

**Australian Academy of Technological
Sciences and Engineering
(NSW Division)**

**Commercialising Innovation
*“The Second Step”***

**Edited by
Dr John Nutt, AM FTSE**

**Workshop Proceedings
Sydney – 10 May 2001**



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The **NSW Workshop 2001 - Commercialising Innovation - "The Second Step"**
was organised by the NSW Division, Australian Academy of Technological Sciences and Engineering, and held
9.00 am - 1.00 pm, Thursday, 10 May, 2001,
at the Function Room,
NSW Department of State and Regional Development,
Level 44, Grosvenor Place, 225 George St, Sydney.

The Workshop Organising Committee comprised Professor Peter Gray FTSE (Convenor), Dr John Nutt AM FTSE (Secretary), Dr Peter Jones FTSE, Dr John Sligar FTSE, Dr Susan Pond AM FTSE, Anne Howard, and Professor Trevor Cole FTSE, with Professor Rolf Prince AO FTSE, NSW Division Chairman in attendance.

Proceedings Editor: Dr John Nutt
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Disclaimer

The opinions expressed by the speakers in the presentations and discussions do not necessarily reflect the views of the Academy. The analysis, response and recommendations are those of the Organising Committee and have not been accepted nor endorsed by the Academy. They are published in the interests of stimulating debate.

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Foreword

Professor Rolf Prince AO, FTSE

The New South Wales Division of the Academy of Technological Sciences and Engineering took the opportunity of setting up a workshop to analyse and discuss Australia's record in commercialising innovation, at a time when we are seeing many benefits to the country from the successes, but also know that we have not yet realised much of our potential in this regard.

We selected half a dozen examples, to understand the driving forces behind the ventures, and the factors for success or otherwise; and the barriers which might be removed or the incentives provided, by governments or others, to make ourselves a more enterprising country.

That would lead us to some first recommendations to appropriate bodies. More generally, we knew we could only uncover the tip of the iceberg. We therefore plan to use the present experience, and the comments of the workshop participants and of the readers of this compendium, to make a wider and deeper examination of the issues here in the form of a National Symposium of the Academy, to be held in Sydney, November 19 and 20, 2002.

An account of Australia's endeavours in commercialising innovation, and of the issues involved, is in itself an appropriate and important task for the Academy. Behind that, the Academy's Fellows, as a group of technological scientists and engineers of achievement and standing, are ready to assist governments, Federal and State, and public and private enterprise, through the Academy or as individuals, in any further analysis or resolution of the issues presented here.

In conclusion, I would wish to thank the Workshop Chair and the presenters; the Organising Committee, backed by our National Office; and the New South Wales Department of State and Regional Development, for their encouragement, support, and provision of venue.

**RGH Prince
Chair
NSW Division
Academy of Technological Sciences and Engineering**

Executive Summary

Australian Governments have realised the importance of promoting innovation as a means of ensuring the continued quality of life experienced by Australians. Both major political parties are committed to funding innovation. The Australian Academy of Technological Science and Engineering shares these views and many of its members have successfully commercialised their inventions.

As part of its contribution to Australia's future, this Workshop was held. Six successful entrepreneurs spoke on the process of commercialising their technology. This was supplemented by a financial speaker and introduced by the Chief Scientist, an Academy member.

The common themes and shortcomings in commercialising innovation in Australia at present are identified. A number of key findings are outlined together with minimum cost solutions.

Excellence

It was recognised that excellence at all levels from research to registering intellectual property to commercialisation was imperative.

The success rate for projects with excellence in all aspects was recorded as having ten times the likelihood of success than for conventional projects. Excellence in research must be complemented by corresponding standards in developing intellectual property and commercialisation.

Government needs to identify excellence and smooth the path for selected organisations.

Reward

There is a lack of incentives in the process, ranging from rewarding researchers to providing incentives in commercialising.

Government and industry need to work together to allow excellence to be rewarded. For instance, in the case of tax options and equity, the law should be changed to tax when value is added rather than at the time of issue.

Facilitation

The success of an environment which facilitates innovation was a recurring theme. The multi skilling of the management team include finance, production and marketing aspects is important. Incubator arrangements and clustering were identified as means to overcome system dysfunction due to fragmentation of sectors. The Government has a role to play.

Foreign Investments

There are significant barriers to foreign investment in commercialising innovation.

There is a reluctance to accept risk by Australian investors that is

not shared by many international funding organisations. Simple changes to the Australian tax regime could unlock investment by such international organisations without incurring significant loss of tax opportunity for Australia. The largest potential investors are the United States Pension Funds that allocate a small but significant tranche of funds for early company development.

Seed capital

There is an extreme shortage of capital available at the earliest stage of development, the seeding stage.

Many promising organisations cannot pass the basic gap in the second step of turning innovation into a commercial success. Governments are committed to providing strong assistance to developing organisations. Some rearrangement of this funding would fill a gap in the present process at the seeding stage.

Globalisation

Effective commercialisation implies globalisation for companies to really succeed.

Government should review assistance programs for global market penetration by start up companies to accelerate their export ventures.

Academy action

The participants provided adequate feedback that the Workshop was a resounding success. The Academy will hold a two-day symposium to expand on this initiative in November 2002 in Sydney. The Workshop has provided valuable guidance for this event.

In addition the Academy is preparing a database of potential mentors from its ranks to assist in this process of accelerating and supporting the second step.

It is also considering what other actions it can take to assist prospective organisations to commercialise their innovations for the benefit of all Australians.

Issues, Responses and Recommendations

Issues Framework

In the interest of facilitating the debate, the Organising Committee have made a first pass at identifying the issues raised by the speakers. The issues framework following is a summary of the major points made, based on a first analysis (Appendix A) of individual comments and responses.

The ATSE is to hold a National Conference in Australia on 19 and 20 November 2002 in Sydney. As Professor Prince has said in his Forward to these Proceedings, the NSW Division would welcome comment from the Workshop participants and readers on the Workshop outcome.

Intellectual Property

- High quality IP (intellectual property) is essential.
- IP must be suitable for the market.
- IP resulting in paradigm shift leads to greatest rewards.
- Protection of IP essential.

Commercialisation

- A project champion is needed.
- The champion must be motivated and resilient.
- Good development planning is required
- Good business planning is necessary.
- Skilful multi-skilled management team including finance, production, marketing.
- Incubator arrangements support commercialisation.
- Alliancing and networking in Australia and overseas is important.
- Team and champions require rewards.
- Picking winners is necessary.

Funding

- Seed funding initiatives and sources require enhancement.
- There is a shortage of Stage 2 funding initiatives and sources.
- Venture capital climate requires facilitation and competition.
- Introduce overseas pension funds to widen funding sources.
- Develop mechanisms for government and/or institution to prioritise identification and support.
- Leverage funding from an established operating base.
- Support networking between financiers, business entities and start-ups.

Economic Climate and Culture

- Facilitate changes to community and the market's attitudes to risk.
- Enable commercialisation by supporting best opportunities (Prioritise winners).
- Amend Australia's tax climate so as not to penalise options and equity made before value has been added.
- Overcome system dysfunction due to fragmentation of sectors - research, business skills, financing, production, and marketing.
- Provide matching support for home development similar to other countries.
- Facilitate overseas expansion.

A page of recommendations follows:

Recommendations

(These Recommendations have been prepared by the Organising committee and do not necessarily reflect the policies or views of the Academy. They have been prepared so as to focus the outcomes of the Workshop)

Excellence

Excellence at all levels is imperative. Excellence in research must be complemented by corresponding standards in developing intellectual property and commercialisation. The success rate for projects with excellence in all aspects was recorded as having ten times the likelihood of success than for conventional projects. *The Australian government should be targeting performing companies and rewarding the creation of intellectual property and its commercialisation; (Bishops) Picking winners. In a small place like Australia, with the amount of catch-up and time required, Australia has to pick winners. (CHAMP). Government research organisations should nurture start-up companies..... the CSIRO provided special funding to enable research to be done in the wireless LAN area... (Radiata)*

Recommendation 1:

The Government should be willing to prioritise its support for companies and sectors (ie pick winners).

Recommendation 2:

Commercialising IP from the public sector should be encouraged.

Facilitation

Incubator arrangements and clustering should be facilitated. Multi-skilling of the management team to include finance, production and marketing skills early is important to overcome system dysfunction due to fragmentation of sectors. *There is a real and absolute need for incubators. (ResMed); Clustering is a very unpopular word at the moment, but we need some variation of that, where you drive people with mutual interests together and the potential benefits can help the very early stage venture process. (CHAMP); Redfern Photonics was created essentially as an incubator company. It has grown and now runs a number of operating companies, all of which source technology from the CRC. (Redfern)*

Recommendation 3:

Incubation arrangements and clustering should be encouraged.

Rewards

There is a lack of incentives in the process, ranging from rewarding researchers to providing incentives in commercialising. Government and industry need to work together to allow excellence to be rewarded. *This country has to reverse the brain drain. There is constant frustration for Australians who would like to come back... and Australia's offerings by comparison are, at minimum, tax-convoluted and at worst, tax-frustrated (CHAMP) Employee share ownership plan is very critical - the tax laws here are not good in that regard. (Bishops).*

Recommendation 4:

Australian tax laws should be amended to tax options and equity at the time when added value is achieved and not at time of issue.

Funding

The sources of funding should be widened, and be made

attractive to overseas investors. Simple changes to the Australian tax regime could unlock investment by international organisations without incurring significant loss of tax opportunity for Australia. Most of the world's venture capital, between 95 to 99 per cent, is provided by the US pension funds. Australia has had an embargo against that supply because their tax regimes and exemption (do not) travel with them. ... (overseas investment)... will bring international alliances and networking which will provide greater value to Australia's high growth companies. (CHAMP).

Globalisation

Effective commercialisation implies globalisation for companies to really succeed. Government should review assistance programs for global market penetration by start up companies to accelerate their export ventures. *The offshore incentives provided (by the German Government) were far in excess of anything that Bishop could have achieved here. (Bishops). Australia is still a great place to do research. It is not quite such a great place to do development. (Biota)*

Recommendation 5:

Australia should match its national competitors in incentives, tax holidays, and establishment of industries of national importance with overseas investments and technology.

Recommendation 6:

The Government should review the assistance programs for global market penetration by Australian high tech start up companies and see if it can be improved so as to match their needs.

Academy Actions

The Academy's Fellows, as a group of technological scientists and engineers of achievement and standing, are ready to assist governments, Federal and State, and public and private enterprise, through the Academy or as individuals, in any further analysis or resolution of the issues presented here. (NSW Division Chairman).

Recommendation 7:

The Academy should maintain a database of potential mentors from its ranks to assist in the process of accelerating and supporting the second step, and should examine the other actions it can take to assist prospective organisations to commercialise their innovations for the benefit of all Australians.

Recommendation 8:

The Academy will hold a two-day symposium to expand on this initiative in November 2002 in Sydney. It should include invited speakers from its allied Academies in other countries, (USA, Ireland, Finland, Canada, Israel, Malaysia etc) and seek Australian Government support to bring them to Australia.

Welcome by Academy Seminar Chair

Professor Peter Gray FTSE

(Professor of Biotechnology, University of NSW)

In his capacity as the Chair for the workshop, and on behalf of the Australian Academy of Technical Sciences and Engineering, Professor Gray extended a warm welcome to all.

OECD studies have estimated that as much as 50 per cent of the long term economic growth in advanced industrial countries is due to innovation, with a high degree of correlation between the wealth of countries, GDP per capita, and R&D expenditure per capita.

Many of the current indicators for Australia are disturbing. For example, Australia now ranks seventeenth out of 24 developed countries surveyed by OECD according to level of business expenditure on R&D.

The President of the World Bank has been quoted as saying that the Australian dollar's record low is due to the perception that Australia is an old economy with too little investment in new technology products.

In the field of biotechnology, the current per capital investment in companies is running at about one tenth of that of the US.

Against this background, the New South Wales Division of the Academy felt that it would be appropriate to showcase a group of companies that had been successful in commercialising intellectual property from Australia. New innovative companies are seen as the drivers in a knowledge-based economy.

This seminar is featuring a Group of speakers, each of whom has been closely involved with the commercial development of the company they will be discussing. In showcasing these successful enterprises, the speakers were asked to identify critical factors which mark the turning point to success for the company and to discuss hurdles that they overcame in developing from an Australian base.

The Academy believes that the speakers at this important workshop will identify certain areas, which, if addressed, could help smooth the way for the companies that follow in their footsteps.

Opening Address

Professor Denis Wade

Denis Wade has combined successful careers in both medicine and business. He has held academic positions at Oxford and Dartmouth and was a foundation professor of clinical pharmacology at the University of New South Wales. He has had extensive experience in commercialising innovation, both in the USA and Australia, and is currently Chairman and Managing Director of Johnson & Johnson Research Pty Ltd, located in magnificent facilities at the Australian Technology Park.

This is a unique experience for me - it is the closest I have ever been to being called a bureaucrat! On behalf of the State Government and the Department of State and Regional Development, I welcome you to this workshop. I guess when you look out the window you can see one of the reasons why we are still able to attract bright, innovative young people to work in Australia in circumstances that many would think are not all that competitive.

I am absolutely delighted that an august body like your Academy is thinking very seriously about how to commercialise innovation. In fact, you are joining a rapidly expanding cadre of thinking people in this country who are realising that as a nation, we must innovate and then commercialise those innovations, if we are to enjoy the fruits of our research base and our national inventiveness.

Only two nights ago I was at the Vice-Chancellors' Awards at the Australian Technology Park, where a very successful incubator exists and a marvellous co-operative venture between four of the major universities in Australia. It was a great joy to see the young scientists with a glint in their eye, being so proud of their achievements and this being recognised.

If we can only persuade a small percentage of the number of people who are now talking about innovation or seeking to sell their services and advice, to roll up their sleeves and do it, Australia may indeed have a rosy future. There may even be a chance that our children may find interesting and challenging careers in something other than tourism or hospitality.

I want to say one or two words about innovation. I realise that some may even find this offensive but, as an old academic, I know that it sometimes helps to say things several times. I want to say

what I understand by innovation because, as you hear this topic discussed, it is quite clear that people have different ideas.

To me, innovation means that you are providing a new solution to an unmet need or at least a problem or perceived need. It is not discovery; it is not high tech; it is not advanced science, but certainly all those may be exploited to be innovative. It is rather enough technology and the right science to provide an acceptable, practical and affordable solution to a real problem. And not only that, you have to deliver it at the right time. Some of my own heroic failures in this area have related to meeting most but not all of those criteria.

Let me disabuse you about some ideas some have of the importance of innovation in established industries. We hear a lot of talk of start-ups and building growth from new companies and ideas. But in my own company, which is the world's largest diversified health care company with sales of more than US\$30 billion per year, it is important to note that 35 per cent of our sales come from products that we have introduced in the preceding five years. That is important, but let me tell you that 100 per cent of the growth of profits comes from those products introduced in the preceding five years.

So it is not only important to innovate in order to grow but, given the mechanisms that operate in our capital markets, if you don't grow you don't survive. Because of that, the graveyards of the stock market and the coffers of merchant bankers and merger consultants are full, thanks to the companies that have not been sufficiently innovative.

What is the role of government? How can we, in bodies such as the Innovation Council, help? Does government have a role at all? Its first role, of course, is not to do things that make innovation difficult. I regard part of my role, as Chairman of the Innovation Council, simply to provide advice to government that often is "perhaps you ought not do this". But, of course, government can do many very positive things and it does try very hard to do that.

I spoke earlier of the Australian Technology Park, and I believe this is a very significant development. A very important coming together of four of the major universities in this country - three in Sydney and the ANU - and government to put together a technology park which, to this stage, I can say fortunately has not lost its vision and has remained true to its charter. At this point, the park is absolutely full and there is a waiting list for people to come there.

The Innovation Council itself has a statutory role to advise government on ways in which the State Government may facilitate innovative developments throughout New South Wales. Together

with the other actions of the Department of State and Regional Development, it operates right throughout the State and has regional outreaches.

The Council has a number of working committees or sub-groups in areas as diverse as regional innovation, biotechnology, industrial design, smart manufacturing, smart marketing, communications, doing what it can to not get in the way of the CRC program, and, most importantly, technology showcasing. Most of you are aware of the Australian Technology Showcase, which had its origin here in the Innovation Council in NSW.

The Innovation Council from time to time produces major reports or recommendations to government and, in recent times, the NSW Government has had recommendations from the Council in areas as diverse as technology incubation, access to the synchrotron facilities, biotechnology in New South Wales, as well as an ongoing contribution in the area of showcasing and facilitating access to trade shows, etc.

How can you learn about innovation? I am reluctantly prepared to accept that there may be some aspects of the innovative process or entrepreneurship that can be taught. But there is no doubt in my mind that the best way to learn about the innovative process is to do it. The second best way to learn about it is to learn from others who have either done it or tried.

Today you are going to hear from several, mainly successful, Australian innovators and I am sure you will hear much good advice and many things that are worth discussing. But I must say that this is not the group of people that I would have chosen to present to you today. The ones presenting today have all, more or less, been successful.

It is my absolute conviction that you learn much more from failures than you ever learn from successes. That is not simply me trying to justify my own heroic failures over the years, but certainly the one thing I can claim is that, from all those failures, I have learnt very significant lessons, and I try very hard not to repeat the mistakes the next time around.

It is said that the outrageous success of Silicon Valley is simply due to the fact that you can fail much faster there and more cheaply! It is also undoubtedly true that if you look at successful entrepreneurs in innovative technologies, you will find that most of them have risen from the ashes - often several times.

So the characteristics of those who do succeed in this business are to some extent definable. They are people with a dogged

determination, with infectious enthusiasm, clear understanding and a single-minded focus on the end-game. The end-game is not, by the way, getting a grant or some other form of largesse.

The end-game is a product that works, that is on the market and is successful. These people also know the key hurdles - what is the critical path, which hurdles do I have to jump over and which can I dodge? They ask why not, rather than why. Or more often than not they do not ask at all, they just go and do it. They embrace ambiguity and they never seek to rediscover the wheel. Above all, they enjoy the game.

In my experience the successful ones are always focused on a single product opportunity. This is one aspect of the CRC program, for example, that has always worried me.

No one ever succeeds in commercialising an innovative product, either within a big industry or in a start-up or in any other way, unless there is a champion. That champion has always been battered and bruised and has always had negative input from their peers and their superiors.

One final comment: Timing is absolutely critical in the innovative process. There is an enormous difference between first and second prize in this game. In fact, in most cases there is no second prize. It can be just as fatal to be too early for the market as to be too late.

A great friend of mine started a company in Florida to provide home intravenous infusion therapy. He was spectacularly unsuccessful and the business went belly up. About two years later, there were three or four companies with exactly the same business plan and they were outrageously successful and became darlings of the stock market. My friend had the need right; he had the perceived answer correct; he simply got the timing wrong - he was a bit too early.

So, in order to be successful, you have to understand what the value adding steps are and where you are going. You have to understand how to capture the value and what are the rules of the game. I could tell you about one or two successes we have had, but I don't think you would learn much from them. But sometime later, perhaps, I will tell you about some of my failures. They have been great products, great bits of science, but they were still commercial disasters.

Keynote Address

Dr Robin Batterham FTSE

Dr Robin Batterham was appointed as Chief Scientist of Australia in 1999. During that time, Dr Batterham has had a major impact in a relatively short period. His report into Australia's science, engineering and technology, *The Chance to Change*, demonstrated the extent of Australia's failure to support national investment in R&D in comparison with OECD countries and set out strategies to rectify the deficiencies, many of which have already been picked up. Dr Batterham has had distinguished success in research and technology in both the public and private sectors.

I would like to make a few background comments leaving questions primarily - I am not going to try to pose answers - and certainly leaving a challenge, which I will come to fairly quickly.

Given the territory we are on and the magnificent view from this venue, I have to start off by quoting Premier Carr on the staging of the Olympics. He said: "The old Australia could not have organised the world's biggest event. Only a new, smarter Australia, with its competitive, open and tolerant social milieu could have carried it off so well. A new smarter Australia." And that, of course, is very much what we are on about and is the theme of today.

I will make only one comment about the innovation package and its roughly \$3 billion of initiatives. The point has already been made by Professor Wade, so I will not hammer it, but you need innovation in your existing competitive industries just as much as you need to grow the new. It turns out that the science base, the type of things that you do, the financing that is needed and the commercial nous and so on is roughly the same, whether we are talking about keeping the old and growing it even more in its world competitive position, or developing the new industries. You do need both.

Yesterday (9 May 2001 at the National Press Club) I issued the timely reminder that I have used before: if you look what several countries, not just one, have done in 10 years in increasing their R&D from roughly 1-1/2 per cent of GDP, up to 3 per cent - with the assumption that it is connected and that the financing and the commercialisation and so forth are happening - you see a GDP increase, based on OECD estimates, of roughly 15 per cent. That is not a bad sort of target, and it does give you the order of magnitude of what we are talking about.

I want to say something about excellence, because there is no doubt that we have a lot of excellence in science, engineering and technology in Australia. The study that we did in working up the package looked at the relationship between the quality of the science and its subsequent commercial impact.

I want to make three points:

- First, the top one per cent of science in some bioscience areas had nine times the chance of being utilised in subsequent commercial activity as the rest - nine times the chance!
- Second, in the commodity industries - and I can speak with a little bit of authority wearing a Rio Tinto hat - the study that we did showed that the companies that were more active in technical innovation and had better science behind them had 30 per cent better market-to-book values. If I were to rock into my board and say: "I think I can deliver you a 30 per cent increase in market value of the company", they would sit up and take notice. That is the track record in that area.
- Third, I turn to the dreaded bubble of NASDAQ in the last year and the fall. There is a patent out on how you can look at the science behind companies such as the ones that you find in NASDAQ. There is a patent that analyses the strength of science. If you take the results quoted in that patent - and I am not trying to sell it too hard - they showed that those companies that had top class science behind their innovations sailed through, and did not suffer the NASDAQ decline that most saw. That is an interesting result.

Now, the challenge: If you look at Australia's performance in terms of the number of start-ups and spin-offs over the last few years, and the amount of licence revenue that comes out of every hundred million that we spend on R&D, you will find that it is not bad. There are definitional things there, but it is actually on a par with the North American average. But I am sorry to say that you will find that in the top 11 American universities, or the top five Scottish universities, the level of commercial activity that resulted from R&D was five to 20 times higher than the Australian average.

So the challenge that I put is not one of self flagellation for those who are in the industry, as I am; rather, it is one of saying, "There is a benchmark out there that says we have a factor of 10 on performance; how are we going to make it happen?" We can listen to the successes; we can listen to the failures; but just keep in mind the size of the challenge.

We have some fantastic stories that we are going to hear about this morning. But the fact that you can recite them on the digits of your hands for the whole country for the last 10 years or so, instead of

having to be a Barry Jones with a photographic memory to have them all there, says that we have a factor of 10.

In terms of the value of early stage development and invention, we have some unrealistic expectations. In commercialisation, we really have to think about culture, undergraduate education, incentives and pre-seed funding. In the commercialising process, we don't actually have much in the way of access to nous - real commercial nous. It is there, but I don't think we have anywhere near enough of it available. If I had to point to one area in some of the commercialising arms and activities that I see that would really worry me, I would pick that one.

In culture, the comment on failure has already been made and I endorse it. I notice that we, as a nation, still have the habit - perhaps it is because of some of the statues that universities operate under - where the slightest hint of failure involves a massive witch-hunt, banner headlines, people being pilloried, court cases and the like.

I am not advocating freewheeling to the point where you arbitrarily declare yourself bankrupt this morning so that you can avoid paying your gas bill. Of course not, that would be absolute nonsense. But the way we tolerate failure is something that is a little peculiar, if we are going to be competitive in sharing risks and benefits. So there are a few cultural issues.

Undergraduate education: I commented yesterday at the National Press Club that there should be some strong changes to the way people are educated and the way they think. I would hope that any science, engineering, bioscience or medical science graduate could read a balance sheet and could understand at least the rudiments of how you finance a development and take it through to the market. I hope that it would be regarded as almost criminal to produce a graduate who could not do that.

I would hope also that no faculty of business administration or business studies could produce an MBA without that student having at least trawled through, as a major project, the faculties of science, bio-anything or medical, looking for a project that was coming out of research and doing, as part of their MBA, the market plan, the business plan and the development plan to take that product to market. Then if, instead of only receiving gongs and the university medal for the best student, they also got \$50,000 in cash to go and try it, as per the MIT scheme that has been running for some years, we might get some results. Enterprise in schools is similar - you have to start fairly young.

Personal incentives are very important. I do not like the notion that we have in one or two of our government-funded research agencies

at the moment that you cannot give personal rewards to individuals on account of that being unfair to those who work for the public good area, because they cannot get rewards of a similar nature. To that I say just separate the work out so that you can reward people at a personal level. It doesn't have to be with cash or options - although those two aren't bad for starters.

The ability of people to move: much more flexible arrangements are needed for people to move between R&D, consulting, company leadership and so on. When I left the public sector to join the private sector, the flexibility was there to the extent that I was sent off on leave without pay, which was fine, but which had some peculiarities to it. What I am looking at here is much more flexible arrangements and even having people with feet in both camps.

Employee share ownership needs tackling. I could elaborate on that, but I think many of you are already well familiar with the issues.

Finally, in pre-seed funding, it is very important for us to get a much better culture going where we are looking at, in terms of commercialising gateway-type processes, where one of the first moves is to go out to find a champion in the marketplace, to at least bring market sanity in at an early stage. There is plenty of private equity around, I would argue, of one sort or another, but the financial vehicles to target pre-seed funding are a bit light on.

I did propose to try to pull several of these things together into things that I called "innovation centres", but that didn't go down too well because a lot of people felt threatened by it. But I would still argue for this bringing together of commercial nous, finance, ability to find the champions in the marketplace and do deals, and to do all that in a trusting environment with the researchers.

But how you stitch all that together is still a significant and important challenge. I am not going to debate it, but I do ask the question. Finland, Singapore, and a good few others have pretty targeted investment in such areas. They don't call it "picking winners"; they just talk about "enabling commercialisation".

So, no clear answers, plenty of questions, and I would like to finish by reiterating the challenge. There is a factor of 10 as a minimum that we can go for, so how are we going to do it?

ResMed Inc.

Professor Colin Sullivan FTSE

Professor Colin Sullivan is a medical researcher who has been involved in the formation of a successful company based on his own research. The company, ResMed, has now grown to a market capitalisation of more than \$3 billion and is listed on both the New York Stock Exchange and the Australian Stock Exchange.

Professor Sullivan's early work on obstructive sleep apnea led to his personally filing the first patent. This resulted in the formation of ResMed in association with Peter Farrell. Professor Sullivan still leads an active research centre at the University of Sydney, the Australian Centre for Advanced Medical Technology (AMTeC) and maintains links with ResMed as head of the company's scientific advisory board. AMTeC now operates as an incubator to assist in bringing medical advice technology to market.

History

ResMed had its origins 21 years ago in Professor Sullivan's lab at the University of Sydney where the experimental and technical development occurred, and later within Prince Alfred Hospital and other areas where he conducted the clinical testing.

Today, ResMed is Australia's largest medical device company employing approximately 900 people worldwide, with 600 located in Australia at North Ryde.

Professor Sullivan's initiation into obstructive sleep apnea occurred during the 1970s, when he and his mentor at the time, Professor David Read, applied for a research grant from the Asthma Foundation. At that time the disease was thought to be extremely rare – so much so that their application was rejected on the grounds that it was not considered to be worth the money. His first lesson therefore concerns the need to have a very high tolerance for repeated failure.

Today, we know that the disease affects approximately 10 per cent of all adult males. Half of all stroke victims have it; it is a key part of anyone who is in a ward for respiratory failure; it is a part of these syndromes and it is a risk factor for vascular disease. It is also part of the mechanism causing atherosclerosis.

ResMed is Australia's largest medical device company employing approximately 900 people worldwide, with 600 located in Australia

To be successful, people need to have a very high tolerance for repeated failure

The problem extends from ordinary snoring, which is very common, to absolute closure of the upper airway when the blood oxygen falls. Obstructive apnea can result in death.

In severe cases, tracheotomies were performed, where a hole is cut in the throat to leave it open at nighttime. However, Professor Sullivan decided to try an experiment that provided positive pressure as a backing pressure to keep the airway open, and it worked on the first patient.

Professor Sullivan tested five patients in the first year and published the results in The Lancet on 18 April 1981

Professor Sullivan tested five patients in the first year and published the results in *Lancet* on 18 April 1981. Although the treatment device, called nasal continuous positive air pressure (CPAP), began as an individual product, it rapidly turned into a family of products. He had about 100 patients on treatment at home in the first few years.

Commercialisation process

The first commercial device was made in the US by Respirationics following publication of Professor Sullivan's work. Respirationics has been the major competitor and at one stage tried to convince the Australian team work with them. Professor Sullivan rejected the offer as he was keen, together with the University, to try and have the commercialisation occur in Australia.

At the same time, a French company called Sefam was started by Professor Pierre Sadoul, who had spent a year with the researchers in Sydney. Sefam had widespread exposure from a commercial point of view.

The early devices that Professor Sullivan made resembled a vacuum cleaner in reverse and were quite amusing provoking many disparaging comments (and were described by one medical colleague as "a rubber hose up the nose!"). Despite their appearance, however, there were more than 1,000 devices in practical use over a period of 10 years.

In 1986 Professor Sullivan, the University of Sydney and the Baxter Centre for Medical Research met Peter Farrell – who decided to take the company on

It was 1986 before commercial activity in Australia commenced with the company known as ResCare. Professor Sullivan, the University and the Baxter Centre for Medical Research met Peter Farrell, who decided to take the company on. It was touch and go, as within 24 hours Dr Charles Barnes came back to the University and indicated that there was a problem with the date and timing of the patent. Peter Farrell and his team could have walked away from the deal. Fortunately, they did not; however the problem with the patent led to a less than ideal arrangement with the University.

The first device was launched by ResCare in 1989. Although a number of improvements had been made to the product between 1986 and 1989, it still used the original masks made by Professor Sullivan.

The next generation of products being produced by the company are machines which contain a cerebral cortex which is an intelligent auto setting device. The cerebral cortex belongs to Professor Sullivan's first PhD student, Michael Berthon-Jones, who is now a senior research director in ResMed.

Difficulties faced

It was difficult to attract investment as no-one was interested in a one product company

There were many difficulties that had to be overcome in the path to commercialisation. In the early days, it was extremely difficult to attract interest in ResMed with potential financiers repeatedly turning their backs on the opportunity. In the main, the reasons related to the fact that ResMed was principally a one-product company, and no-one was interested in investing in a company that only had one product.

There was also the added problem of awareness, as people lacked an understanding of the potential dangers of obstructive sleep apnea. Instead, people found the disorder somewhat amusing with Professor Sullivan gaining a reputation as the "world's snoring expert". Indeed, the product (CPAP) played a crucial role in identifying and opening the whole area.

Following the formation of ResCare in 1986, Professor Sullivan continued to improve the product. However, with every year of success the Professor seemed to have greater difficulty in attracting support, both within the university and the hospital. In fact, his centre at Prince Alfred Hospital was closed down three times. On each occasion Peter Farrell and Professor Sullivan fought to have the centre reopened by pointing to the work they were doing.

Even today, Professor Sullivan believes that it would be difficult for him to attract the support needed to do it all again.

Yet when ResCare, or ResMed, listed on NASDAQ in 1995, it raised US\$24 million. This enabled ResMed to erect a purpose-built, state of the art R&D building and to employ a large number of people. Today, many of Sullivan's PhD and clinical trainees work for ResMed.

When the company listed on NASDAQ in 1995, it raised US\$24 million

Since the company's listing on NASDAQ and then on Wall Street, 24 successive quarters have met or exceeded projections, including the current year. The net income for the last quarter has been

extraordinarily successful. ResMed now has 49 percent of the American market and 42 percent of the European market.

Today, there are two players in this field: one is still Respirationics, however, the other is ResMed. There is a huge difference between the two. Figure 3 shows the R&D spending of Respirationics and ResMed. In the early stages, Respirationics could have squashed ResMed, except that ResMed spent more on technological development than Respirationics.

In the beginning, the idea of ever creating a company such as ResMed was beyond comprehension

In the beginning, the idea of ever creating a company such as ResMed was beyond most people's comprehension. Not only that, the mere idea was thought to be quite ridiculous. In reality, however, the lack of interest by potential investors combined with the complete lack of understanding of what 'could be' actually assisted ResMed to become established in Australia.

Critical factors

Firstly, the research base is critical to success. Professor Sullivan's group has always led this field of research and they are the people who are quoted when anyone talks about sleep apnea and sleep disorders.

ResMed took advantage of its credibility to seed markets by attracting the best researchers from Sweden, Germany and the US to come and work in Australia. In turn, doors were opened for the ResMed executives to go to those countries. There is no doubt that this was extremely important early in ResMed's history and it is being maintained by the presence of an active international medical advisory board.

Incubators allow scientists to be surrounded by people who can support and assist them in the process of commercialisation

There is a real and absolute need for incubators which can take research outputs with potential commercial applications and add the currently missing ingredients for investment. Incubators allow scientists to be surrounded by people who can support and assist them in the commercialisation process.

Finally, intellectual property is crucial to success. In ResMed's case, the original patents, although partly flawed, enabled ResMed to keep Respirationics out of Australia for approximately five years. This was enough time to enable ResMed to start selling and establish an important base in the US.

Bishop Technology Group Ltd

Mr Bruce Grey

Mr Bruce Grey is the Managing Director of Bishop Technology Group Ltd. Mr Grey has extensive experience in devising strategies to market Australian designed and manufactured products and technology in difficult and competitive international markets. Bishop Technology has proven successful in their approach to marketing innovation.

Bishop Innovation is the business unit that actually teaches the process of innovation

The Bishop Group has four business units, two of which are engaged in commercialising technology. Bishop Innovation is the business unit that actually teaches the process of innovation. The concept came from the founder, Dr Arthur Bishop, who has always passionately believed that innovation can be taught. Bishop Innovation has formulated a process to teach the younger engineers joining the Group.

In a period of six years, Bishop's staff has grown from 32 people to 230. One of Bishop's young PhD students, who went through the Bishop Innovation learning process, created technology that was actually being used in Ford cars in Detroit before he had completed his PhD. This story illustrates the power of teaching the innovation process and also the speed at which intellectual property and intellectual capital can be commercialised.

The key to starting the process of developing innovation is to create the intellectual property

Bishop's process of developing innovation is to appoint a project champion. It is essential to have someone who lives and breathes the technology. The person revisits the product technology, reviewing all the prior art. Often further strong patents, particularly in the process area, are created, while new patents are added. The whole process starts by creating the intellectual property.

Bishop's typical business model had been to appoint non-exclusive licensees around the world, who would then take the technology and commercialise it. One of the problems with this process, as a business model, was that the licensees typically tended to hold Bishop at arm's length because we were more than likely licensing their competitor. This model began to disadvantage Bishop in terms of learning more about their own processes as they were put into production.

Turning failure into success

Re-visiting failure can lead to success

The Bishop Group owns in excess of 500 patents, and Bishop technology is put on one in five cars made every year around the world. The company's oldest technology and one of Arthur Bishop's early inventions was variable ratio. It became clear, however, that the company was actually failing with this technology. Bishop decided to revisit it.

Chassis engineers are trying to reduce the steering wheel turns, lock to lock, in rack and pinion systems. Problems arise with the constant ratio teeth to the point where, on centre, the vehicle becomes very twitchy. When driving at high speed with a small number of turns lock to lock and a constant ratio rack, the vehicle can shift for a small movement in the steering wheel, making it unsafe.

Arthur Bishop invented the concept of narrowing the ratio on centre to take out the twitchiness, and then opening up the ratio at lock to assist with parking. This is fundamentally variable ratio.

Although Bishop had a very good collection of product patents, they had not developed a sound process for making this product. The only viable methods were all forging processes – cold, warm and hot forging.

The advantages of warm forging are that it is an extremely cost-effective process. It is referred to as net-shape forming. When the rack comes out of the press, there is no further work needed on its tooth section. The only additional work is to finish machining the shaft. It is therefore a very fast process.

Bishop had originally signed up a licensee in 1979 in Europe and at that stage did not have the process patents. That licensee developed their own process technology, which was cold forging. Although Bishop did not agree with that particular process, they did support the licensee. That licensee, in turn, signed up a sub-licensee, Mercedes-Benz Steering, which is a wholly owned division of Daimler-Chrysler.

Unfortunately, Mercedes' experience with the cold forming process was not very satisfactory as they found it very difficult to commercialise the technology. By the time they contacted Bishop, Mercedes was not a happy customer. This turned out to be a key success factor in taking failure and turning it into success.

Bishop had strong patents, so they proposed a joint venture with Mercedes-Benz Steering

Bishop had strong patents, so they proposed a joint venture to Mercedes-Benz Steering, rather than simply licensing the technology. After much consideration, Mercedes finally agreed.

Bishop was able to learn more about the technology because of the sharing of information with their JV partner

The great advantage of the joint venture was that it enabled both parties to openly share information. In the process, Bishop discovered that their prime licensee had actually charged Mercedes-Benz a royalty that was significantly higher than Bishop's royalty to them. This 'eye-opener' assisted in future pricing of the technology. Bishop also learned many of the shortcomings of the cold forming process, which highlighted the advantages they had with the warm forming process.

Funding the joint venture

Bishop was not sure how it was going to fund the joint venture with Mercedes-Benz. In fact, at that time, the joint venture was a bigger investment than the net worth of Bishop.

The total investment was \$43 million. Bishop raised \$38 million in finance from Industrie Kreditbank in Germany. The company was able to secure the finance on a 10-year term with fixed interest at 4.95 per cent and a two-year principal repayment holiday. Bishop also secured a state of Saxony Anhalt guarantee, so the state guarantee basically underwrote the investment which eliminated any downside risk in the investment.

Bishop had to provide upfront funding of DM2.75 million (A\$2.3 million), DM751,000 (A\$625,000) as equity and DM2 million (A\$1.67 million) as a shareholder loan. They approached Deutsche Bank for a loan. In return Deutsche Bank asked for security. As Bishop could only offer its intellectual property, Deutsche Bank insisted that they secure a guarantee.

A guarantee from EFIC costing Bishop \$50,000 enabled them to leverage into a \$43 million investment

Bishop approached EFIC. At this stage, EFIC was uncertain as to whether the Bishop request fitted their charter. After an examination of their charter, however, EFIC agreed to provide Bishop with a guarantee. The guarantee cost Bishop \$50,000 which enabled them to leverage into a \$43 million investment for a total upfront cost of \$50,000, without any downside risk in the investment.

Bishop received a great deal of support from the German government in finding a facility. Costing DM250,000 (A\$210,000) a 12,000 square metre factory was located just south of Berlin. Some work was required to clean and make it ready as it was in fairly poor condition.

Bishop signed the letter of intent with Mercedes-Benz in 1997 and in the following year the joint venture agreement was signed. In 1999 the facility was opened.

First test

The heart of the technology is a forging cell, which incorporates a 1,000-tonne screw press. The first rack to be produced was for the current C class Mercedes-Benz. There was a very tight deadline on that release. During this period, Bishop had to contend with a degree of scepticism on the part of Daimler-Chrysler with many people doubting that it was achievable. Fortunately, they did achieve the schedule, and even had one month to spare.

A key success factor is having an extremely good project team

A key factor in achieving the schedule was the extremely good project team. The team was made up of half Australians and half Germans who all worked together very cooperatively.

Greatest difficulties

The three greatest difficulties that had to be overcome included ensuring that the facility opened by October 1999; ensuring that they could deliver on their promise of the 12-second cycle time for producing the rack; and, bringing new customers to the facility. In the beginning, Mercedes-Benz volume was insufficient for the capacity of the facility. Therefore, additional orders were secured from the Ford Motor Company, SAAB and Fiat.

The facility has been so successful that a second forging cell has been installed. Negotiations are currently under way with a Japanese customer. A third facility is inevitable.

Lessons for Australia

Australia has an extremely competitive cost structure, however, it is also very remote from the major industrial markets.

While exporting is feasible, the offshore incentives provided by the German Government in this case were far in excess of anything that Bishop could have achieved here. The incentives enabled a facility to be built right in the heart of Germany. This contributed to the winning of further business and also to the signing up of more licensees. Since building the facility, three new licensees have been signed - two in Japan and one in America. As a result, the process technology is being taken up a lot more quickly.

German labour is very expensive. For example, in the old East German states, labour costs are approximately 15 per cent higher for a C N C machinist than in Australia. However, with the state government guarantee and investment incentives, it makes the decision to locate the facility in Germany straightforward.

It is widely believed that a dollar invested in R&D has a very effective payback. The key factors are the creation of intellectual property, the creation of the patents and the know-how, and the protection of the patents.

General remarks about where Australia rates in terms of R&D expenditure to GDP do not really serve any purpose because in the past a lot of Australia's R&D was not really R&D; it was more like application engineering.

The Australian government should be targeting performing companies and rewarding the creation of intellectual property and its commercialisation

The Australian government should be targeting performing companies and rewarding the creation of intellectual property and its commercialisation. For example, by targeting performing companies that have applied their intellectual property, such as ResMed and Cochlear, it is possible to see that the returns are there.

The government should also be encouraging multinationals to undertake their R&D in Australia

A further factor is to ensure that in addition to Australian companies, the Government should also be encouraging multinationals to undertake their R&D in Australia, to own their intellectual property in Australia and to ensure that the profits earned on the creation of that IP are reinvested in Australia.

Summary

The key factors for achieving successful commercialisation in Bishop's experience include the following:

- developing a matrix of both product and process intellectual property;
- developing a strong collection of patents around a core technology;
- continuing to add to that patent base. Having the IP puts one in a very strong negotiating position with both customers and partners; and
- establishing a presence in the market with adequate support services.

Redfern Photonics Limited

Professor Mark Sceats FTSE

Professor Mark Sceats is Director of Redfern Photonics Limited and CEO of Australian Photonics Cooperative Research Centre (CRC), the largest CRC established in Australia to date. Professor Sceats is a distinguished researcher, having held positions at the University of Chicago and the University of Sydney before moving to establish the CRC.

The Australian Photonics CRC currently coordinates over 90 per cent of Australian research and development in optical fibre and photonic technology. The CRC, through Redfern Photonics, has generated a large number of spin-off companies to commercialise discoveries and technologies.

Photonics is the use of photons, the fundamental particles of light, to transmit, process and store information. Photons can therefore carry out the same processes as electrons do in electronic circuits. However, photonics lags behind electronics in terms of integration of functionality – electronics has had its integrated circuits in chips for 30 years whereas photonics is just beginning to make the transition to integrated photonic circuits.

Origins

The driver for photonics is communications link capacity - in other words, using photons in transmission. One hundred years of evolution of link capacity in communications focuses on the growth of the copper network, then microwaves, and so on. Every now and again there is a paradigm shift.

The first paradigm shift signified using optical fibre. In 1992 the CRC began researching wave division multiplexing technology. Researchers have learnt to put hundreds of wavelengths of light down the same optical fibre, thereby achieving another large enhancement of the capacity.

The timescale and timing is everything. The serious activity started in 1989 when OTC and the University of Sydney got together and formed the Optical Fibre Technology Centre at the University of Sydney. That was the beginning in Australia of large-scale research collaboration.

Industry partnerships were an essential ingredient for the foundation of the CRC

Simultaneously, at the University of Melbourne, Professor Rod Tucker was lured back by Telecom, OTC and the University of Melbourne to set up a research centre there. Those centres essentially came together, with the ANU and UNSW, to form the Cooperative Research Centre.

The CRC was formed by people who had a view that collaboration and interaction with industry was their *raison d'être*. Initially, the CRC had 10 participants. This increased to 20, and today, it has 29 participants. These include manufacturing companies as well as organizations such as Macquarie Bank and venture capitalists A&B Investments.

The CRC has been and is the driver for the innovation. The universities and DSTO are the places where the innovation occurs for the CRC and where the research is done. The CRC is also very involved in vocational training issues, and therefore TAFE is involved, as is AEEMA, the industry association.

Some companies have grown out of the CRC activity, either from activities that have promoted the intellectual property or by the students going off and forming companies in their own right, and then returning as participants.

The CRC structure

The CRC focuses on R&D, education and training and commercialisation

The CRC structure is very complex. In the main, however, it is a partnership between government, industry and research organizations. Every activity that the CRC undertakes always considers three areas, namely the R&D, education and training, and commercialisation.

As the CRC has such a large number of participants it was decided to create one company with the sole right to licence the intellectual property arising from the CRC. This company is called Australian Photonics. It invests both cash and intellectual property in start-up companies. In this way the CRC has created quite a lot of paper wealth at this stage.

Redfern Photonics was created essentially as an incubator company. It has grown and now runs a number of operating companies, all of which source technology from the CRC.

The Photonics Foundation is the last step in the process. The idea is to move the wealth created in start-ups to a foundation that will support research and education in photonics in perpetuity. In the US, the critical thing that creates the powerhouse in the university system is access to multiple sources of funding. The Photonics Foundation will provide that.

Strategy

A priority has been to change the research culture

It took Taiwan 20 years to establish its micro-electronics industry. So we have given ourselves 20 years to develop a Photonics industry in Australia. Redfern are about half way through, and it has to be said that the first eight years were about changing the research culture –

- trying to get our universities to be flexible in the way that they dealt with the opportunity
- to form structures which allowed risks to be taken without getting the universities deeply involved at that level
- getting industry to be aware of the opportunities for them - even for large companies - in having spin-off companies as the mechanism for the commercialisation of intellectual property.

There was very dense and deep networking between existing players in Australia and these new start-up companies.

Redfern are now in the phase of industry development and boosting market share. Today the photonics industry in Australia exports in excess of \$1 billion. That is quite a significant contribution. The first spin-off company is now exporting well in excess of \$100 million of product a year.

The target for Redfern as a CRC - and this is a key thing - is that if they wish just to maintain the market share in this rapidly growing industry that Redfern had in 1996 when they did an industry survey - that is, around 1.1 per cent of the global market in photonics - they will have to create 18,000 new jobs. That means a lot of training and research activity - and that is just paddling to keep their place.

The Redfern Photonics Group of companies

▪ Indx

The Redfern Photonics group of companies arose from funding the CRC raised from the sale of its first spin-off company, Indx, which we formed in about 1995 to commercialise some technology. It was difficult then because it was a project to develop a product for which a market did not quite yet exist. Redfern could see it coming, but could not really easily talk to the investment community or anyone else sensibly about that.

Government financial support through the CRC program was important for success

The Government was "brave and courageous" in the sense that the CRC program, through its mysterious ways of operating, allowed Redfern to borrow the research money two years in advance to invest in Indx, provided that they paid them back in two years' time. They accomplished that, but accomplished it by selling Indx. Redfern got a factor of 10 return on investment.

Redfern had invested about \$490,000 in Indx and the net profits well exceeded the factor of 10 when they sold it. The company was sold with six people; it now employs more than 300 in Ryde. The Prime Minister opened their second factory a couple of months ago. It is well on its way.

- **Fasten Photonics**

Redfern used the money from selling Indx to fund Redfern Photonics, and a number of companies, including Fasten Photonics in China in which Redfern has a 30 percent equity. It has a plant that will be operational in about two months. It has had investment from Chinese capital in excess of \$40 million. It will be a significant venture.

The reason Redfern are in Fasten Photonics is that one of their students always wanted to go back to China. They worked with him for years, sending him to host delegations and doing all those sorts of things. He brought the opportunity to Redfern because he went back to his home town on a visit and mentioned what he was doing to his former high school teacher who had risen in the political ranks there. The teacher said,

That is interesting. The largest company in our town has just broken off negotiations with a very large manufacturer of fibre because they were never actually going to transfer their technology to us - it was to be a sort of turnkey factory

One thing led to another, and now Redfern have started that venture.

- **Redfern Fibres**

The University of Sydney said that when Redfern started making fibre in 1992 they could sell a little bit of it as long as they didn't embarrass the university, which they didn't, and they kept it below a certain level, which they did. So timing is everything. At an appropriate time Redfern formed the company, Redfern Fibres, which is now Nufern International. It is now opening up its second plant in Connecticut.

Why manufacture in the United States? It was simply that key people were becoming detached from some larger companies and they were going to form a company which would become a competitor to our company. So Redfern realised the best thing to do was to create an operation in the United States and grab that talent as quickly as they could. That is the history of Nufern.

- **Technology platform companies**

Redfern has a number of technology platform companies - Redfern Polymer Optics, Redfern Integrated Optics, Redfern

Timing is everything!

Technology is a critical driver

Optical Components. They are all at the very hard components manufacturing end. Everything that has been said about intellectual property is really important there. The success of those companies really relies on their intellectual property portfolio.

These companies collectively have probably licensed about 20 or so of the CRC's patents. The first six months after that licensing event, those companies invested a lot of money, putting patent portfolios around those core patents. So each company is engaged in a process of submitting roughly about 80 patents each at present. Therefore technology is king in this Photonics game at the moment.

- **Redfern Broadband Networks**

Redfern Broadband Networks is a networking company that is actually making boxes that can provide gigabit capacity. It will be taking orders in a couple of months. It is launching its big product at the big international trade show, Supercom. Twelve months ago that company had about five people in it; it now employs more than 120. So there has been very rapid growth.

- **Redfern Interlink**

When Redfern people were in the United States talking to investors and companies interested in Redfern Broadband Networks, the point they made was: where are your domestic reference sites for the products from this company? We thought, "Oh God!" so we came back and started a company called Redfern Interlink, which has the mandate to roll out networks and test beds for generically Australian companies, but particularly for Redfern Broadband Networks. It is an essential part of this kind of industry capacity.

Looking ahead

Growing the team of people within Redfern Photonics been absolutely vital

While the CRC may create some bits of intellectual property, it really is the bringing in of talented people from the world of commerce, with all their experience and back pains from failures, that is really important there. That is why Redfern Photonics has a capacity there, because it can have other people, who know about incubating companies, drawing on their networks of people to bring into those companies.

The other advantage is that the brand name Redfern Photonics is now internationally recognised. It is an "interesting beast" because it develops companies under the Redfern Photonics brand and moves them through to independence. Redfern is always present at the international trade shows, with a different set of products every year because there are a different group of companies being

incubated. But it is getting Australia known on the international stage.

Looking at photonics in another way, we are really where electronics was about 50 years ago. The founder of Sun has bravely extrapolated the photonics components market out to the year 2025. If you are a guru you can do that. Mind you, Redfern researchers looked at those numbers in US\$ billions and divided them by the number of people on Earth and worked out that on average an awful lot of people are going to be paying \$100 a year just on photonic components. There is something deeply worrying about that extrapolation, but these things happen.

For Redfern it really is a few seconds after the big bang. Our industry structures have not evolved yet; there are a lot of disruptive technologies coming through. That is great, it really presents Redfern with an opportunity.

***A small and growing
business allows flexibility
and responsiveness***

The big guys are too sluggish in how they can move forward. They know, more or less, what is going on, but their ability to influence events is somewhat limited. Basically the message here is that the timelines are getting shorter and shorter. It still seems to take about 10 years from key innovation to getting a product out, but the cycle times are just immense.

The nice thing about the CRC is that it has moved a lot of people from the universities - probably more than 50 people now - into the world of commerce. The innovation in the universities is really terrific.

The minds of people and the milieu that they are in is truly good: to be able to delve in there and pick up the intellectual property and the people early is a great competitive advantage.

Redfern does not have to have the huge research infrastructure of a transnational company that would otherwise be required to employ more than 300 people. They are employed in our universities and they love doing this stuff. It is an interesting way of getting ahead.

The opportunities

The future for us is at the components level - it is ultimately a chip game. At the moment the photonics circuits - if you want to put it that way - are still bolted together from discrete components. We are just on the verge of the photonic integrated circuit, so that is the next big thing.

***Pressures for innovation
and reducing cost are
immense***

If you look at what is happening in the stock markets you see that the telcos are under stress, except for Telstra. They are finding it damned hard to make a profit because they are expected to roll out the equivalent of a new network every nine months. It took 100 years for Telstra to get its copper network right; now it has to build something of the equivalent capacity every nine months. It is a frightening technology challenge.

The point is that the systems integrator companies are still selling the products, the Manhattan-scale solutions that have been adapted from that first era. It is just too expensive. For example, to make a profit from the Internet, there must be new products that come into play that are factors of 10 lower in cost. It is not going to happen unless this chip game thing starts to happen seriously for us. Today it is a cottage industry.

The classical model can cope with a 15 to 30 per cent reduction in cost per annum of those components, but it is getting harder. The big companies in the United States are locating manufacturing to low labour cost environments like China, but it is a losing game. That is not going to be the way it works eventually. So disruptive technologies are emerging.

The focus of our centre has started to shift. While maintaining the strong focus on core photonics, it is starting to move into areas such as automated manufacturing, where fibre handling is the challenge. Australia actually has some advantages there - robotic automation - and a whole lot of consequences will flow from that.

***The business model is
continuing to develop***

The big challenge for the Redfern group is whether we can grow one or more medium -to- large-scale enterprises in Australia. We have attracted well in excess of \$180 million in investment into those companies in the last year. We have opened up offices in the US and Germany, and we have manufacturing in China and the United States.

There is a huge way to go. The task is exponentially becoming more difficult because scale creates more complexity: we have to engage with a lot of very skilled people in the world of finance, commerce and technology, other than core photonics, in order to be successful.

Radiata Inc.

Dr Dennis Cooper FTSE

Dr Cooper is the Vice-President of AMBRI Pty Ltd. In 1988 he was appointed Chief of the CSIRO Division of Radiophysics and he redirected the division's research into telecommunications with emphasis on wireless system, advanced image coding, and content recognitions. During this period, he established joint research with Macquarie University on wireless local area network (LAN) technology, seeing it through to commercialisation by the company, Radiata Inc. The technology was recently sold by Radiata to Cisco for \$500 million.

Radiata Communications was founded in 1997 by Dave Skellern and Neil Weste from Macquarie University

Radiata Communications was founded in 1997 by Dave Skellern and Neil Weste from Macquarie University. Others involved in the team were Chris Beare, formerly an engineer who became an investment banker and Steve Simpson who became the Chief Finance Officer. It was a very good team as Dave had the dynamism, Neil had the expertise in chip design, Chris knew the finance markets, and Steve kept control of the money.

Utilising joint IP from the CSIRO and Macquarie University, the team designed and built chip sets for high speed wireless LANs, replacing the conventional wire networking cable. Its standard name is IEEE802.11a, or commonly called 11A.

The project funding

Before incorporation, the CSIRO provided special funding to enable research to be done in the wireless LAN area

Before incorporation, the CSIRO had provided special funding to enable research to be done in the wireless LAN area. Eventually, the CSIRO redirected its relationship with Macquarie University quite deliberately in order to gain access to the University's expertise. The universities at that time were known as a source of cheap research.

After incorporation, Dave Skellern and Neil Weste personally provided the initial funding. There was also a START grant and a development contract from an American company called MA/Com. Series A funding was provided from Cisco, which is a systems house and Broadcom, which is a chip house. They were deliberate strategic alliances and investments to obtain market information, and to provide a little "creative tension" between the two companies. As is well known now, Radiata was sold to Cisco in September 2000, with the deal being finalised at the end of January for a large amount of money.

Creating the company

It is interesting to look at the timeline.

No matter what the idea, it takes 10 to 12 years before anybody makes any money

It does not matter what the idea is, it takes 10 to 12 years before anybody makes any money.

During a CSIRO restructuring stage in 1989-90, Dr Cooper took over the Division of Radiophysics. With the impending deregulation, his group moved into mainstream telecommunications, specialising in signal processing and wireless as well as a small amount of imaging work.

Work began in 1992 when Macquarie University was co-opted into the project. The University had very complementary chip design expertise and some network and decoder knowledge needed to undertake the project.

A crucial time and a low point for everybody involved with the project occurred in 1995. They had just lost IBM as an alliance partner, and the Europeans had been looking at high speed wireless LANs and chosen a different technology. There was mounting opposition within the CSIRO division to even continue with the project.

CSIRO's Dr Cooper, however, did not want to lose the investment of the past five years. He believed that they needed to have something that looked like a system and therefore decided to seed-fund a demonstrator project within Macquarie University.

The decision to fund the project was one of the key turning points

In many respects, the decision to fund the project was one of the key turning points, as suddenly, a few things started to flow. One of them was the creation of a champion in Dave Skellern, which was also a vehicle to trigger a great deal of attention. In fact, many years later, the team learned that Cisco had been tracking their activities from 1992.

A patent was issued in 1995. However, this whole area is more involved with "know-how" and being "fast" and therefore the patent was not top of mind for the researchers.

It was during this period that something very important happened. Al Gore "invented" the internet and at the same time made available some spectrum at 5 GHz for a National Information Infrastructure (NII). This, in turn, created a big potential market in the US and provided the trigger that people like Dave Skellern needed to take the final step and create the company.

Critical factors

There were several critical factors. In the first instance, picking the right area is important. However, it is equally important to match one's view of the future with the level of expertise. There is no point in employing the expertise in an area that does not have a future. In Radiata's case, they knew they had world-class people and that they could create a world-class technology.

A second critical factor concerns the need to tackle the very hard problems early as they usually provide great rewards. For example, in 1992 Dennis Cooper and his deputy, John O'Sullivan, initiated work on some very fundamental propagation and signal processing issues that were later to become the key to Radiata being successful.

A third critical factor is the preparedness and ability to adapt. The embryonic Radiata believed that the Europeans chose some wrong technology when they went to a different frequency range and different speed ranges. Even so, Radiata still understood the technology and how to do it. When the NII came along, Radiata was able to quickly adapt once again, and move into those spaces. It had the background and the technology, and it had the people who were able to make it happen.

A fourth, and very important, critical factor, is the need to be part of the standards process. It provides valuable marketing information that is crucial to preparing the marketing strategy. It also provides an opportunity to influence what is going on, to learn what other people and competitors are thinking (as opposed to simply hearing what people are saying!) and to plan marketing strategy. If a company is small, there is an added bonus of not being noticed.

A fifth critical factor involves management and people. These two factors cannot be overemphasised whether it be the research team in the beginning or the team in the company in the end. It is essential to have the right group of people to drive it and make it happen. In Radiata's case, they had a highly integrated and extremely competent team, which had all the expertise necessary between the two organisations. They were also located within a short 15 minute walk from each other.

Management and people are critical - Dave had the dynamism, Neil had the expertise in chip design, Chris knew the finance markets, and Steve kept control of the money

Radiata also had Dave Skellern and his dynamism in the area and Neil Weste's background in chip design in the US. Dave had the contacts, the knowledge and the expertise while Neil had the experience of someone who had developed a company in the US and knew what was involved.

A sixth critical factor was the NII and Al Gore providing spectrum at 5 GHz.

A seventh critical factor involved the ability to hang on during the middle years, and the low point when they lost their major alliance and it was hard to see where the market would be. They were surrounded with negativity and people telling them that it was never going to happen.

The incubator environment was invaluable in the early stages of the company's formation

An eighth critical factor is incubating. Taking the CSIRO as an example, it had the company on site and rented it space. When the company consisted of only five or six people, it was of enormous value to be embedded in an environment where they can walk down the corridor and ask somebody a question. If they want to make a quick measurement, the equipment is there. They have access to that infrastructure and they are not isolated. There is constant stimulation and in the early stages of a company's formation, this is invaluable.

Radiata was born global ...

Finally, Radiata was born global. It started as Radiata Inc, a Delaware company for tax and regulations reasons. It then set up an Australian arm - Radiata Communications Pty Ltd, to undertake the R&D and engineering. Radiata Communications Inc. was established in California as the sales and marketing arm. Right from the start the target market was the United States.

Radiata looked like an American company, employed people with American accents and was seen as "one of them". This was important as the US had 60 per cent of the world's market.

Some observations

Start-ups are providing a major source of technology for big corporations

There are many ways to transfer technology into the commercial arena and licensing is an important aspect. However, start-ups provide a major source of technology for big corporations. The big companies watch for start-ups, allow them to take the risks, and pay the premium to buy up later in order to get the technology.

It is significant that the founders of Radiata were from the university where they had flexible arrangements, and not the CSIRO. Although venture capitalists do not like safety nets, it does make a difference when somebody is trying to make the decision of whether or not to take a risk.

In government research organisations need to think seriously about providing access to equipment and time to nurture start-up companies. The idea is not to make money; it is to create a company.

Government labs and other in other large organisations, conditions can be just too comfortable. There is no incentive to move out into the commercial arena. There is no personal gain so why take a

risk. A big threat to CSIRO could be something like the Photonics CRC because it has all those mechanisms in place in terms of taking equity and being prepared to take that risk for long-term gain.

On the other hand, some stability in the government labs is necessary to provide infrastructure for start-ups in their formative years but other mechanisms as encouragements are important to get turnover of companies.

Energetics Pty Limited

Mr Jon Jutsen FTSE

Jon Jutsen, is a chemical engineer and the CEO and founder of Energetics Pty Limited, a company he set up in 1984. Under his leadership, the company has grown from a successful consulting business to become a global leader and supplier of energy management software and solutions on energy and greenhouse gases. Jon's company now has a network of offices in Australia, South-East Asia, USA and the United Kingdom.

While the company has been in operation since 1984 as a specialist energy consulting operation, it is only during the last three years that Energetics has been using its intellectual property as a software provider.

Currently, international oil prices are very high. There is a shortage of electricity supply in California, across other parts of the United States, in Russia and even in parts of Australia. The US is facing very high electricity prices and both the US and Europe are facing very high natural gas prices.

Energy markets are deregulating around the world, consolidating and globalising. Greenhouse is a global issue and is being treated very seriously by Europe. There is also a corporate focus on improving business efficiency and reducing costs.

There is also a growth in e-procurement, and Energetics sees an opportunity to facilitate energy being handled in these marketplaces. Energetics vision as a company is to become a global leader in creating and delivering energy and greenhouse management solutions.

Origins

Energetics began life as a consulting company. It was an innovative company and employed a very process-oriented and technical approach to its field. Today, Energetics advises many of Australia's top companies on energy and greenhouse. However, while the company has been providing advice for the last 16 or 17 years, it now also sells software globally.

The big change for the company occurred approximately three to four years ago. At that time, Energetics began to realise that its

Energetics changed from a consulting company to a manufacturing company

intellectual property and knowledge in its field was very competitive. It decided to start leveraging its IP and focusing more globally.

Energetics believed that the whole energy management field needed a management systems approach and decided to take a completely different tack from the rest of the field. The company developed some tools to help companies make management decisions in this area, as opposed to only conducting technical energy audits. The company developed software tools and took the big step of investing some of its hard-earned consulting revenues back into building those products.

Product development

Product development presents new challenges

Energetics' first product was a diagnostic software tool - One-2-Five Energy – which helps senior management decide how effectively they were managing energy and to take them forward. It took the consulting process, which would normally take a month, and put that into a software package with a diagnostic that can be completed in approximately one and a half hours. It would then produce a forward plan of action. It is a breakthrough product in that it has changed the field of energy management to a management discipline from the traditional technical energy audit approach. It is also being used by utilities in USA, UK and Australia as a relationship management tool for their key commercial and industrial customers.

The company moved rapidly into product sales and that was a pretty big change. Energetics made its first sales in Australia and decided that it would try to establish the One-2-Five tool as a world standard, and can benchmark companies globally – there are now 600 corporations on the benchmarking website. The company licensed the software to the US EPA and they are still using it as a core part of their Energy Star programs today.

Energetics received an investment from the Gas Research Institute, (now called the Gas Technology Institute). Energetics received capital from them to help take One-2-Five to the US market. The company made sales to a lot of the major utilities in North America, such as PG&E, Southern California Edison, BC Hydro, and TXU and established the company in that country, in San Francisco.

The next step involved Energetics making a major investment to take its energy management consulting methodologies and experience onto the Web, and develop a comprehensive energy management service on its website. They aimed to automate all the processes they provide for our clients to help companies make decisions, manage information and transfer information on their electronic energy manager - Our-e-Manager.

Energetic s successfully raised a Government START grant, which was extremely helpful, as the project is an on-going multi-million dollar development.

Energetics are taking the first release of the toolkit out to market at present and formally launching in July, and are still expanding the network on the One-2-Five side. In the next three to six months they will start looking for capital again to expand our product range and take them to market in the US and the UK.

It is a very scaleable management system on a website. It is aimed at companies with multi-site operations, using over \$5 million of energy a year.

Meeting challenges

There have been many challenges and lessons learned over the last few years. Fortunately Energetics has had more successes than failures, although they have made a few mistakes along the way.

Managing risk is a major challenge

One big challenge was the big change in their risk profile - consultants are not usually of a mindset to make major investments, take risks and have a high volatility in the business.

The personal cost has also been significant. Jutsen: "I have a three-year-old and a five-year-old and I dearly love my family, but to my shock I found myself travelling 128 days last year to the US and the UK. A lot of our company have spent spells in the US and some staff have relocated and it all comes with a cost."

There is a need for self-discipline to maintain focus, and to deal with management issues – "as you expand it you need to ensure you have the management capability to do all the things that you want to do. This is pretty annoying to an ideas person and entrepreneur."

The importance of managing cash in a business making rapid investments is well known (cash is king), and tight cash management is essential when you are consuming cash rapidly in a development process.

Attracting venture capital

Venture capital allows companies to tap into networks

Energetics has found out that deciding on a VC investment is a lot more than the valuation; it is also about the networks and how they can assist the business to grow in new markets.

Energetics took on capital from Equity Partners in Australia - extremely good people - but in retrospect there would definitely have been an upside in taking more capital from the US VC market earlier in terms of networking. There are obviously trade-offs in being in Australia versus the US.

It is very difficult dealing with American VC companies without being American-based. Energetics are looking at when they will need to take that step, because one just cannot get funded and treated seriously by the US capital market when one is in Australia.

It is not that we are not taken seriously: it is more that people do not trust their money going where they cannot see it every day: cannot drive down the road and visit you and see what you are doing. In terms of raising capital, you also have to know what is happening in your field in the US and European markets, and it is hard to that from here.

The globalization challenge

We have a great deal of innovation and some cost advantages in being in Australia. But the other side of it is isolation, which is very difficult. Even with the Web, you still feel isolated from the main game. There is isolation from the direct stimulation - from being able to walk down the road and see what your competitors are doing.

Managing US business operations from here is difficult. There are cultural differences and communications problems, which are far from trivial.

Regardless of a personal wish to stay in Australia, Energetics will eventually have to relocate. It is an expensive and time-consuming business to be continually going backwards and forwards.

Being global presents difficult challenges

It is a difficult thing to globalise - much more difficult than expected. Things like logistics, language, culture are not trivial issues. Energetics started off taking their product into the US and England. They had some serious interest from Japan and France. They could have got some business, but had to pull back because at the time they just could not handle the logistics and investment required.

When Energetics first started going into the export business they focused on product development and marketing and did very well, but the local consulting business suffered. They had to go back and reorganise and now the consulting practice is really thriving again. But it came at a cost at the time.

Looking forward

There is some tension between the Australian and US operations about where future R&D should be done. The START Grant and the weak Australian dollar is helping Energetics to keep it here for now, but is likely to become increasingly difficult long-term to do their commercial product development, away from their major markets and marketing activity.

Developing management capability has been a major issue

Energetics had big issues in change management to resolve. Adapting to change from being originally a services-type business to a global products business was a huge task and they still have a fair way to go.

They have had to learn a lot more about dealing with channels, partners and value-added resellers. There is a steep learning curve there.

They have had to deal with people issues from the rapid change, and that brings tension as well.

There is a need to bring on new management as the company gets bigger. There are necessary investments in systems to go forward because the next step is going to be a major change in size. The company currently employs about 100 people, but is still growing rapidly. Turnover is expected to increase by 50% this year for the 3rd consecutive year. These factors alone present a real challenge.

The lessons

What would have been done differently? The following come to mind quickly

- Raised more venture capital last year in the US.
- Taken tighter management control over the US operations.
- Focused a little more on the health of the existing business while going through the growth phase.
- Avoided a bit of pain by recruiting more better people earlier.

Energetics did not have the depth of management capability to handle the rate of growth and diversification and have needed to take on people to fill the gaps. Having top class managers is terribly important.

That is the story. It is not a huge success story yet; but Energetics are reporting progress. They have done some really good things and have some challenges ahead, particularly over the next two years. They want to be the mouse that roared. They want to be the Australian company that took over the world in energy and Greenhouse management. They are very ambitious, and the next few years are going to be very interesting.

Biota Holdings Limited

Dr Hugh Niall

Dr Hugh Niall is the CEO of Biota Holdings Limited. Biota is best known for the discovery of its anti-influenza drug, Relenza. Biota through its partner and licensee Glaxo obtained regulatory approval for the flu treatment product, taking a new chemical entity through the clinical trials and regulatory hurdles to obtain marketing approval in the US and 51 other countries. This is no mean feat, and Biota's achievement in this field is an Australian first.

Biota Ltd has had a long history as a public company, being first listed in 1985.

The anti-influenza drug, Relenza, is the main product of the company and can be used to illustrate where Biota Ltd has been and where the company is going

The anti-influenza drug, Relenza, is the main product of the company and can be used to illustrate where Biota Ltd has been and where the company is going.

The development of a flu drug, involves solving the problem of finding a way to beat the flu virus. The flu virus is extremely diverse with new viruses appearing almost every year.

The solution in terms of getting a treatment for flu began with work at the CSIRO and the ANU. Scientists found a region of the flu virus which had been conserved across all strains. This is a location on the surface of an enzyme called neuraminidase.

In the 1980s, however, conventional wisdom was that the neuraminidase enzyme, was not essential for the virus and was therefore not a good drug target.

The first lesson is to not take any notice whatsoever of the existing conventional wisdom

The scientists involved in the project decided to go against the conventional paradigm and test the concept. Work done at the ANU, at the CSIRO by Dr Peter Colman and later at the Victorian College of Pharmacy by Dr Mark von Itzstein, pushed this concept as far as a test against viruses. They found compounds that worked. Therefore, the first lesson is to not take any notice whatsoever of the existing conventional wisdom if you have an idea that you believe in

Financing the company

There is a saying that you cannot be too thin or too rich. The perennial problem for many companies is not having enough cash. But you cannot be perceived to have too much cash either.

Venture capitalists investing in a private company do not like a situation where their money is sitting still when they could use it in other places, while in a public company, people do not like a 'lazy' balance sheet either. So it is difficult to maintain the right amount of cash.

Biota was started with a relatively small amount of money, \$300,000, from Alan Woods and other entrepreneurs in August of 1985. The company however had only a transient history as a private company, as within a few months it was floated on the Second Board with \$3 million raised.

Private placements and rights issues were made subsequently - \$4.6 million (placement, May 1992), \$5.1 million (rights issue, October 1992), \$10.5 million (placement, May 1994), \$6.8 million (placement, December 1995), and \$21.8 million (Rights issues, November 1997). Importantly, these rights issues or placements also offered options in the company. Options and employee options raised \$22.4 million. This provided a means of smoothing out the availability of funds. For example, if the company is doing reasonably well, the options attached to the placement will be taken up later.

The key to financing the company was identifying a partner, Glaxo-Wellcome, who took over all the expenses associated with the flu project

For a long time Biota was run almost as a virtual company. In this way, it was possible to keep the internal burn rate down. The company also contracted outside people. The key to financing the company was identifying a partner, GlaxoSmithKline, or Glaxo, as it then was in 1990.

Glaxo took over all the expenses associated with the flu project, and the company was able to use its funds in other ways. Biota has raised approximately \$75 million in its entire lifetime from public sources. Today, the company has approximately \$40 million of that in the bank; the remainder, \$35 million, has been spent over a 15-year period. There are now two products on the market and a number of others are in development.

People with any experience in the field will recognise that it is not an easy path to tread to raise the required large sums of money. There are periods in the company when things are going well. However, when things are going badly the money is still needed.

In hindsight, Biota may have benefited from diversifying its portfolio more than it did in the early period. At the time however, in 1990-91, there was no real biotechnology industry. There was no venture capital in Australia. At the time the Board of Biota did an excellent job, having nursed the company through the 1987 crash when many companies on the Second Board went out of business. Biota's Board managed the company conservatively, which allowed

it to survive, however, it also probably delayed the expansion and flowering of the company to a somewhat later time.

Like a number of other biotechnology companies, Biota went to the public markets much too early for its safe evolution

In reality, like a number of other companies in biotechnology, Biota went to the public markets too early for its safe evolution. In effect, Biota was a private company operating as a public company. This situation reflected the fact that the only way to raise money during the early 1990s was to go straight to the market. Things have improved somewhat in that respect, but not enough.

With one product, the company is vulnerable. Market cycles together with problems with the product can mean that there are times when it is difficult to raise funds. In Biota's case, the Glaxo partnership was crucial, while the options helped to smooth the flow of income.

Corporate Structure

Biota faced another problem. It had an untidy corporate structure. The original company, Biota Scientific Management (BSM), owned the intellectual property from the flu drug and had licensed this intellectual property from the CSIRO. The company that went to the market, however, was Biota Holdings, a holding company which then owned 74 per cent of BSM, with private investors owning the remaining 26 per cent. The way in which the company was set up was not desirable, as it was structured in such a way that the minority ownership created a potential conflict of interest.

Ensure that no single minority shareholder has rights that are counter to the interests of all the other stakeholders

The structure would have worked if the flu drug had been Biota's only product. However, the structure was such that if new projects came in and the company wanted to expand in different areas and wanted to raise money, the minority ownership was not appropriate. In the end, the holding company had to buy out the minority shareholders at a substantial cost.

The second lesson is to seriously think through the kind of company it will be in five or 10 years and make sure the structure is right. Ensure that no minority shareholder has rights that are counter to the interests of all other shareholders.

Diversification

Biota's experience with diversification has been like a ride on a roller-coaster

Another problem area involves diversification. Biota has experienced a roller-coaster ride. The company started with three projects: a flu drug project; a flu vaccine project; and, a cancer project. Two of the projects, the cancer project and the flu vaccine project were dropped when they failed to gain results. The science behind the flu drug project, however, worked and the project

survived. This led to Biota becoming a single product company concentrating on the flu drug during 1987 to 1992.

Once the flu drug was licensed off, new projects were added. At this stage, however, the company arguably became too diverse. Projects in rotavirus, which causes infantile diarrhoea, diabetes, a flu diagnostic, as well as a project involving a rather 'blue-sky' approach to cancer were picked up. In the end, the diversity of projects was not helpful, and after spending time and money, Biota changed direction and decided to focus its attention on just one or two areas.

During the last two years, the company has turned its attention to concentrating on respiratory viruses. Biota is beginning to expand cautiously, without moving too far from its main theme. The company is about to start work on respiratory bacterial infections, which will enable it to capitalise on some of the expertise it has gained and will also move to other areas of virology now that it has in-house expertise in that area.

The company's stock price and financial analysts

The next problem is a recent one. Biota's stock price has been hit recently. One of the benefits of being a private company is not having to worry about the stock price, just as long as the company keeps its small group of investors happy. Biota has 17,000 shareholders and the company is unable to keep them happy when the stock price goes down.

Lack of flu in the northern hemisphere and competition have hit Biota's share price

Over this last quarter Biota has experienced a drop in its income due to a fall in royalties from Relenza. The company was helped however by a strong performance from the flu diagnostic. The reason for the fall in royalties for Relenza was that it was one of those years when there was very little flu around. Flu just didn't show up in the northern hemisphere. That was coupled with strong competition from a rival US product.

What is the solution to these problems? In the first instance, there is nothing that can be done about a lack of flu! There has been a recent movie (Mission Impossible 2) about a Sydney-based biotech company (obviously not Biota) that released flu viruses deliberately to boost their drug's sales. The Biota Board has not felt the necessity to go that far! Flu will be low in some years and high in others.

Biota's solution is to build a strong pipeline of other products

The market and the financial analysts like to see profits going up, preferably in a steep, straight line. They like predictability. Investors do not like the fact that Biota could have a five to tenfold difference in its income, as a result of there being a pandemic one year and no flu the next. The solution to that really is getting the

products that will smooth that out, through building a strong pipeline.

Biota is developing a second generation flu drug, which it believes to have a much better marketing profile to cope with the competition.

In summary

Biota took 16 years to get from where it started to where it is now. That situation would not happen today.

Nowadays, the timescale in getting products to market has compressed greatly

Today the big pharmaceutical companies have become much more competitive, with many companies having merged. They work with the FDA, which is under pressure from the US Government to perform more efficiently. The approval time for drugs by the FDA can be a year or less, and in some cases, six months. The big companies are becoming much more aware of the need to keep their own shareholders happy by getting products on the market more quickly. So the timescale has compressed greatly.

What would Biota do differently? Firstly, the company would not have listed nearly as early in its path, and probably not until year four. Secondly, Biota would probably not have listed in Australia. In hindsight, the company would have gone straight to NASDAQ. The reason for that is that the American market is, as other speakers have noted, much more sophisticated. There is a lot more ease of access to capital and the US market is able to look at the pipeline and ascribe value to that. The Australian market, by and large, just looks at Biota's sales of Relenza and values the company accordingly.

Biota would not just stall at one product for a period of time, as Biota did before branching out. The company would branch out much more quickly, as it is doing today. Biota has increased the level of activity in its areas of focus. The company has also set up a US presence, opened an office in San Diego, and hired someone with great experience in the industry - who has an American accent! - to run that office. Eventually, companies need to be in the US because the capital market is in the US.

Australia is still a great place to do research but not such a great place to do development

Australia is still a great place to do research. It is not quite such a great place to do development. Biota will be doing mostly "R" in Australia, with some in the US; and mostly "D" and business development in the US because that is where the money is. That is the current plan.

Castle Harlan Australian Mezzanine Partners

Mr Bill Ferris AO

Bill Ferris is an economics graduate with an MBA from Harvard. He was the founding chairman of the Young Presidents' Organisation in Sydney. In 1985 he chaired a committee for the Australian Government, which reported on lifting the performance of manufacturing and service exports. He served as chairman of AusTrade from 1988 until he retired from the position in 1993.

He was one of the pioneers of venture capital in Australia and built his company into the leading private equity group. He is now Executive Chairman of CHAMP (Castle Harlan Australian Mezzanine Partners Pty Ltd), with a greater than \$500 million fund. In the midst of all this and many other activities, Bill has found time to write two books on venture capital

Venture capital means different things to different people.

Woody Allen: *I have finally worked out what venture capital is and what venture capitalists do. They are these bright young guys and women of Wall Street and they very adroitly and patiently invest other people's money in these relatively high risk portfolios until there is absolutely nothing left.*

There are three stages during which venture capital funds invest in the growth cycle of the typical company. The early stage is sometimes pre-revenue, but usually post-revenue of an operation. During the expansion stage, the growth is rapid and there is a demand for capital. Finally, when a company is in a mature stage, management buyouts (MBO) require venture capital.

AMWIN is an Innovation Investment Fund (IIF) specialising in early stage technology- intensive investing

CHAMP has one fund, AMWIN which concentrates on and specialises in early stage technology-intensive investing. At the early stage, the investment range is in the \$500,000 to \$3 million range per investee. AMWIN is an Innovation Investment Fund (IIF) in partnership with the Walden Group out of the USA. AMWIN has had some failures and some fantastic successes.

Interestingly, last week Walden, who are San Francisco based, closed a US\$1 billion technology fund. It is amazing that in this environment they can still do that in the American marketplace

and raise that sort of money for early-stage technology investing. Australian Mezzanine joined up with Walden to overcome some of the sorts of problems that have been referred to this morning.

AMWIN needs to have a capacity here to offer our portfolio companies true international - not just American - access to due diligence, networking and access to capital markets, not just here, but also offshore. It was decided to do that in selective joint ventures with like-minded private capital people.

As the companies expand, CHAMP has several other funds for expansion capital. CHAMP typically provides \$3 million to \$15 million of equity per investee over a three-to-five year period. This funding can be used for pre-IPO situations to help them get ready to go public, and where businesses are looking for new capacity, including acquisitions.

The whole process of innovation is just as important at the mature stage of the cycle as it is at the early stage

There is another whole sector in the private capital markets known as the management buy-out business. CHAMP has a partnership with a New York based company which specialises in buy-outs and a dedicated fund and group of people. The fund concentrates on the unloved subsidiaries and divisions of multinationals and Australian companies, and getting them back into the hands of managers who actually know what they can do with them. The whole process of innovation is just as important at the mature stage of this cycle as it is at the early stage.

The common theme through all the stages of growth for venture capitalists is growth. Venture capitalists try to help grow the companies fast. If they are successful, then they will make money for their investors, and themselves!

CHAMP has approximately \$40 million for investment in the early stage fund, which will be expanded again this year. In the expansion capital area, CHAMP has several funds that collectively have had about \$160 million subscribed to them, primarily by the superannuation funds in Australia. The buy-out fund is a \$570 million dedicated fund, subscribed by, again, traditional superannuation fund investors, plus some offshore pension funds from America. This is the first time the offshore investors have been attracted into the country.

Venture capital funds are established as 10-year limited life trust structures. The investors ask for their money back, or whatever the venture capitalist has left within that 10-year period. The internal rate of return (IRR) describes the formula for this situation, with an annual compound rate of return.

It is amazing what can happen without heroic growth, just committed and focused attention

CHAMP's first fund was a modest but reasonable outcome, and sufficient to attract most of the investors back into the second fund. The third fund was even better. CHAMP had a 'free kick' with one particular company called LookSmart as it rode the NASDAQ hype of the last 24 months. In this case, the venture capitalist achieved a 100 per cent cash-to-cash compounding annual return for the investors.

The CHAMP management buy-out transactions included eight successful transactions. It has been a great confirmation of the thesis that if you can get assets and businesses out of lazy or disinterested hands and get them back into the hands of people who want to make something of them, it is amazing what can happen without heroic growth, just committed and focused attention.

CHAMP is absolutely committed to the venture capital business in this country. It is believed that the management buy-out end of the business will be where most of the dollars go over the next five years. There will be massive amounts of assets coming on to the market in the form of unbundling by the major corporates, such as BHP and others. That activity is being supported by a culture shift, where good management and proprietorship are not mutually exclusive.

There are four challenges to the venture capital sector

There are four challenges to the venture capital sector with some possible solutions and ideas.

Firstly, Australia needs to open its doors to the international supply of venture capital. This will not just attract more dollars into the country, it will also provide a competitive situation between Australia's own supply of superannuation fund money and international venture capital. In turn, it will bring international alliances and networking which will provide greater value to Australia's high growth companies, such as the ResMeds, the Cochlears and the Biotas, as they develop offshore.

People at present are concerned that there is too much money chasing too few deals. On balance this is probably the better of the evils for Australia.

Australia needs to open its doors to the international supply of venture capital

At the end of the day, it is about survival for the venture capitalists to drive international competitiveness in what they do, just as their portfolio companies must. The curious thing is that most of the world's venture capital, between 95 to 99 per cent, is provided by the US pension funds. Australia has had, wittingly or unwittingly, an embargo against that supply. That is because these entities are exempt in their own tax regimes. Their exemption travels with them to almost every country in

the world, other than Australia. When they get to Australia they are taxed as companies. The Government, post-Ralph inquiry, did, to their credit, pick up on some of this, however the problem has still not been solved.

There is a need to get commercial savvy into the very early stage process

This second point concerns the need to get commercial savvy into the very early stage process. There are many ways it can be achieved. There is the incubator model, which has certainly benefited Redfern Photonics. Colin Sullivan is embarking on an incubator track where he is providing the framework for early stage researchers and business people to get together and make things happen. There needs to be the mechanism to commercialise that process more.

One opportunity is to look to creating a son of IIF scheme. The Innovation Investment Fund scheme has worked. It is still early days to finally measure it. Its predecessor was the Management Investment Corporation, the MIC, and most people glaze over and collapse when they hear talk of the MIC program. In reality, if the MIC program could be measured it may well produce a reasonable outcome. Cochlea, for example, grew out of MIC money or at least benefited from MIC assistance. When Cochlea was worth \$70 million, many thought that was pretty tops, but now it is close to \$2.5 billion in market capital.

In any event, the IIF scheme has a better architecture than the MIC program because it is not tax-driven, and it does not separate the high net worth tax investor from the manager. It has a better architecture where the private sector only benefits from the design of the scheme upon the success of the portfolio, and not upfront.

CHAMP and AMWIN invest mainly in post-seed companies. Various speakers today have talked about the 12-year process. Most venture capitalists cannot invest in year one. They like to invest at 12 minus three. They pay the higher price, and get involved when they can see a reality in marketplace terms.

What would make venture capitalists invest earlier? One opportunity is to create a son of IIF scheme

What would make venture capitalists invest earlier? What would encourage their involvement earlier in that process? It is possible to come up with a skewed IIF scheme requiring that venture capitalists only invest in pre-revenue projects, allowing follow-on investments and tying the IIF scheme recipients, by making sure that they are run by people who are already in the business, who have funds under management, who have teams and have been doing it for a while.

If venture capitalists only invest in early stage, pre-revenue portfolios, they will either go bonkers or broke - or both - unless

they are absolutely brilliant! It is extremely doubtful that any scheme that makes these assumptions is going to work. However, if it is part of a portfolio within private capital expertise it will work.

Australia needs to be open about picking winners

Thirdly, picking winners. This will be controversial and perhaps unpopular, however people should discuss picking winners. It is very unfashionable in Australia and most market economies to talk about picking winners. In a small place like Australia, with the amount of catch-up and time required, Australia has to pick winners.

Of course the marketplace tries to pick winners, however, in the interface with government policy, Australia needs to be open about this. There are many areas that might qualify. The CSIRO picked the area of wireless LANs and dedicated money to giving it a go: that was picking winners. The whole biotech-life sciences sector could be declared a tax-free zone from both State and Federal taxes for the next 10 years and see what happens.

Australia has world-class clusters of excellence, such as Florey, Walter and Eliza Hall in Victoria, or the Institute of Molecular Biology in Queensland and others. There is world-class research happening and some development with it. With some venture capital and some inspired effort, Australia could actually get in the race and stay there.

Australia needs to reverse the brain drain by making it attractive for our best and brightest to return to work here

Fourthly, this country has to consider reversing the brain drain. Obviously Australia has to accept that its best people will go offshore - they will study, they will work, they will get ideas and they will be better for it. However, Australia needs to be able to attract them back as and when it needs to. There is the constant frustration of finding Australians who would quite like to come back to a life in Sydney, Melbourne or elsewhere; however, companies in California has offered them \$6 million or so worth of shares or options and Australia's offerings by comparison are, at minimum, tax-convoluted and at worst, tax-frustrated.

Why is this so? The answer is essentially the philosophy in this country that employee shares and options are taxed when they are issued, not when and if they ever make anything. That is the fundamental different mindset in tax thinking in this country. It is just ridiculous and will contribute to a continuing brain drain. It is easy to change.

Just an observation on that point: I thought Dennis Cooper's comments about the government lab problem were interesting. If scientists can easily, and without any embarrassment, take

equity and become wealthy, it is not mutually exclusive of good results for humanity and for Australia. We should be able to name heaps of very rich scientists. In our activities as venture capitalists over 15 years we find that 163 of our entrepreneurs are millionaires to multimillionaires, and of those there would be only about four scientists. The rest are financial-based entrepreneurs - good people, but not scientists. We have a long way to go.

Panel Discussion

CHAIR: Dr John Nutt (OVE ARUP & Partners)

We have selected the speakers because they bridge across three market sectors - ICT, manufacturing systems and biotech. I have no doubt that the lessons also apply to many other sectors. I will not go into any more detail, but will allow you to interact.

(The name and organisation of the questioners is identified, the speakers and the subject of their presentation is given once only.)

ANGUS ROBINSON (AEEMA Ltd):

I want to ask Bill Ferris a question relating to the importance of integrating technology and focus into key areas, which leads on to the concept of centres of excellence.

BILL FERRIS (CHAMP):

My interest, as a venture capitalist, is that we see 20 business plans and proposals a week which fail for lack of a team, or a milestone business plan. As a venture capitalist, we can only carry on board a limited number of technologists. We would go broke if we spent months looking at all these things. We need access to these centres. My idea of a son-of-IIF would be that to get a licence, an IIF would have to be in partnership with a Redfern Photonics or a Unisearch or some other demonstrable area of excellence. We would try to drive the relationship at an earlier stage and get early advice. Clustering is a very unpopular word at the moment, but we need some variation of that, where people with mutual interests come together.

COLIN SULLIVAN (ResMed):

Could I just reinforce how important that is. My experience with a whole lot of projects leads me to believe that a mechanism for getting in earlier and kick starting the technology development would be great. Then you add all the IP. People say, "I have an idea. I have a patent provisional." The next phase of actually putting it into place and testing it is where the most powerful patent position comes from.

DONALD BROWN (O'Connell Street Associates Pty Ltd):

How do you get in capital without getting rid of too much equity? In the pre-revenue stage and the pre-market stage, you don't know what the value might be. Having been involved in a CRC where we successfully commercialised, I can say that at a very early stage we had a combination of royalties and equity preserved for the participants. That was a good formula. It is the equity which, at the later stage, is of value to the original participants.

HUGH NIALL (Biota):

It is a tough commercial world out there. Some competition among different funding parties is desirable. Hopefully you can get it at the lowest rate possible. Conventional wisdom in the biotech field is that you really shouldn't be too worried about dilution. What you should be worried about is growing the company and increasing its value. If it works out, the value will increase much faster and the original people will be very happy.

BILL FERRIS (CHAMP):

As an add-on to that - we have invested in two biotech companies this year. The entrepreneur believes the budget when he writes it down, and the investor believes it when he sees it later. So you are always going to have this divide. I would not agree with Hugh that you just shop around and take the cheapest money. You have to find the investor for you - someone who really can add value. The right investor is usually willing to say, "Look, if this works, I don't need as much equity as a clinical analysis at day one would say. We are willing to leave buy-back options in place for the entrepreneurs and the founders. We are willing to work with convertible Preference shares that ratchet up over time as milestones are reached." If the founders and the

entrepreneurs are not excited by a smaller piece of a rapidly expanding pie and are driven by hanging on to the whole pie, there ain't going to be a feast for anybody!

ARCH JOHNSTON (Dean of Engineering, University of Technology, Sydney):

My question is to Bruce. In my faculty there is a huge amount of raw talent in the undergraduates, post-graduates and staff. We have definitely not got it right in trying to harvest that talent and bring it into the excitement that I see today. Do you have any advice as to how we can better involve and harvest that talent and the right messages that we can be giving in our programs and our staff training developments?

PAUL COMPTON (University of NSW):

This question is mainly for Dennis. You skirted around the issue a bit of CSIRO and Macquarie University and what their stake was in Radiata. How well are universities travelling in terms of deciding to take equity in start-ups, rather than setting up impossible royalty agreements?

BRUCE GREY (Bishops):

That is a difficult one. We have an operation in the US and in Germany, and we notice much greater co-operation and alliances between industry and universities in both of those countries than in Australia. I am not sure what we can do about it. We are so busy doing what we are doing that it is very hard to be altruistic as well. We see our role mainly as attracting them out of the university and then teaching them the process. As all the other speakers have emphasised, I think the employee share ownership plan is very critical. I think the tax laws here are not good in that regard either. In America we see that the tax treatment of share schemes is a lot more liberal than it is here. Clearly, from our perspective, once people are out of university we give them the incentive to move forward.

DENNIS COOPER (Radiata):

It is changing rapidly right now. The Radiata deal was a royalty deal. Equity was put on the table, but CSIRO certainly at that time was pretty risk-averse - it had been through a couple of difficult deals - and wasn't really interested in equity. So it didn't really get considered. It would have been much better for both Macquarie and CSIRO - with hindsight, of course - to do an equity deal.

The other comment I want to make is that I know of one deal that fell over on the point that Don Brown was making. The organisation wanted to be too greedy, it wanted too much. It was not prepared to give the downstream people - the developers, the people taking the risk - enough to even make it interesting for them. Universities are having the same difficulty. It is better to have a small piece of something that is very successful than a large piece of a failure. That is something that universities and government institutions have to come to grips with - just what is the level of equity that is right for them to own and that will not hinder a company's development.

ROBIN BATTERHAM (Chief Scientist):

I would like to say something on the equity side. There are some hurdles that we have to get through on equity, which is tied up with what our institutions can and cannot do under their various enabling acts. I look at that, like tax, and say, "For heaven's sake, if it worth changing, just get in there and change it - this is not out of the question." But more significantly, we have a track record which simply has not favoured the equity route - and for all the wrong reasons. When we have looked out to see how other people do it, we have looked at the US market. We find that, in government-funded organisations and universities, they don't actually go for equity as much as they go for revenue from licences. That is because they have a private equity market, which is banging on the doors and actually queuing up to get into the annual "show-and-tells" that you find around some of the universities. We have an entirely different state, and until we hear a lot more of some of the successes - like we did this morning - we just have to accept that we have a cultural hurdle to jump through here. Until that private market builds up, our public institutions really have to have a lot more thirst for equity. Then it is so much easier to get a share of a cake which is going to grow very large, rather than having these arguments about "give it all to us now".

MIKE ETHERIDGE (SRK Consulting):

I work in a service sector of the innovation industry,

JON JUTSEN (Energetics):

Speaking from our own experience, I think services companies generally are

and I work with businesses in the mining industry. I seek comment from anyone. Why is the service sector not particularly represented in this forum? The only representative we have heard from in the service industry is Energetics, because they have crossed over and made it to being manufacturers of software.

not very good at garnering and valuing their intellectual property. There are two big issues. One is the internal competency in terms of recognising intellectual property and managing that IP. The other is that there is often an internal conflict between making that IP available so that you can leverage it very effectively to the outside market, and the service that you are providing, one-to-one, for organisations. There tends to be a very strong internal conflict - "I don't want to take this wonderful piece of intellectual property that will allow people to go off and do it by themselves out to the marketplace because that will cut my services income".

Those very strong factors stop consulting companies from taking advantage of intellectual property by commercialising it. There is very strong internal conflict.

DR JOHN NUTT, (OVE ARUP & Partners):

I wish to comment from my position in a consulting organisation. I think you will find that the service industries are changing from a position of providing advice but not taking responsibility for the decisions, to one in which they will be a participant in the mainstream. I think they have got to do that.

JOHN BENNETT (University of Sydney):

I speak with a background of about 50 years in the computer industry. A point which was not touched on is the role of getting a very expensive new device introduced by providing a service. To what extent is offering a service facility being contemplated as a way to get a new idea on the road, if it is very expensive?

JON JUTSEN (Energetics):

Again I will answer from my own experience. We are doing this at the moment with our on-line application - it is a service bureau or an ASP-type model, to allow people to get access to that technology by paying a rental fee in effect. You can be a subscriber, rather than having to buy the Internet application. These things are happening as part of the Internet revolution. A lot of ASP-type applications are coming onto the market, which allow access to the application without having to buy it as a software product.

COLIN SULLIVAN (ResMed):

I should have pointed this out in my presentation, but in the years 1981 to 1990, I was the one who provided such a service. If you made a C-PAT machine, no one would have used it, so someone had to bring the patients and create and grow the market. We actually created the market here by seeing patients, and that was the market into which we sold. That is now the model that has developed in taking the technology into other marketplaces. So it is absolutely critical, certainly in the medical device area. It is the same with Cochlear.

RHETT SAMPSON:

I work with early stage companies, helping them develop their businesses. It is driving me crazy and I haven't gone bankrupt yet, but I have come very close! I have a question to Dr Batterham. There are two things an early stage company needs - lots of service, advice, help, IP, business development and finance; and it needs money to pay for the services. If it doesn't have the money, which invariably it doesn't, then it can give equity. But as Bill Ferris says, if you take equity in lieu of fees you incur a tax liability in that year. So not only do you not get the fee, you are going to need a cash flow. It is just a total disincentive. I guess the question is: Does the Government recognise the lack of funding? I think Bill's idea of mandating

ROBIN BATTERHAM (Chief Scientist):

I guess that some of you would know the two recommendations out of 20 that I made that did not get through. One of them was exactly this area. I called it "an innovation centre" and I think my words got a few people offside. With hindsight we could have described it very differently. It is bringing together that combination that you described that you have in your operations, plus the financial backing. There is a market failure here - it depends on the tax structure you have; it depends on the sort of economy you have around, and the sort of people and availability. I am heartened by the fact that we have a pre-seed fund that has come through, which will tackle some elements of that area. I also think that there is actually a reasonable amount of private equity around. What is missing is the nous, the connections, the networks and the technical ability too to get in and pick the very early stage work and back it. It does require that combination. The pre-seed fund will do some of it, and I am hopeful that that will set the stage - whether it is son-of-IIF, whether it is your company growing or whatever, it actually requires a bit of government

from the Government and investment funds to invest pre-revenue is an interesting one. The second question is: Does the Government recognise the Catch-22 situation with the tax issue, and what plans do they have to do something about it?

RHETT SAMPSON:

Perhaps there needs to be an incentive for the investors to take some of the risk out.

RHETT SAMPSON :

I understand and agree totally. By nature it drifts to the right in the risk curve because of the risk profile and there needs to be something to pull it back to the left.

TREVOR COLE (Warren Centre):

It is a pity, Robin, that you were not able to transfer into Australia, for example, the enterprise challenge program from the UK. I want to comment on something differently. About 10 years ago, the word "innovation" was not respectable, five years ago "entrepreneurship" wasn't. Now "cluster" is not a respectable word. However, mention was made of the Walter and Eliza Hall Institute and the cluster in Melbourne; mention was made of Redfern and the cluster developing there; there was also mention of the walking across between the CSIRO and Macquarie University. All of those are the spillovers that occur when you have researchers in government, universities and industries growing together in a common sense of interest. Finland is, in fact, a cluster issue. Scotland has a very explicit clusters program, which is a core of their growth. The question relates then very specifically - if we are to do that, 7 per cent of our graduates here are in the technology degrees compared with 26 per cent in Finland and elsewhere. How are we going to do the paradigm shifts which can get all those synergies working together?

BOB MEYERS (Pillsbury Winthrop (International)):

I am with a US law firm here in Sydney. Virtually all of you have stressed in your presentations today the importance of IP and protecting that IP. I have a question for Dr Niall. One concern obviously for your company is in respect of the various regulatory approvals that you need in order to bring your products to market. That timeframe had shortened in many respects - as with the FDA in America - but with respect to the lifetime of your products in terms of competition with generics, I wondered whether you could comment on how that also has affected your company?

backing because there is market failure there.

BILL FERRIS (CHAMP):

My proposal does not require the Government to mandate anything. What I am suggesting is with a son-of-IIF that if we, the private sector, put up money at risk into this area and the Government makes available leveraged funding to match it, or on a 3:1 or 2:1 or whatever it takes. Drive it out of the public sector decision making, and push it into the private sector with an incentive to bother. Drive it into innovation clusters or incubators. That is what I was suggesting.

ROBIN BATTERHAM:

How much time have I got here! You are spot on, and I totally agree with your thrust.

I can point to a few initiatives that are there - the major national research facility that has come out, the CRC scheme, the way the ARC will move also. These things to me are, from the Government side, the keys with which you can start locking things up. But there has to be a preparedness to do it. Would you believe that there really is almost religious zeal against the notion that you should have anything to do with picking winners. Also, clusters tend to get tarnished with that brush.

All I can say to that is: We have to have the groundswell from people here who can see the light and realise that this is all worthwhile. Let me urge you to keep on saying the things you have just been saying. But let me hear it from the whole room. I am not looking for thunderous applause. What I am looking after here is getting this message out repeatedly and often, because in my book that is the only way to go. There are initiatives there that we can build on.

HUGH NIALL (Biota):

Your point addresses the situation where you license a product out and, because of the lengthy time it may take to do that, you have a limited life of royalty stream from that particular product. In the case of our flu drug, we are developing a second generation flu drug which will, by its nature, extend the patent life out a further seven or eight years. One thing is to keep working in the area and build up a portfolio of products. The only other approach is that you retain some of the ownership and participate in the brand name and in the generic phase which will ultimately be inevitable.

Summary on the Day (AATSE Rapporteur)

Dr Susan Pond AM, FTSE

Dr Susan Pond is a Director of Pharmaceutical Research at Johnson & Johnson Research Pty Ltd. She is a member of the organising committee for this Workshop, and a member of the NSW Division Committee of the Academy.

I am not going to attempt to match the eloquence of the speakers who presented today; I think everyone will agree that it has been a highly successful program and a lot of messages have come from it. My role is to pick up the threads that are common to the speakers, and highlight their suggestions about the way forward, rather than to dwell on the problems of the past.

The gauntlet was thrown down for us by Denis Wade and Robin Batterham. The challenge to New South Wales and Australia in general is to lift its game in commercialising innovation. In fact, Robin put a figure on it by at least an order of magnitude. They pointed out that even well established companies, the old economy, will have to innovate to survive and introduce new products from that innovation.

The seven speakers were asked to talk about their successes and the reasons for them, but also to highlight the difficulties they encountered, the pitfalls, and how they would do it again if, indeed, they would choose to do it again. Some of the speakers indicated that they may not choose to do it again.

What I would like to use as my framework is a toolkit, or the female equivalent of that, which is a purse. I choose the word "purse" very carefully. Everything in the toolkit or purse that I am going to highlight is very necessary for success. I have listed everything in the toolkit or purse under seven headings, all of which begin with "P" - the seven continuous positive pressure "Ps".

- First of all we need People - partnerships, patrons, perspective, professors, pedigree and people willing to play the game.
- Secondly, we need Patents that are protected. We need to look for paradigm shifts; we need to pick the right area; and we need to pick the area at the right time.
- Thirdly, we need Patience, persistence, passion, pliability (or flexibility), the capacity to pick up after failure, plumb the depths of despair for the lessons rather than give up. All these attributes are required to succeed.
- Fourthly, we need to realise that we are on a Planet. Planet US was mentioned, but everything has to be viewed in the global context. We have to have a presence globally and understand the whole planet's market, not just the local market.
- Fifthly, we need a Pipeline. We have to have the right number of products or projects - not too many, not too few. We have to know when to pull the plug.
- Sixthly, we need Policy. As has been mentioned, we need it in education, tax and all areas across government. We need to have a position on issues that will make us relevant and competitive globally. We need to involve politicians, and Denis Wade has mentioned some of the attempts of politicians through initiatives such as the NSW Innovation Council. We need to promote Australia, get publicity and raise our profile. All of those things come under the policy area - not only policy of government, but also of bodies such as the Academy.
- Finally, we need Pesos - pesos, pesos and pesos! We need performance rewards. We need to take personal risks with our money, mortgage our houses. We need to make profits so that people see that this is a worthwhile venture. There need to be all those forms of pesos that have been mentioned - pre-seed, private equity and so on.

I would like to end by telling a small story that was very illuminating to my professor when I was up in Queensland. As a lapsed academic I can tell this story! One of the components of the annual grind is the generation of exam questions, and this is something people always do at the last moment and with great reluctance. Thus they probably do not do it as well as they should.

One day in our department when an outside body wanted exam questions, they came and offered \$30 per question. Whereas it normally took our professor weeks and months to get questions out of his staff, he had more questions than he could handle within 24 hours! So I think pesos are very important, and we cannot sweep them under the rug. People are money-motivated, so we really do need to see some of those changes in the arrangements of the tax structures that have been mentioned before we can really turn on the lights for the young scientists and people with technological and other skills in this country. Otherwise, we will not really pull them in.

Appendix A

Analysis of Comments

The Organising Committee has analysed the Speaker's comments and to encourage debate, this Analysis is included here:

| Issue/Topic | Speaker's Comment | Response |
|--|--|--|
| Intellectual Property | | |
| High quality IP essential | <i>The key factors are the creation of intellectual property, the creation of the patents and the know-how, and the protection of the patents. (Bishops)</i> | <i>The top 1% of science has 9 times the chance of success (Batterham)</i> |
| IP must be suitable for the market | <i>Picking the right area is important. It is equally important to match the view of the future with the level of expertise. In Radiata's case, they knew they had world-class people and that they could create a world-class technology. (Radiata)</i> | How can good judgement be introduced in a routine manner? |
| IP resulting in paradigm shift leads to greatest rewards | <i>A lack of interest combined with lack of understanding of what could be - a paradigm shift. (ResMed)</i> | |
| | <i>The scientists involved in the project decided to go against the conventional paradigm and it worked. Therefore, the first lesson is to not take any notice whatsoever of the existing conventional wisdom. (Biota)</i> | Some IP must be visionary, but how can it be chosen? By chance? |
| | <i>Energetics changed from a consulting company to a manufacturing company, moving into product sales, and leveraging its IP from an existing base - a paradigm shift. (Energetics)</i> | |
| | <i>Tackle the very hard problems as they usually provide great rewards. (Radiata)</i> | |
| Protection of IP essential | <i>A protection of intellectual property is crucial to success. (ResMed)</i> | Is the patent system effective? |
| | <i>We have a number of technology platform companies -Redfern which are all at the very hard components manufacturing end. The success of those companies relies on their intellectual property portfolio. (Redfern)</i> | |
| | <i>Bishop had strong patents, so they proposed a joint venture with Mercedes-Benz Steering . (Bishops)</i> | |
| Commercialisation | | |
| A project champion is needed | | Can innovation be taught? Bishops train their staff. |
| The champion must be motivated and resilient | <i>Another critical factor is the preparedness and ability to adapt. (Radiata)</i> | |
| | <i>Hang on during the middle years, (when) surrounded with negativity and people telling them that it was never going to happen. (Radiata)</i> | |

| Issue/Topic | Speaker's Comment | Response |
|--|---|--|
| Good development planning required | <p><i>The Champion must have a very high tolerance for repeated failure. (ResMed)</i></p> <p><i>Biota should have diversified its portfolio more than it did in the early period. (Biota)</i></p> <p><i>Dr Arthur Bishop has always passionately believed that innovation can be taught. (Bishops)</i></p> <p><i>The Innovation Investment Fund scheme has worked. (CHAMP)</i></p> | <p>How is motivation reinforced?</p> <p>Institutions should recognise persistence by rewards and encouragement and accept risks and possible failure.</p> <p>Bishop Innovation is the business unit that actually teaches the process of innovation.</p> <p>What would make venture capitalists invest earlier?</p> <p><i>One opportunity is to create a son of IIF scheme. - a skewed IIF scheme requiring that venture capitalists only invest in pre-revenue projects, allowing follow-on investments and tying in the IIF scheme recipients, by making sure that they are run by people who are already in the business, who have funds under management, who have teams and have been doing it for a while. (CHAMP)</i></p> |
| Good business plan necessary | <p><i>Biota went to the public markets much too early for its safe evolution. In effect, Biota was a private company operating as a public company. (Biota)</i></p> <p><i>Managing risk and developing a suitable business plan is a major challenge. (Energetics)</i></p> <p><i>With one product, the company is vulnerable. As a long-term solution, Biota is developing a second generation flu drug, which it believes to have a much better marketing profile to cope with the competition. (Biota)</i></p> <p><i>A very important, critical factor, is the need to be part of the standards process. It provides valuable marketing information, it also provides an opportunity to influence what is going on, and to learn what other people are thinking (as opposed to simply hearing what people are saying!). (Radiata)</i></p> | <p>Commercial skill should be introduced early. But how?</p> <p>Can a suitable trusting environment be created?</p> |
| Skilful multi-skilled management team including finance, production, marketing | <p><i>Get commercial savvy into the very early stage process. There is the incubator model, which has certainly benefited Redfern Photonics. Colin Sullivan is embarking on an incubator track where he is providing the framework for early stage researchers and business people to get together and make things happen. There needs to be the mechanism to commercialise that process more. (CHAMP)</i></p> | <p><i>CRCs may create some bits of intellectual property but, it is the bringing in of talented people from the world of commerce, with all their experience and back pains from failures, that is really important there. (Redfern)</i></p> |

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| Incubator arrangements support commercialisation | <p><i>Growing the team of people within Redfern Photonics been absolutely vital. (Redfern)</i></p> <p><i>Management and people - In Radiata's case, they had a highly integrated and extremely competent team in two organisations, which were within a short 15 minute walk from each other. (Radiata)</i></p> <p><i>There is a real and absolute need for incubators. (ResMed)</i></p> <p><i>Redfern Photonics was created essentially as an incubator company. It has grown and now runs a number of operating companies, all of which source technology from the CRC. (Redfern)</i></p> <p><i>The CRC has been and is the driver for the innovation. (Redfern)</i></p> <p><i>A critical factor is incubating. Taking the CSIRO as an example, it had Radiata on site which was of enormous value to walk down the corridor and ask somebody a question, make a quick measurement, have access to infrastructure and be not isolated. There is constant stimulation and in the early stages of a company's formation, this is invaluable. (Radiata)</i></p> <p><i>Clustering is a very unpopular word at the moment, but we need some variation of that, where you drive people with mutual interests together and the potential benefits can help the very early stage venture process. (CHAMP)</i></p> | <p><i>Incubators allow scientists to be surrounded by people who can support and assist them in the process of commercialisation. (ResMed)</i></p> <p><i>The Photonics Foundation is the last step in the process. It owns the intellectual property and invests that property in equity in start-up companies. (Redfern)</i></p> <p><i>It is a partnership between government, industry and research organizations. Every activity that the CRC undertakes always considers three areas, namely the R&D, education and training, and commercialisation. (Redfern)</i></p> |
| Alliancing and networking in Oz and overseas | <p><i>Seed markets by attracting the best researchers from overseas to come and work in Australia and visa versa (ResMed)</i></p> <p><i>It is very difficult dealing with American companies without being American based because you just cannot get funded and treated seriously at a high level when you are in Australia. It is more that people do not trust their money going elsewhere, which they cannot see every day. (Energetics)</i></p> | <p><i>It is being maintained by having an international board. (ResMed)</i></p> <p><i>How can the high cost of globalisation be supported?</i></p> |
| Team and champions require rewards | <p><i>Government labs do not have the incentive to move out into the commercial arena. There is no personal gain for the individual unlike Photonics CRC which has all the mechanisms in place for taking equity and being prepared to take that risk for long-term gain.</i></p> <p><i>Stability in the government labs is necessary to provide infrastructure for</i></p> | <p><i>We should be able to name heaps of very rich scientists. As venture capitalists over 15 years, we find that 163 of our entrepreneurs are millionaires or multimillionaires, and in those, there would be only about four scientists. The rest are financial-based entrepreneurs - good people, but not scientists.</i></p> |

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| Picking winners is necessary. | <p><i>start-ups in their formative years but other mechanisms as encouragements are important to get turnover of companies. (Radiata)</i></p> <p><i>Safety nets, it does make a difference when somebody is trying to make the decision of whether or not to take a risk. (Radiata)</i></p> | <p><i>We have a long way to go. (CHAMP)</i></p> |
| Funding | | |
| Seed funding initiatives and sources require enhancement | <p><i>We successfully raised a Government START grant, which was extremely helpful. (Energetics)</i></p> | Noted. |
| There is a shortage of Stage 2 funding initiatives and sources | <p><i>A difficult to attract investment in ResMed which was seen as a one product company. (ResMed)</i></p> | |
| Venture capital climate requires facilitation and competition | <p><i>CHAMP is absolutely committed to the venture capital business in this country. It is believed that the management buy-out end of the business will be where most of the dollars go over the next five years. (CHAMP)</i></p> | |
| | <p><i>Venture capital allows companies to tap into networks. In terms of raising capital, you have to know what is happening in your area, and it is hard to that from here. (Energetics)</i></p> | <p><i>Overseas market presence for alliances, clients and funding is essential - a VC decision is a lot more than a valuation; it is also about the networks and how they can get you into business. (Energetics)</i></p> |
| Introduce overseas pension funds to widen funding sources - | <p><i>Australia needs to open its doors to the international supply of venture capital. It will also provide a competitive situation between Australia's own supply of superannuation fund money and international venture capital. In turn, it will bring international alliances and networking which will provide greater value to Australia's high growth companies, such as the ResMeds, the Cochlears and the Biotas, as they develop offshore. (CHAMP)</i></p> | <p><i>Most of the world's venture capital, between 95 to 99 per cent, is provided by the US pension funds. Australia has had an embargo against that supply because these entities are exempt in their own tax regimes and their exemption travels with them to almost every country in the world, other than Australia. When they get to Australia they are taxed as companies. The problem has still not been solved. (CHAMP)</i></p> |

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| | <p><i>How do you get in capital without getting rid of too much equity? I am talking about the pre-revenue stage and the pre-market stage. (Question from floor.)</i></p> | <p><i>The first thing is have some competition among different parties to provide you with this funding. What you should be worried about is growing the company and increasing its value. If it works out, the original people will be very happy about it. (Biota)</i></p> <p><i>I would not agree with Hugh that you just shop around so competitively and take the cheapest money. You have to find the investor for you. But at the end of the day, if the founders and the entrepreneurs are not excited by a smaller piece of a rapidly expanding pie and are driven by hanging on to the whole pie, there ain't going to be a feast for anybody! (CHAMP)</i></p> |
| Leverage funding from an established operating base | <p><i>Biota would probably not have listed in Australia. In hindsight, the company would have gone straight to NASDAQ. The reason for that is that the American market is much more sophisticated and companies need to be in the US because the capital market is. (Biota)</i></p> <p><i>It was possible to keep the burn rate down. The key to financing Biota was identifying a partner, Glaxo-Wellcome, who took over all the expenses associated with the flu project. (Biota)</i></p> | <p>This is a good example of leveraging, but how does a new start-up company and an old profitable operator establish the trust to go ahead together?</p> |
| | <p><i>I provided the service, creating the market by seeing patients from which came ResMed. (The same was with Cochlear). (ResMed)</i></p> | <p>Encourage government and institution support for service centres.</p> |
| | <p><i>Bishops is beginning to expand cautiously focussing on areas that capitalise on its expertise. (Bishops)</i></p> <p><i>We are offering an on-line service bureau. (Energetics)</i></p> | <p>Note that Bishops have operated for 30+ years and have strong cash flow and profitability.</p> <p>Is a service facility a way of getting an idea on the road?</p> |
| Support networking between financiers, business entities and start-ups | <p><i>Radiata was born global, started as a Delaware company for tax and regulations reasons. It then set up an Australian arm. Radiata looked like an American company, employed people with American accents and was seen as one of them. This was important as the US had 60 per cent of the world's market. (Radiata)</i></p> | <p>Is the attraction of the US market such that all companies relocate there eventually?</p> |
| Economic Climate and Culture | | |
| Facilitate changes to community and the market's attitudes to risk | <p><i>It is significant that the founders of Radiata were from the university where they had flexible arrangements, and not the CSIRO. (Radiata)</i></p> | <p>Getting industry to be aware of the opportunities for them - even for large companies - in having spin-off companies as the mechanism for the commercialisation of intellectual property</p> |

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| | <i>There is a need for demonstrator projects in Oz. (Redfern)</i> | |
| | <i>Before Radiata's incorporation, the CSIRO provided special funding to enable research to be done in the wireless LAN area. (Radiata)</i> | Is a cultural change of attitude to risk recognised? How can it be brought about? |
| | <i>Government research organisations need to think seriously about providing access to equipment and time to nurture start-up companies. The idea is not to make money; it is to create a company. (Radiata)</i> | |
| | <i>A priority has been to change the research culture. (Redfern)</i> | Trying to get our universities to be flexible in the way that they dealt with the opportunity and to form structures which allowed risks to be taken without getting the universities deeply involved at that level |
| | <i>No matter what the idea, it takes 10 to 12 years before anybody makes any money. (Radiata)</i> | Note this recurring theme. CHAMP and AMWIN invest mainly in post seed companies. They like to invest at 12 minus 3. They pay the higher price, and get involved when reality in the marketplace can be seen. (CHAMP) |
| Enable commercialisation by supporting best opportunities (Prioritise winners) | <i>The Australian government should be targeting performing companies and rewarding the creation of intellectual property and its commercialisation. (Bishops)</i> | Note, this means picking winners. |
| Amend Oz tax climate so as not to penalise options and equity made before value increase | <i>This country has to reverse the brain drain. Australia has to accept that its best people will go offshore - they will study and work where they will get ideas and they will be better for it. However, Australia needs to be able to attract them back. There is constant frustration for Australians who would like to come back, but Biotech in California has offered them \$6 million worth of shares or options and Australia's offerings by comparison are, at minimum, tax-convoluted and at worst, tax-frustrated. It is just ridiculous and will contribute to a continuing brain drain. It is easy to change. (CHAMP)</i> | <i>The philosophy in this country is that employee shares and options are taxed when they are issued, not when, and if, they ever make money. (CHAMP)</i> <i>An early stage company needs lots of service, advice, help, IP business development and finance. If it has no money it cannot pay, but it can issue equity. However if equity is taken in lieu of fees, a tax liability is incurred in that year. So there is a cash flow problem in paying the tax. It is a Catch 22 situation. (Comment from the floor.)</i> |
| | <i>I think the employee share ownership plan is very critical - the tax laws here are not good in that regard. In America we see that the tax treatment of share schemes is a lot more liberal. (Bishops)</i> | Noted. |
| Provide matching support for home development similar to other countries. | <i>A guarantee from EFIC costing Bishop \$50,000 enabled them to leverage into a \$43 million investment. (Bishops)</i> | Noted. |

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| similar to other countries. | <p><i>Australia is still a great place to do research. It is not quite such a great place to do development. Biota will be doing mostly "R" with some in the US; and mostly "D" and business development in the US because that is where the money is. That is the current plan. (Biota)</i></p> | <p><i>The Government should also be encouraging multinationals to undertake their R&D in Australia, to own their intellectual property in Australia and to ensure that the profits earned on the creation of that IP are reinvested in Australia. (Bishops)</i></p> |
| | <p><i>Australia has an extremely competitive cost structure, however, it is also very remote from the major industrial markets. (Bishops)</i></p> | <p>Note the geographic and business isolation of Oz.</p> |
| | <p><i>The offshore incentives provided by the German Government in this case were far in excess of anything that Bishop could have achieved here. (Bishops)</i></p> | <p><i>The Australian Government should be targeting performing companies and rewarding the creation of intellectual property and its commercialisation. (Bishops)</i></p> |
| Facilitate overseas expansion | <p><i>Why manufacture in the United States? It was simply that key people were becoming detached from some larger companies and they were going to form a competitor. So we realised the best thing was to operate in the U S and grab that talent. (Redfern)</i></p> | <p>Globalisation is essential but expensive.</p> |
| | <p><i>It is difficult long-term to do large parts of your product development, especially commercial product development, away from your major markets and marketing activity. (Energetics)</i></p> | <p>The weak \$A makes overseas expansion very very expensive.</p> |
| | <p><i>Establish a presence in the market with adequate support services. (Bishops)</i></p> | <p>Do Australian tax laws relating to taxing overseas operations support offshore expansion sufficiently?</p> |

