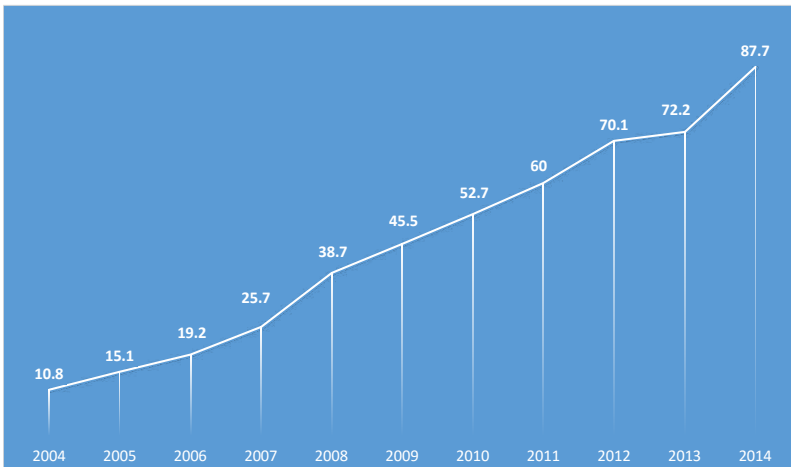
VI. Annex

LRD Total Revenues - Millions of Euros



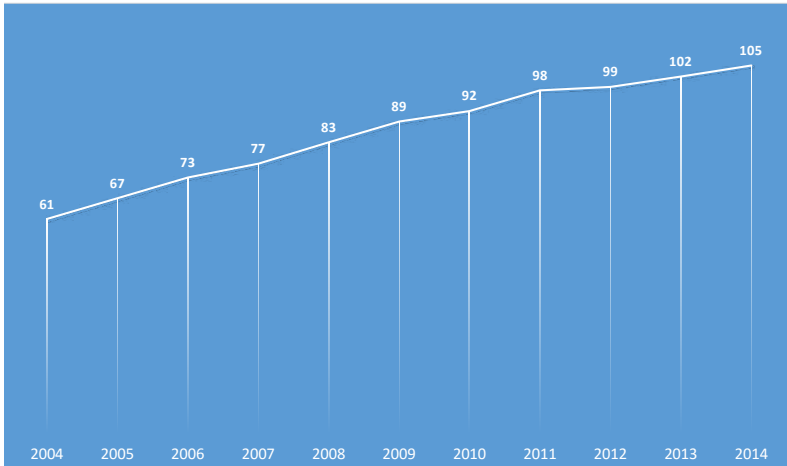
Source: Leuven Research and Development

LRD Licensing income - Millions of Euros



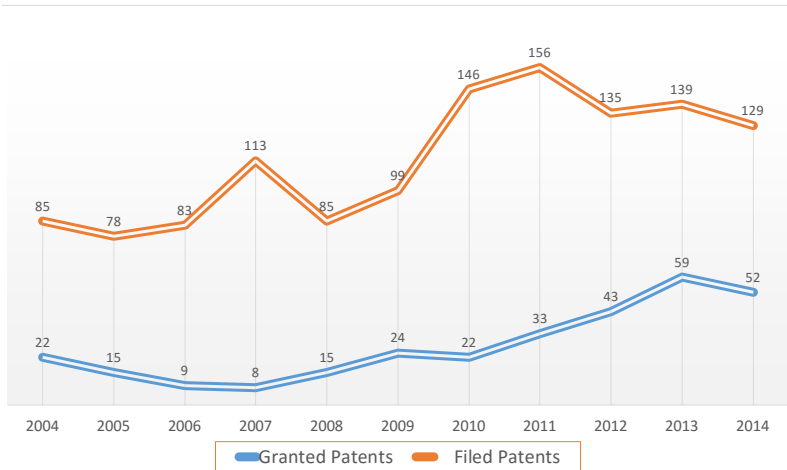
Source: Leuven Research and Development

LRD spin-outs: Total KU Leuven spin-outs with university investment



Source: Leuven Research and Development

LRD Patents



Source: Leuven Research and Development

Translational Medicine: Major drugs invented at KU Leuven

- tPA (Genentech)
- Jetrea (Thrombogenics)
- Brivudin: marketed under the names Zostex, Brivirac or Zerpex
- Rilpivirine: research and discovery done in Leuven but no patents
- Cidofovir: licensed to and commercialised by Gilead (CMV eye infections)
- Adefovir: ditto (HBV infections)
- Tenofovir: ditto (HIV infections)
- Valacyclovir: also Leuven inventors on the patent; commercialised by GSK (“Valtrex”)

KU Leuven Research and Development

Founded in 1972 Employees: 82		
Three activities		
Contracts and collaborative research <ul style="list-style-type: none">• 1774 new agreements per year	Intellectual property <ul style="list-style-type: none">• 150 invention disclosures per year• More than \$100 million in royalty income per year• 70 licenses per year	Spinning out companies <ul style="list-style-type: none">• 105 spin-outs to date (only companies in which the university holds a stake)• 7 initial public offerings• 4200 direct employees
2014 data		

Source: Leuven Research and Development



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