The challenges and opportunities of commercialisation

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Government is challenging New Zealand public research organisations to increase the rate of commercialisation of intellectual property (IP) and research findings. It is generally accepted that a high-tech economy offers the potential to increase GDP through exports of high-value products, and this view is well supported within universities. However, in practice, academic staff face conflicting incentives and pressures to invest their time and succeed in the university environment. Commercialisation managers work at the interface of the university culture and the external business world, and manage the conflicting philosophies and drivers of each side. Unlike 'translators,' these individuals add value by creating opportunities and proactively managing the supply and demand of early-stage, high-risk ideas. Viclink, the commercialisation arm of Victoria University of Wellington, has been in turnaround mode for the past 24 months in an aim to deliver increased value from its research and IP, and has seen first-hand the challenges of working in the market for innovation. New Zealand universities have approached and scoped their roles quite differently. Around the world different models and priorities exist for commercialisation and tech transfer of university IP. A recent case study on a clean tech start-up company highlights several of the observations and opportunities in commercialising publicly funded research, and on the relationships between inventors, commercialisation companies, incubators and investors. This discussion provides a summary of current challenges and opportunities in commercialisation, as observed by practitioners in a university setting.

Background

The University Commercialisation Offices of NZ (UCONZ) has published data for the economic returns from the commercialisation of research and IP for the period 2003 – 2006 (UCONZ 2005). Encouragingly, we see a trend showing increased revenue and exports. The models of New Zealand commercialisation companies vary significantly, for example, some also manage university assets (student accommodation) and contracts (e.g. teaching and education), and provide support for a wider network of commercialisation (e.g. PSAF management, AngelLink). These different models are to be expected in an immature market, but this makes it difficult to make fair comparisons or analyse performance. Waikatolink's analysis places it in the top 3% of commercialisation offices worldwide (Waikatolink, *www.waikatolink.co.nz/newsandspinoffs*) and has generated a range of IT, medical and industrial start-up companies. Other universities have outsourced commercialisation to local incubators or focused on finding industry partners and licensing early.

Case Study: Viclink (1)

The Viclink model is a 100% university-owned company, with a mission to create and capture value from Victoria University's IP and expertise. We employ Commercialisation Managers to take ideas from concept to business plan. Where appropriate, we establish spin-off companies (Wetox, Magritek). In some cases, we may licence the IP and, in the case of a pharmaceutical lead (Peloruside), we licensed the IP to the United States drug firm Reata Pharmaceuticals Inc. Our shares in Reata are now valued at approximately $10 million, and we have also received royalty payments, R&D funding and capability development for the key inventor who sits on the Science Advisory Board. In the last 18 months, we have invested in marketing and relationship building with academics. This has resulted in a significant increase in new disclosures (from single figures per annum to over 100 this year). However, without medical or mechanical engineering schools, we generally receive concepts or very early stage ideas for development. There are benefits (early influence, low initial cost) and disadvantages (no IP or proof of concept) with this type of disclosure.

The challenges

Incentivising academics

Viclink staff consider the *motivation of academics* to be the primary challenge in the task of commercialising IP and expertise. Academic staff are primarily incentivised by the Tertiary Education Commission's Performance-Based Research Fund (PBRF) scoring system (PBRF Guidelines *2012*), a quality score assigned to them individually, based on research outputs and contribution to the research environment. The greatest weighting is given to the top four nominated research outputs, usually high-impact, peer-reviewed journal publications. The entire university system – including recruitment and retention of

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After graduating, Sophie worked for the Tertiary Education Commission and gained an overview of New Zealand's research sector. She went on to work in the supply-side team at Pharmac.

With a desire to return to academia, Sophie took a job at Victoria University as a Portfolio Manager helping VUW scientists secure research funding and, at the same time, completed an MBA. In 2007, she moved to the more commercial environment of Viclink.

graduate students, timing of research and study leave, applications for research funding, and the promotions process – is all carefully balanced to maximise individual PBRF scores.

A rational academic seeking promotion or a higher PBRF score would do well to secure research funding, have teaching time replaced through that grant, recruit a productive team of graduate students, and publish the results. There would be virtually no benefit in engaging in commercial activity, and it would be an additional requirement of their over-committed time. Adjusting the criteria for PBRF would be the single most beneficial policy change to increase academics' engagement with commercialisation (PBRF SRG review 2010*)*.

Staff and postgraduate students have self-selected careers that are neither product-development-based nor especially lucrative. The option for academics to invest their time or resources (including research students) on commercial projects is not a rational choice in the current promotion and PBRF-driven environment. Any academic who chooses to work on commercial projects could easily face ten years to see financial return and has a high chance of failure, and the opportunity cost is high. Peer review and recognition in the academic field drives academics to perform at international levels; New Zealand scientists publish prolifically for the amount of RS&T and Vote Education funding. In commercialisation, the best science does not always 'win' and by the time a product has reached market, it is estimated that only 15% of the market capitalisation relates to R&D, even in a high-tech business. A lot of the development is out of the hands of the inventors and founding scientists, the development work is mundane and not always worthy of science publications, and academics are not often motivated by pecuniary gain. In a recent and typical example at VUW, the inventor was willing to pursue research on a novel material into a biomedical application, but not a new product for the construction industry. This position is a moral choice, combined with academic freedom, that we respect and support. The culture clash of private investors and their timeframes is at odds with the university environment. Recruitment of academics increasingly takes note of previous commercial work and industry links. However, once within the university system the PBRF system drives behaviours consistent with increasing PBRF grades and publications. The search for new knowledge is not the same as the development of new products; this fundamental difference means academics lose interest once the system or theory behind the invention is understood and published.

Finding the right people

Recruitment of good commercialisation managers is difficult. For most commercialisation companies, the range of products and services varies greatly, so commercialisation managers need to be generalists, brokering technologies where they are neither product nor market experts. This work has long timeframes and the expertise is not recognised by many university personnel.

Sending clear signals re commercial advantage

Clear signals about the commercial advantage and market interest in the technology are very important and are under-recognised. Commercialisation companies often have a low barrier to filing provisional patents, as this enables the scientists to publish the work quickly. A 12-month window after provisional filing should be used to secure commercial interest; with none after 12 months many offices will drop the patent application, thus avoiding up to $250k in patent costs.

> ***Case Study: Viclink (2)***
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> There are inefficiencies working in different sectors with different technologies for each project that comes in, so we balance the costs and benefits of specialists and research assistants to most efficiently assess and develop each opportunity. In a recent recruitment drive we found no suitable candidates and appointed an entrepreneurial PhD student, whom we knew, as a development appointment. The main difficulties are finding people with a balance of an appreciation of research / university environment with generic science / technology, analytic and business skills. The growth of the industry requires more of these skilled 'all-rounders' and there is no obvious source for the next generation. We are addressing this by engaging students on commercial projects and investing in training and development of Commercialisation Managers. A formal relationship with Grow Wellington and Creative HQ's business incubator has been beneficial in this development and training and we have sent eight students on a 16 week applied entrepreneurship course to develop their ideas. We also sponsored the Bright Ideas Challenge, a business planning competition and generated over 150 new leads to investigate as potential Viclink projects.

> ***Case Study: MIT***
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> MIT has a policy for all inventions, where the Technology Licensing Office will only progress a patent and commercial project if a partner is paying the costs and showing commitment to the technology commercialisation (MIT TLO, http://web.mit.edu/tlo/www/index.html). MIT will use local angel investor networks, a pool of local and experienced entrepreneurs, the IP, and the inventors to build aggressive, high-growth businesses to take the product to market. Interestingly, MIT imposes strong performance clauses as it sees an important social responsibility to transfer the new knowledge to industry. If licensors do not hit development or sales targets, MIT will revoke the licence.

Recognising the outcomes are long-term

International technology transfer benchmark data can be used to understand the implications of promoting technology transfer and the likely outcomes of a technology transfer initiative (Table 1: Heher 2007). The benchmarks indicate that average income to an institution, after eight to ten years of activity, is likely to be 1%–2% of annual research expenditure (ibid). The income is, moreover, highly uncertain and variable. Institutional and public sector managers must understand the nature of this income and the dynamics of the technology transfer process in order to manage this emerging discipline effectively, because unrealistic expectations can lead to dysfunctional policy decisions (Campbell 2007*)*.

Table 1. Likely outcomes of a university technology transfer initiative (estimated budget v. likely income).

Group	USA and Canada	UK and Australia
Bottom 50% (of all universities)	Loss	Large loss
50%–95%	Break even/profitable	Loss
Top 5% (of all universities)	Very profitable	Profitable

NB: Only 1 in 200 licences will earn the institution more than US$1M.

There is social benefit in transferring IP and expertise, and a perceived obligation from a taxpayer-funded institution. Viclink has attempted to make itself better known through developing a people-centred, relationship-based model, and trains up a future stream of entrepreneurs and scientists by getting involved in teaching, mentoring and hiring students and staff who show an interest and/or aptitude for commercialisation.

Securing funding for long-term outcomes

Shareholders

Commercialisation companies require patient capital from their shareholders, i.e. the universities that own them. To date there are few variations on the ownership, and until a commercialisation office generates cash flows the university must invest in the operations. These costs are considerable, and there are other challenges such as some university central services (e.g. finance) being unable to cope with the specific requirements of these different projects and suppliers. Some universities cross-subsidise their operational investment into high-risk, new ventures by managing other profitable commercial work, e.g. student halls, teaching contracts, clinical trials. Very few commercialisation offices break even around the world; most are in it for the possible return from one 'killer' project, as these portfolios are extremely high-risk and long-term (Heher 2007). Gardisil,* the prophylactic human papillomavirus vaccine, and a few other large university deals skew the data in Australia. Most don't make money, including Stanford University.

> ***Case Study : Stanford University***
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> Stanford University's spin-offs include Genentech, Google and Hewlett Packard. However, they claim to run at a loss and see their role as transferring the technology and as a service to the university. Like MIT, they are not seen as a source of funds for the university, but a portal between the inventors and the market. Their scope is far narrower than a typical New Zealand university commercialisation company as they seek a partner to transfer the IP or technology to. The New Zealand model requires the commercialisation companies to be far more entrepreneurial and manage university expectations of cash flow and timeframes.

Government

Funding from the Ministry of Research, Science and Technology (MoRST) increasingly requires a clear commercial strategy and commitment to economic gain to New Zealand from the research (MoRST 2010). Funding from the New Economy Research Fund (NERF) even requires commercial outputs such as prototypes or new processes. Where university capability aligns with New Zealand industry (e.g. dairy research), finding relevant industry players and demonstrating the benefit to New Zealand is relatively easy. We struggle with the nanotechnology projects, where there is no local industry, and we have to describe a scenario where a future licence or spin-off sale returns financial benefit to New Zealand. This drives adverse selection, where the scientists willing to make the biggest claims about commercial benefit and to have those translated into contracts, stand to win the funding. These cases force us to partner earlier than makes good commercial sense. Another challenge for research organisations is the difficulty of funding market research and IP protection.

* See http://www.gardasil.com/

> ***Case Study : Wetox***
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> Wetox is a 100% Viclink-owned company, with a mission to solve liquid waste problems using a unique clean tech invention. The invention was developed by Professor Jim Johnston, Dr Michael Richardson and Associate Professor Peter Northcote at Victoria University's School of Chemical and Physical Sciences. Originally a PhD project, the team was unable to secure any research funding and the idea was protected and lay dormant for several years. The economics of the waste water and clean tech industries recently became able to support the technology's development for commercial purposes. Viclink secured New Zealand Government funding from Pre-Seed Accelerator Fund (PSAF) and the Facilitation Fund to understand the market opportunity and develop plans for the pilot plant. This was less than $150,000 in total, and as it is publicly owned, the company is not eligible for any TechNZ or NZ Trade and Enterprise funding. Viclink has invested in a CEO and has based the company in Creative HQ, Wellington's business incubator. Wetox has several early-stage customers and is about to prepare for the first round of capital raising.

Private investors

Many commercialisation offices in New Zealand work closely with angel and venture capital investors. In our experience there is a vast amount of development work to turn an idea or concept into an investable business case, and it requires significant input from the inventors. Seed Co-investment Fund and PSAF leverage makes these deals attractive for early-stage investors, but many funds are fully invested and others lack the expertise or interest required for high-tech product companies, especially pre proof of concept.

In the UK, the increasing interest in technology transfer as an area for external investment has meant that university technology transfer companies have been able to secure funding when there is a clear income-generation model. One example is Imperial Innovations, of Imperial College, London. This company (and, in turn, Imperial College) has benefited from private institutional investment and intends to become a publicly listed company.

> ***Case Study : Sheffield University***
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> Sheffield University is another interesting example of external investment (Campbell 2007). Due to a lack of capital, the director of the Tech Transfer Office developed a relationship with external experts, an initiative that led to establishing a separate company: BioFusion PLC (Sheffield, UK). A ten-year exclusive agreement with Sheffield University to commercialise all University-owned medical IP rights means that BioFusion runs independently of the University and its TTO. In 2005, BioFusion listed on the Alternative Investment Market (AIM) of the London Stock Exchange, raising UK£8.23 million. Sheffield University is one of the shareholders.

The 'valley of death' is the term given to the funding hole where research funding has supported a project but it is not yet investor-ready, so the project risks running out of resources and terminating, even if there is potential. PSAF attempts to bridge this gap by funding prototypes or more commercial research, e.g. head-to-head trials of new products v. incumbent or competitors.

The opportunities

A series of Tertiary Education Commission (TEC) sponsored events is under way, with 16 events being held across New Zealand with the aim of facilitating new university/business relationships. UCONZ is organising the events with the long-term goal of better communication and engagement between universities and industry. Some of the perceived current barriers include attitudes, timeframes, priorities, relevance of industrial problem-solving for PBRF scores and university promotions, costs and lengthy negotiations around IP ownership and costs. In our experience, the trust and development of a working relationship must precede any commercial dealings.

Engineering and design proposals offer the best potential, as their research cultures are quite different: the idea is 'reduced to practice', is part of their expertise, and the payoff is far quicker.

Building a relationship and trust with commercial partners takes a major investment of time; students on summer exchanges funded through the Foundation for Research, Science and Technology or TEC schemes have often been noted as being the single most effective way for the two partners to engage on a shared problem or opportunity. Standardising some of the agreements and precedents when engaging at an early stage of a project would help focus on constructive discussions, without lawyers controlling a bureaucratic and mistrustful process. Visibility of IP and expertise would help companies find what they are looking for, including students available for work on applied problems.

On a less positive note, we have scrutinised some older patents and found many of them to have very little commercial utility, due to adverse selection at the time of filing. In an extreme case, a patent has been found to be already published by the inventor. We have recent examples of scientists refusing to let us be involved in a commercial discussion with a multinational company because they perceive we will want to negotiate commercial terms for them using the Victoria University IP.

Since academics do not report to us we have no negotiating power to influence their behaviour, and have to decide carefully which issues to escalate to university management. We have become pragmatic and focus our efforts on the small percentage of academics who want to engage with commercialisation and industry. There will be a funding challenge ahead for those who do not want to engage with industry or commercial work, and increased pressure for those in non-applied areas.

Adding value to the university in non-economic terms has been a major focus for Viclink over the past 18 months. We have focused on building key relationships and marketing our services to the university. We have employed people with strong interpersonal skills and outsourced many of the IP, analysis and technical aspects of the work. We have sponsored student schemes such as business planning competitions, which generated 180 business ideas (Viclink does not have access to or ownership of student IP). As a result of our marketing efforts, our portfolio of projects has grown rapidly, with over 100 disclosures this year. We have supported the application for promotion of some academics in an attempt to give weight and relevance to commercial work as part of their university work. However, a rational academic would still do well to focus on publishing only, given current incentives, and put effort around the margins of PBRF scores (publishing papers) rather than draft a new patent application or visit a trade fair in a relevant industry.

Conclusion

The key benefits of publicly funded research commercialisation are social and economic, although individual institutions may not break even or be profitable. Interventions to increase engagement in the process are policy-based, and would need to focus on PBRF rewards in the case of New Zealand universities. The non-competitive nature of the commercialisation companies ensures networks and expertise can be shared willingly and this is working well in practice. Good news stories that increase public awareness of the importance of science are crucial, as this will have flow-on effects not only to investors and funders backing applied science, but also school leavers considering science degrees, and university leavers considering careers in research or commercialisation of science. Policy makers should be receptive to a bottom-up approach that builds on individual and local expertise. Micro-level interventions appear to work well, for example, summer students and short-term projects sponsored by FRST that have a low barrier to entry and allow the relationship to develop slowly. Reducing the transaction cost of working with universities and commercialisation companies is an area of interest, and are following some of the Open Innovation markets for ideas, entrepreneurs and partners such as Innocentive and Yet2.com.

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