Commercialising Engineering Research in Australia

Jean Armstrong
Dept of Electronic Engineering, La Trobe University

ABSTRACT: This paper describes some of the steps in commercialising engineering research in Australia. The experiences of the author in patenting her research and taking steps to commercialise it are described. The patenting process is outlined. Possible ways to make money from a patent, include licensing the patent to a large company or creating a start-up company. Practical information about both of these approaches is given. The role of the varying funding sources available in Australia is explained. Would-be entrepreneurs are often required to give presentations or 'pitchs' to potential investors. The role of the 'pitch' is described. A number of recommendations about how universities could remove some of the barriers to commercialisation, such as the emphasis on published papers in promotion criteria, are given.

KEYWORDS: innovation, industry partnerships

TECHNICAL BACKGROUND

In 1997 research at La Trobe University resulted in a new digital modulation scheme which removes some of the limitations of current modulation schemes. This has the potential to form the basis of better high-speed digital communication systems. The new technique is a form of orthogonal frequency division multiplexing (OFDM), called polynomial cancellation coded OFDM (PCC-OFDM). OFDM is already used for digital television, digital radio, ADSL and wireless LANs.

Because of the wide potential application, La Trobe University applied for patent protection. Since then further research has resulted in numerous papers in leading international conferences and journals and has supported the view that PCC-OFDM can give substantially improved performance at the cost of increased digital signal processing in the receiver. One of the leading international manufacturers of digital video television equipment has privately conceded it would have formed a much better basis for digital television than the method actually used.

Despite what now appear to be clear technical advantages, and despite many discussions with industry and financiers, we have so far been unable to commercialise the patent. We have however learned much about the commercialisation process. In this paper we share some of this knowledge with the engineering education community.

PATENTS

A possible first step in commercialising technology is to lodge a patent application. The patent process is long and potentially very expensive. There is no 'international patent' so eventually patents must be applied for in every country in which patent protection is required. The expenses are partly made up of fees charged by national patent offices, but the greatest costs are associated with patent attorney fees and translation fees if applications are made in non-English speaking countries. There are now many web-based sources of information on the patenting process. For example, IP Australia (the Australian patent office) has a very useful web site [1]. This provides links to many sources of useful information such as the Patent Application Guide [2].

An invention cannot be patented if information about it is already in the public domain. This immediately creates a conflict of interest for academics. If you wish to patent your work you must lodge a patent application *before* you submit a paper to a journal or present your work at a conference.

Although patenting can ultimately be very expensive, it can be very inexpensive in the early stages. There are a number of stages in the patent process. Normally the first stage is to lodge a provisional patent application. The cost of lodging this is only $80 and the legal requirements on the content of the application are very simple. In Australian universities it appears to be normal practice to employ a patent attorney to prepare the provisional patent application, but in the United Kingdom it is common for academics to write their own. A patent attorney will normally charge a few thousand dollars to write a provisional patent. The date at which the provisional is lodged is your 'priority date'. If two people patent the same technique the one with the earlier priority date prevails. In practice a series of provisional patents may be lodged as further research reveals other aspects of the invention.

The provisional patent lasts for one year, at this stage either a PCT (patent cooperation treaty) application must be lodged or applications must be lodged in every country (the national phase). The main purpose of the PCT is to delay the expense of the national phase.

Writing a patent specification is very different from writing a technical paper. The words, and in particular the words in the claims must precisely specify the invention. To understand how difficult this can be, try describing a paper clip unambiguously in words. The specification must describe the invention as generally as possible. One cannot simply give one example and get patent protection for the more general case. A constant demand by your patent attorney is 'Can you generalise that?'

PCT applications and patents filed in many countries are now available for free on the web see for example [3]. Academics and others can now perform patent searches and obtain patents for free. Only a few years ago, performing a patent search could cost hundreds of dollars.

MAKING MONEY FROM PATENTS

The ultimate aim of patenting an invention is to make money by selling or licensing the patent. Large sums of money can be made from patents. License fees represent a substantial proportion of the income of some telecommunications companies such as Qualcomm (CDMA patents) and Texas Instruments. It is however very difficult for an academic to turn an invention into an income.

There are two main ways of commercialising a patent: license it directly to an existing company, or start up a new company.

In my field, telecommunications, international standards for communication equipment play a huge role in the value of patents. If a patented technique is included in a standard then everyone using or manufacturing that equipment must pay a licence fee to the patent holder. Anyone manufacturing CDMA equipment must pay Qualcomm. This means that rather than being based purely on technical merit the standardisation process is the subject of intense lobbying by telecommunications companies. In my case, even although PCC-OFDM would have provided a better basis for digital television, it was too late - the digital television standard had already been agreed. To make it profitable in emerging applications such as fourth generation mobile telephony will probably require a major company to champion it through the standardisation process.

Useful Sources of Information

A few sources which helped my understanding of the technology commercialisation process are available on the internet. *Managing Technology for Profit* is a complete book, written by an Australian [4] and available through a number of web sites. The Association of University Technology Managers (AUTM) an American professional society has a web site [5] which gives access to past copies of *The Journal of the Association of University Technology Managers*. These contain many relevant articles on

commercialising university technology. Thursby and Thursby [6] report on a survey of companies in the USA. Hsu and Bernstein [7] report on the result of case studies. A more recent source, directly relevant to Australia, is the proceedings of *Commercialise 2001,* an innovation workshop sponsored by the Victorian Government. At this experts from Australia and overseas took part in a number of workshops aimed at improving commercialisation of technology in Victoria. The proceedings summarise the findings.

A number of universities offer courses on entrepreneurship for example in Victoria, the Australian Graduate School of Entrepreneurship at Swinburne University runs a number of courses on entrepreneurship and innovation.

Licensing patents to existing companies

Licensing patents to industry is much harder than might be expected. First is the problem of finding the right person to talk to, next the problem of convincing them of the value of your patent, finally persuading them to negotiate a deal - rather than simply use your technology for free and wait for you to risk taking them to court.

Most universities have some form of technology transfer office responsible for commercialisation of technology. However research has shown that in the US at least, that a key factor in success is the role of the inventor. Commercialisation is much more likely to succeed if the inventor champions the cause [7]. Marketing by the technology transfer office was on average much less successful. So if you wish to make a fortune from a patent you will have to be prepared to put in lots of work on the commercialisation. You will find that the brilliant research was the easy bit.

I approached a number of large telecommunications companies who were active in OFDM research. A fundamental error that I made at first was to approach the company through researchers rather than at a higher level. Typically the engineers initially tried to convince themselves and me that my idea would not work. Once they realised that this was not true - arguments such as 'it is not in the standards' became more common. A better technique is probably to find out who is the research manager and make a direct approach to them. However this requires identifying the correct person. A contact at a higher level in BT (British Telecom) resulted in the patent being taken much more seriously, much more quickly, but BT is not an original equipment manufacturer so was never a likely customer.

My contacts with companies did however result in invitations to visit leading companies in UK and Canada, and although I was unable to sell them the patent, they may form the basis of future collaboration or research contracts.

Commercialisation through a start-up company

The second approach is to either start up a company yourself, or to find someone else who wants to start a company based on your technology. Hsu and Bernstein found that:

> "Individuals who took the initiative to organize a business around a technology were overwhelmingly the single most important factor for technologies successfully licensed to start-up firms. These entrepreneurs ranged from the inventors themselves to individuals who went to the TLO (university's technology licensing office) in search of technology in which to invest."

A number of would-be entrepreneurs approached me, however for various reasons I have not committed to that path yet.

FUNDING SOURCES

There are a variety of different funding sources available at different steps in the commercialisation process, although gaining adequate funding is difficult at every stage. The original research can be funded by a research grant. However research funding does not cover construction of prototypes or any of the costs associated with marketing the concept to large companies or with forming a start-up company.

I am aware of no current external sources of funding for the prototype stage. However *Commercialise 2001,* found that this was a critical hurdle in the innovation process and recommended that the Victorian Government

introduce such a scheme. As one of the main purposes of the workshop was to inform government policy it is likely that some scheme will be announced shortly. Thus the main source of support at this stage are what is known in the trade as "the three F's" - family, friends and fools.

Another possible source of support is from *Angels*, although they normally prefer to enter at a slightly later stage. Angels are private investors who are willing to invest capital in new entrepreneurial businesses [4]. They often have been successful entrepreneurs previously, and as well as providing finance may be involved in giving detailed advice during the establishment of the business.

Once you have a prototype some government sources of finance become possible, in particular the federal government COMET (commercialising emerging technologies) program [9]. *The Tailored Assistance Program* gives will provide up to 80% of the costs and up to $100000 assistance for 'strategic and business planning, market research, establishing a sound management team, intellectual property strategy, proven technology and a working prototype.' However in practice competition is so fierce that you must already have a working prototype to have any chance of success.

Armed with a business plan, a management team and a working prototype you can be begin to approach Business Angels and Venture Capitalists (VCs). Business Angels in general provide funding at an earlier stage and for smaller amounts than VCs.

THE PITCH

Before meeting with VCs or business angels it is important to have prepared your 'pitch'. In my case I gave an 'elevator pitch' at a B2B café meeting [10]. This is an event in Victoria designed to bring together different players in the commercialisation field. Attendees categorise themselves as 'investors', 'entrepreneurs/ innovators' or 'intermediaries' each group being identified by a coloured dot on their name tags. Investors are readily identifiable as the ones with the crowd around them. For the pitch I was allowed a maximum of two minutes (measured by a stop watch) - the time it takes in an elevator. Being an academic used to public speaking was an advantage. However the two-minute rather than 50 minute time slot requires some detailed planning.

Investors seem interested in the answers to only a few questions - the most important is 'what is the income stream?' the second is 'who are the team? the third is 'what is the exit strategy?' The questions that would immediately occur to engineers 'Does it work?' and 'How does it work?' are never asked. These are taken as given at this stage, though would normally be checked in the due diligence process before large amounts of money are committed. Investors are not interested in long term investments. The ideal investment is one that is built up within a few years and then either sold or listed on the stock market. At first the fact that their values and aims are so different from academia can be confusing.

GOVERNMENT SUPPORT OVERSEAS

In 2000 I had a stall at the Korean Technomart a biennial event funded by the Korean Trade - Investment Promotion Agency. This is designed to encourage technology cooperation between Korea and other countries. A number of Australian, mainly Victorian, companies took part and they were well supported by both the Victorian and Federal Government and by the Korean Trade Centre in Melbourne. Multimedia Victoria provided grants of $2000 to a number of us, and the Korean Trade Centre negotiated budget travel and accommodation so that this covered our expenses. The Australian Trade Commission in Seoul organised meetings with some appropriate companies and provided superb translation assistance at these meetings. The Austrade web site [11] gives useful information about doing business overseas.

In Korea, I made contact with a number of companies who were potentially interested in my work. A professor and his graduate student who was doing research based on my work travelled from Kwangju to discuss our research. This has led to some proposals for future research collaboration. I was invited to give a presentation to academics from Hanyang University.

CONCLUSIONS AND RECOMMENDATIONS

My experiences gave me a much better understanding of the current barriers to commercialisation - ranging from lack of understanding by academics of the commercialisation process to lack of funding for critical steps. In October 2001 the Victorian government sponsored a workshop to bring together a broad range of people with experience in this field. Workshops were designed so that together we could identify the problems and solutions. The proceedings of these workshops give a comprehensive explanation of the issues [8]. Here I summarise some that I thought most interesting and relevant to engineering faculties.

Many of the workshops recommended increased funding for university research - given that I was one of the few academic researchers present, I found this surprising. However it is generally recognised that university research is the basis which will underlie any technology development in Australia.

In general 'technology pull' works better than 'technology push'. In other words it is better to base your contacts with industry on consultancies and research contracts which address specific projects rather than to do the fundamental research without industry participation, and then try to commercialise it.

Sadly, some of the main barriers are still within the universities. The most effective and least risky way for an academic to make money from their research is still undoubtedly to publish the paper and apply for promotion than to attempt commercialisation. The chance of success in commercialisation is too small and within academia, in contrast to entrepreneurial circles, it is undoubtedly worse to have tried and failed than never to have tried. There is little understanding within academia of the commercialisation process.

Simple moves that universities could take to encourage commercialisation would be to recognise commercialisation effort, not just commercialisation success in promotion criteria. Provision could be made for 'commercialisation leave' along the lines of 'sabbatical leave'. Staff could be allowed periods of part-time work or unpaid leave in order to start up companies.

Although I have not yet 'made my first million'. There have been many positive outcomes. I have developed further industry and research contacts within Australia and overseas. I have a far better understanding of the perspective of industry. My research has been stimulated both by the patent attorneys urgings to 'generalise' and by the challenge of engineers in some of the companies to 'prove that it works'.

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