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**HOUSE OF
REPRESENTATIVES**

STANDING COMMITTEE ON SCIENCE AND INNOVATION

Reference: Business commitment to research and development in Australia

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**HOUSE OF REPRESENTATIVES
STANDING COMMITTEE ON SCIENCE AND INNOVATION**

Monday, 21 October 2002

Members: Mr Nairn (*Chair*), Ms Corcoran, Mr Evans, Mr Forrest, Ms Grierson, Mr Hatton, Mr Lindsay, Mr Tony Smith, Mr Ticehurst and Dr Washer

Members in attendance: Ms Corcoran, Mr Forrest, Mr Nairn, Mr Tony Smith, Mr Ticehurst and Dr Washer

Terms of reference for the inquiry:

To inquire into and report on:

The international comparisons indicate that while the public sector in Australia supports R&D at an impressive level, business investment is less impressive.

With particular consideration of:

the R&D drivers in small and medium sized business;

the needs of fast-growing companies; and

the considerations by which major international corporations site R&D investment,

the committee seeks to address three questions.

What would be the economic benefit for Australia from a greater private sector investment in R&D?;

What are the impediments to business investment in R&D?; and

What steps need to be taken to better demonstrate to business the benefits of higher private sector investment in R & D?

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Committee met at 4.44 p.m.

FIELD, Professor Leslie, Acting Pro-Vice-Chancellor (Research), The University of Sydney, and Member, Group of Eight Deputy Vice-Chancellors (Research)

SIDDLE, Professor David, Deputy Vice-Chancellor (Research), The University of Queensland, and Member, Group of Eight Deputy Vice-Chancellors (Research)

CHAIR—I declare open this public hearing of the committee's inquiry into the commitment by business to R&D spending in Australia. I welcome representatives from the Group of Eight universities. I would like to point out that, while this committee does not swear in witnesses, the proceedings here today are legal proceedings of the parliament and warrant the same respect as proceedings in the House. The deliberate misleading of the committee may be regarded as a contempt of the parliament. The committee prefers that all evidence be given in public. However, should you wish at any stage to give evidence in private, you may ask to do so and the committee will give consideration to your request. Would you like to make an opening statement before we proceed to questions?

Prof. Siddle—Yes, Chairman. First of all, I thank your committee for inviting the Group of Eight here this afternoon to discuss these important issues with you. Perhaps I could say something by way of introduction about the Group of Eight. It is a coalition of Australia's leading research-intensive universities, although I should not mislead you by putting the entire emphasis on research-intensive; they are teaching universities as well. The Group of Eight between them carry out approximately 70 to 75 per cent of this country's research in the university sector. We enrol more research higher degree students than the rest of the system put together. We rank among the top 20 enterprises in Australia in terms of holding US patents.

To put that into a bit more perspective, especially given the concerns of this committee, the Group of Eight universities command about 57 per cent of all the income from cooperative research centres that flow to universities. For those of you who have managed to look at the results of the ARC-NHMRC-CSIRO survey on commercialisation from Australian universities and from CSIRO, I would like to quote some figures that I think put some of this into perspective.

The Group of Eight is responsible for about 63 per cent of expenditure on R&D amongst the university sector. We are also responsible for 74 per cent of invention disclosures; 77 per cent of patent applications; 80 per cent of patents issued worldwide; 71 per cent of licences executed; 79 per cent of the gross income from licences of intellectual property; 59 per cent of the start-up companies that were formed in year 2000; 78 per cent of the start-up companies that were operational at the end of year 2000; and 78 per cent of the value of equity holdings in start-up companies. So the Group of Eight universities collectively take the business of protecting, managing and commercialising intellectual property quite seriously. Our interactions with industry are also good. Sixty-seven per cent of the research income in the industry and other category flows to the GO8 universities. My colleague Les and I would be more than happy to answer questions about the GO8 later on, should you wish us to do so.

If I could be indulged for another couple of minutes, I am not going to bore you with a long diatribe about the knowledge economy, with which you are all familiar; in part it is why you are here. However, I will make the following observations. It seems to me that the gross

expenditure on research and development in this country is low. It is falling. It is about 1.53 per cent of GDP at the moment. We rank 17th in the OECD, which is about 0.1 per cent more than Slovenia and below a number of other countries with which I think we would want to be compared—for example, Israel, Sweden, Finland, USA, Korea, Switzerland, Iceland, Taiwan, Belgium and Singapore. The international comparisons are not good for us in terms of our expenditure on R&D. To illustrate that, I will use just one example that came recently from Europe. I read the following quotation:

The European research officials have grown increasingly anxious in recent years over the perceived research gap with other major economic powers. According to European Union statistics, Europe spent 1.92 per cent of its gross domestic product on research and development in 1999. In the same year, the United States spent 2.64 per cent of its GDP and Japan spent 3.04 per cent. At a summit meeting in the last spring—

so I guess it was earlier this year—

European leaders set a target of three per cent of GDP for research and development spending and they argued that at least two-thirds of that should come from the private sector.

That puts the European position, I think, fairly clearly. It compares with our current position of 1.53 per cent of GDP.

The last thing I wish to touch on has to do with IP management. I have already alluded to this in my earlier comments. We take IP management and commercialisation very seriously. All of the GO8 universities have well-developed policies for protecting and managing IP. Almost invariably, we have units or separate companies associated with our universities for the commercialisation of IP.

Two of the difficulties that we see in particular in that area, which you may or may not wish to question us on, have to do with the inhibitions to commercialisation in the Australian higher education sector. One of them has to do with capital gains tax—that is, the capital gains tax that would be levied on inventors who have equity in start-up companies. They would have capital gains tax on paper for which they would be liable. The second issue is fringe benefits tax. If a university asserts ownership of intellectual property rights of its staff and it then confers a benefit on staff in the form of equity in a start-up company, we have technically given them a fringe benefit for which we would be liable. We see these two issues as being inhibitors to commercialisation of intellectual property in this country. That affects the GO8 as a group more than any other group of universities in the country. I will stop there. You did not come here to listen to me; you came here to ask us questions.

CHAIR—Thank you. We did come here to listen to you. We want to hear from everybody to find some possible solutions. I will start by going to the GDP figures—R&D as a percentage of GDP. It is interesting when you look at some of the figures. If we take the United States and Australia—and I know the United States and Australia in many respects is not a good comparison but I will start there—the higher education sector in Australia does pretty well. These are figures provided by the CSIRO, actually, whose representatives will be giving evidence later this afternoon. In Australia, 0.44 per cent of GDP is the figure for higher education sector expenditure on R&D. In the United States, it is 0.37 per cent. So we actually do better than the United States. For the government or public sector, in Australia the figure is 0.35 per cent; in the United States it is 0.21 per cent. So we do pretty well there. In the business sector, the figure in Australia is 0.68 per cent; in the United States it is 1.94 per cent. You can even pick out a few other countries which ought to be more comparable. Canada, for instance, is

virtually on a par in the higher education area. We do better in the government area than Canada. Once again, the figure for the business sector is 0.68 per cent in Australia and 1.03 per cent in Canada. Have you got some comments on the break-up of R&D in that sense? I guess it is the nub of our inquiry—this sort of disparity.

Prof. Siddle—I will start with a general one and then hand over to Les, who might have an alternative perspective on it. I think the implication of what you said was absolutely right. Our gross expenditure on R&D is being depressed by our business expenditure on R&D. Essentially, that is the nub of the issue. If you disaggregate the gross expenditure on R&D into the different components, you get that message very clearly. I think that is consistent with the figures you have just quoted. If you need some data to document that, it is here in this document, which we will table and leave with you. But Les might have a comment on that as well.

Prof. Field—No, I do not want to add anything more. I think that is exactly the perspective that I have got, and it is not just with the USA and Canada. By and large, it is the business component which dominates the gross expenditure on R&D and it is that which is the low component in Australia.

CHAIR—That is clearly low in two respects. One is the expenditure that business does within their own business—that is, R&D carried out by business—but it is presumably also in the amount they spend with universities. You said in your introductory comments that you have very good linkages with industry but clearly they are still not strong enough. Is there anything that you think the government could be doing to assist those linkages even further?

Prof. Siddle—Yes. I will go to those figures that I mentioned in my introduction regarding category 3 research income, which is industry and other. There is a little bit of noise in there because it includes some bequests and donations money, but that really is a minor proportion. That category in total was about \$329 million in the year 2000. On the face of it, that sounds like a lot of money, but by international comparisons it is not. There are some very good examples of great industry-university linkages. I can detail some, and I am sure Les can, for you if you wish.

CHAIR—If you could give us some examples, it would be a great demonstration of where things work and do not work.

Prof. Siddle—I will pick two very quickly for you. One is at my own university, the University of Queensland, at the JK centre for the minerals industry. As an R&D and consulting unit it does very well. It has longstanding relationships with the mining industry. Their services are found to be indispensable by them. The second one, which I would take from Les's institution, is to do with a particular researcher who has done longstanding collaborative research with Patrick Stevedores on designing autonomous vehicles to move containers around the docks. It is a superb example of what can be achieved when you have a long-term collaborative arrangement where industry is prepared to invest not just for what they think they will get in 10 months time but for what they might get in two to three years time. That is exactly the nature of that relationship. It is an excellent example.

Prof. Field—Or a longer time frame than that—beyond the term of a year or two and something which is looking even five to 10 years down the track.

Dr WASHER—I was fascinated when Professor Siddle mentioned the capital gains tax and the fringe benefits tax. It seems totally and utterly ridiculous to me, too, but can you flesh that out a little as to how it actually affects things? What we are looking at is that we have a problem in terms of R&D syndication, which you mentioned in your submission. I empathise totally with where you are coming from. I think some of our taxes are not correct in the way we address them and they are counterproductive. Can you reinforce that a little further.

Prof. Siddle—With regard to the two that I mentioned, let us take a staff member who has invented something. If the university's policy—and it almost invariably is—is that as the employer it asserts ownership of the intellectual property rights, we then set about the business of determining whether or not that invention has commercial potential for exploitation and development. That will cost a lot of money because we have to take out patents at different levels and in different countries, so it is actually an expensive business for a university—for which we are not funded, I might add—to hold a patent portfolio.

Dr WASHER—Could you give an example of the kind of money you are talking about — just a round figure—and what it would cost for a reasonable patent.

Prof. Siddle—To push through at international levels, you are probably looking at between \$50,000 and \$100,000.

Dr WASHER—It is a lot of money.

Prof. Siddle—It is a lot of money if you have got a big patent portfolio. By and large, the GO8 holds the biggest patent portfolio across the Australian university sector. Let us suppose we could commercialise that and we find investors, or the business liaison office at Sydney or Uni Quest at UQ find business angels or venture capitalists, it gets through the pre-seed funds and somebody is prepared to come along and put \$4 or \$5 million in. Most of us, because we want to promote an entrepreneurial and innovative culture, have policies that mean we will share benefits with our staff because of the fact that they have actually made the invention. So a staff member may be awarded, let us say, 10 per cent equity in the start-up company or they may be given a certain percentage of royalty returns.

Unless we go to quite extraordinarily complicated lengths—and there are ways of doing it, I believe—if we simply conferred that 10 per cent equity in a company that might be valued at \$6 million or \$7 million on paper, the staff member will have incurred a capital gains tax liability. Similarly, by now conferring that benefit on the staff member from intellectual property over which we asserted ownership rights, we have actually conferred a fringe benefit on the staff member, so the university would be liable for fringe benefits tax on the valuation of the 10 per cent equity.

Prof. Field—And both of these act as a disincentive to people getting involved with the commercialisation mechanism at universities. There is also a financial disincentive within the universities. We have to be very careful about what we pursue.

CHAIR—If that capital gain could be deferred legally in some way so that it did not become taxable until it was able to be realised, would that make a difference?

Mr ANTHONY SMITH—You are not arguing for zero?

CHAIR—No.

Dr WASHER—When we have taxes that are obviously such a repugnant barrier to achieving the goal we want to achieve, I think we have to first remove them before we look at incentives like the 175 per cent—which I am delighted to have, by the way. I compliment my government on doing that. Obviously, that just illustrates how ridiculous it is to try to generate industry links with universities, which is what our big drivers are. This is the concept that we will use in our universities to drive this. These two taxes are obviously a big barrier and they need to be seriously addressed.

You also mentioned R&D syndication. I was quite enthusiastic about it, but the ATO was not enthusiastic about it and said it was no excuse for tax evasion. The ATO people are pretty hard-nosed people to get around. You said you thought it was still a good idea. I agree, but how can we convince the tax office that we could put in some barriers to obvious evasion? What sort of barriers—you have obviously thought about it—could we put in to try to stop evasion and make it a productive exercise?

Ms CORCORAN—Before you answer that question, could you just go back a step for the uninitiated like myself and explain the problem with syndication that you are referring to?

CHAIR—It was effectively that syndication for R&D is used. I guess ‘abused’ is probably the correct term.

Dr WASHER—I will flesh it out a little. The 150 per cent was dropped back to 125 per cent, and various reasons were given to me for that. I asked why we did that. The tax office had advised government that R&D syndication using that was a rort and there was far too much rorting going on. That was one of the many reasons behind the advice given to government by the ATO. That is why I asked whether there was a reason for dropping it back.

CHAIR—I think it is fair to say that there was some proper use of syndication for R&D but there was also significant improper use.

Mr ANTHONY SMITH—They are two separate issues.

CHAIR—I think Tony might know about it even a bit better.

Mr ANTHONY SMITH—Two things happened: in 1996 or 1997 syndication was replaced with a grants program. The 150 per cent was cut back to 125 per cent. They were related but separate decisions. As the chairman said about syndication, even a lot of the participants admitted that it was effectively an open-ended scheme because of the way it operated. So government never knew the size. There was a blow-out. Certainly a significant proportion of the tax dollars, as the chairman indicated, were not actually ending up in infrastructure.

CHAIR—It is very difficult to find a way to have a scheme like that so that it could not be abused in some way.

Prof. Siddle—There are a couple of themes running through this. I think you are absolutely right. There were cases where syndication was not working in the way it was intended.

CHAIR—It gave all the good cases a bad name, which is always the case.

Prof. Siddle—But syndicated R&D can be separated from the issue of what tax concession is given for private investment in R&D, be it 150 per cent or 125 per cent or whatever. In principle, they are two separate issues, so we could have a situation where we do not have syndicated R&D but we had a different tax regime on the tax offsets for investment in R&D. That is something you might want to explore. The third thing is that I think we can and should distinguish between the sort of issue that Dr Washer and I have been talking about, which is commercialisation of intellectual property and the barriers to that versus, in a sense, your main game, which might be business investment in R&D. Those two things obviously overlap at times. One would hope that business investment in R&D led to greater commercialisation of outcomes. Again, in principle, they are separate.

Ms CORCORAN—I was going to ask a little about syndication, but you have probably done enough with that now. I noticed all your recommendations are basically tax based recommendations. I am just wondering whether there are any other ways of addressing the fall in business R&D. I would love to ask why as this is an R&D forum but you may not answer me if I do that.

CHAIR—Well, that is not necessarily the case. We will get some evidence this afternoon from CSIRO which actually shows that it fell between 1995 and 1997 but then rose again from 2000 and 2001. If you take out the increase that occurred in 1995-96 and 1996-97 and then the decrease after, it is a fairly straight line of increase.

Ms CORCORAN—I am really asking whether there is anything else in the minds of the business people—I know that is probably not your exact bag either—that would promote or encourage R&D.

Prof. Siddle—I think there are many mechanisms that can be used. The cooperative research centre program is one mechanism. It is not the entire answer. It is one mechanism to bring university researchers and industry together. When they work, they work very well indeed. Often they produce industry-university interactions that would not have occurred had the CRC not been formed. That is one mechanism. I actually do not think there is enough movement or opportunity for movement between the business and industry sector and the university sector. There are obvious structural impediments to that at the moment in terms of salary differentials and superannuation and so on.

We have a policy at UQ—I think all of the GO8 does—of trying to have a good system of adjunct professorships for people in business and industry to actually get them involved much more in university activity and in R&D. But an adjunct position goes only so far. You really need a system whereby somebody from industry can come and spend six or seven months working with somebody in a university and vice versa so that you learn something about each other's cultures and you learn more about what you need in the short, medium and long term. At the moment there are no incentives for that. The way universities are at the moment, we certainly could not fund that out of our operating money.

Prof. Field—The adjunct scheme is a very valuable mechanism for getting active advice, particularly from industry participants or from outside the universities. We find a lot of our adjunct staff do form parts of our advisory boards in terms of structuring our undergraduate

curriculum and our graduate curriculum and participating in both undergraduate and graduate lectures. I think all of the GO8 have a fairly active adjunct program. Again, it is not something which is funded by a university. It is very much a voluntary thing.

Ms CORCORAN—I was going to ask that. Could you go back a step and explain the adjunct scheme.

Prof. Field—An adjunct position with the university is more or less an honorary position. It provides them with access to some of the resources that we have at universities typically, but it is not something that generates remuneration on their part. We find that they get themselves involved with the university because they feel they can make a contribution. The universities value that contribution because they do make a dedicated contribution to both teaching and research projects.

Ms CORCORAN—In a technical manner?

Prof. Field—In a technical and teaching fashion. We find some of our adjunct staff, particularly in some disciplines, will deliver parts of lecture courses, particularly to the senior undergraduates, and perhaps guest lectures or guest presentations in the undergraduate schemes.

Ms CORCORAN—And that has spin-off too for research?

Prof. Field—It has spin-off for research because these people do contribute directly to associate supervision or co-supervision of graduate students, particularly in programs which have an industry bias.

Mr ANTHONY SMITH—I wanted to pick up where you were talking about relationships between business and academia and take you back to your earlier evidence when you spoke about the value of a relationship where there has been one. You mentioned Patrick Stevedores and another example where the vision is extended from a short-term one to a long-term one. My question really is: what can the business community do? We often hear that tax and all these factors are quite important. However, the culture is a limited one in terms of vision. We have heard earlier evidence about various disciplines on boards. They do not see R&D as an automatic line item compared with the traditional parts of their budget, such as marketing and advertising and that sort of thing. There are other stresses with market analysts or whatever. What more do you think can be done culturally on that front? It seems that, despite all the impediments we have heard about, it has not been an impediment when you have managed to get a relationship.

Prof. Siddle—I hate to say it in some ways, but I think at base it comes down to resources, whether those resources are provided to universities or whether they are freed up on the business or industry side through tax concessions.

Mr ANTHONY SMITH—I am particularly interested in the education side.

Prof. Siddle—Let us suppose you are in industry. You want to send one of your staff to an institution to spend six or seven months to work with a particular group of researchers because you can see value in that for your organisation. How are you going to fund that position that is suddenly vacant in your organisation for six, seven or eight months if there is no oiling of the

wheels mechanism in there or no facilitative mechanism? Most Australian business and industry could not afford at the moment to allow somebody to do that any more than a university could probably allow it to happen in the reverse direction. So at the end of the day it does come down to resources, I am afraid, in order to enable that sort of interaction to happen. It is through that interaction that you will get the cultural change. The good examples we can quote to you are the examples where that culture change has occurred, but they take time.

Mr ANTHONY SMITH—And they have the resources.

Prof. Siddle—And they have the resources.

Prof. Field—That is particularly important for the smaller industry sector. One finds, at least to my knowledge, that the places this has worked best are with the larger industries or industry sectors. The resource limitation particularly bites at the lower end of the industry sector, with the small to medium sized businesses. As I said, the examples I would point to have involved the larger industries where I think benefit has been drawn. At the University of Sydney, my university, we have had a very good ongoing relationship with BHP, for example. This has been a fruitful, productive relationship going on now for 10 to 15 years. I would hope it continues. But it has been a two-way interaction. They have actually funded a research chair at the University of Sydney and reaped the benefits of having both input into research which is done at the University of Sydney and having some knowledge of the students that are coming through and influence over the curriculum to a certain extent. We have introduced over the years various aspects of our course which are of interest to people they might like to employ in the future.

Mr TICEHURST—I have a question on the subject of smaller businesses. Do you see any opportunities where the universities could use their expertise in the sense of IP and making presentations? A lot of small companies do not have the ability or the extra resources necessary to put together R&D claims or project claims. Most of them will probably do the bit of R&D they need to do to extend their business or develop new products. It would be more beneficial to us if we could somehow join the expertise of the two together. That means the entrepreneurial side of the small business. In some ways it can be intimidating for them to deal with a large organisation, such as a university. Do you see any ways in which that collaboration could be enhanced?

Prof. Siddle—I think it will happen. One of the good things in the CRC selection round that is going on at the moment is that the guidelines emphasised the fact that CRC bids should address the issue of how they involve SMEs. It is not without difficulty because you cannot get an SME to sign up into a CRC to make either cash or in-kind commitments for a period of seven years; it is an impossible ask. So you need a much more flexible system whereby SMEs can come in for a limited period of time and go. There have been many innovative approaches to this in the CRC bids I have seen, where many of them are proposing an SME club, for example. For a notional or no fee, small to medium enterprises can come and be part of what is going on in the CRC, receive briefings and hear from leading researchers on what is going on. So that is one mechanism.

Mr TICEHURST—Do you see a facility where it might be difficult for the university or the business to put a staff member in one organisation and still fund it? Is there a way we could do a swap-over? One of the university people might work in the small company and then a person

from the small company would work in the university. Do you see any benefit from that type of cross-fertilisation?

Prof. Siddle—There would be enormous benefit if you can match up the people so that each organisation gets the sort of skills they need from the other, yes.

CHAIR—I want to pursue that a bit further. If you could do that, that overcomes the cost problem because you are getting somebody back and it is part of improving the culture, I guess. What other impediments are there? What about superannuation for that period of time? That is probably not so if they are just on loan.

Prof. Siddle—Well, it may or may not be, I guess. But somebody has to fund the superannuation commitments.

CHAIR—Superannuation becomes a problem if somebody wants to go out of the university sector for maybe a couple of years into industry with the intention of coming back.

Prof. Siddle—It can be an issue.

CHAIR—If that can be addressed, that would assist.

Prof. Siddle—And between industry and universities, there are most often salary differentials as well. It is as straightforward as that, leaving aside the complexity of superannuation.

Dr WASHER—One suggestion that I thought had some appeal was that FASTS—the Federation of Australian Science and Technological Societies—suggested that we should consider taking 100 postdocs a year and the federal government would pay 50 per cent of their wages for them to work in industry for a period of, say, hypothetically, two years. The idea they put forward to do this was that it generated employment for more scientifically and technologically orientated and engineering type students. Industry would benefit from it, and the postdocs would benefit from the knowledge of industry. What do you think of that idea? It is related to this cross-fertilisation.

Prof. Siddle—I think it has merit. I am sure the CSIRO will talk to you about their new scheme with ARC, the ARC-CSIRO postdoctoral scheme. The postdocs there can work either in CSIRO or in the university or a combination of both. The requirement is that CSIRO and the universities put up in cash and in kind the equivalent of the money that the ARC is putting in for the salary. You could fashion a very similar scheme to that except being driven by government, in a sense, and directed very firmly at industry involvement. I think it has merit.

CHAIR—Do you have any other comments about the CRC process? Do you think it is working well?

Prof. Field—There are pluses and minuses with the CRC scheme. The ones that are working well are working very well. That is my experience. My university is involved in 15 or so CRCs at the present time, some of which have gone for seven or eight years.

As I say, the ones that have worked well have worked exceptionally well. Some of them are working not so well. The administrative requirements to be part of a CRC are quite demanding. They typically involve multiple partners, all of whom are large institutions like universities, the CSIRO and perhaps four or five industry partners. The administrative requirements do become quite demanding. As I say, the ones that work well work very well. But some of the CRCs just have not got on top of it.

Mr FORREST—The relationships do not work?

Ms CORCORAN—Put another way, why don't they work? In what way don't they work well?

Prof. Siddle—It is difficult to actually isolate critical success factors or critical failure factors in them.

CHAIR—Other evidence suggests that it can be a personality situation.

Prof. Field—In some of them.

Prof. Siddle—Sometimes it can be as simple as that, absolutely. It is very bureaucratic.

Ms CORCORAN—If they are good, they are good. If they are bad, they are very bad or terrible. Is that what I am hearing?

Prof. Field—Yes, that is right. My university has experience of both. We have had some extremely good ones that were very valuable. But of the ones that do not tend to work well, I would not say that they collapse on themselves but all of the parties are wondering why they are in them and any intended commercial or collaborative outcomes are doomed from the day this sets in. As I said, in the ones that are working very well, the benefits are multifold. With the interaction between industry and university, there is a free flow of information both ways. There is a commercial entrepreneurial flair about the board or the people who are controlling it. They have good control of their intellectual property. The resources are shared and all of those things work extremely well. I think the budgets and finance are all above board and nobody has any qualms about it.

Prof. Siddle—I think the ones that do not work are in the minority. The ones that work well are in the majority. Every CRC is reviewed in year 2 and year 5. If they are not performing, it is pretty obvious that they are not performing. That is picked up in the review.

CHAIR—You mentioned getting more SMEs in through a club. That is potentially a very major step forward to involving more small to medium companies in research and development. I am aware that the CRC on spatial information, for instance, is proceeding that way very successfully.

Prof. Field—I think there have been some very creative ways of trying to involve SMEs. Anything we could do to make it more flexible for SMEs to have a short-term commitment to the CRCs rather than having to sign up for the long haul would be good. If we can find some way of making their entry more flexible and less long term, it would be beneficial. As I said, there are creative ways that people have done this through consortia of various types.

CHAIR—The ARC suggested that there are a number of factors. An example is an underdeveloped R&D management skill within the university sector that is inhibiting higher levels of research commercialisation. Would you agree with that criticism?

Prof. Siddle—Certainly not in the GO8.

Prof. Field—That is exactly what I would have said. I would have thought within the GO8—

Prof. Siddle—Last year, we spun out something like 17 or 18 companies between these two universities that are represented here. I do not think there is too much, certainly not within the GO8. I think there is a systemic problem. If you are in a smaller university that is less research intense, it is going to cost a lot to put in place the infrastructure to do commercialisation for the odd deal that comes along. Commercialisation is all about deal flow. If you do not have deal flow, you do not have anything. To set up the infrastructure at the other end for two deals a year is obviously not going to be worthwhile. Certainly within the GO8 I do not think that criticism is well placed at all.

CHAIR—Do you think there should be greater cooperation between universities where smaller universities work with the larger ones so that they do not duplicate some of those problems? Is that possible?

Prof. Siddle—That is something that I have actually given a good deal of thought to because I have often thought that would be a much more efficient way of doing it. There are two impediments that I see. One impediment would come from the smaller university, which, not unreasonably, would not wish to see its identity in the commercialisation process submerged into the larger organisation. You can understand that. Secondly, I suppose if you are in a largish research intensive university and you do have a good deal flow for your commercialisation arm, it is an important strategic decision as to whether you have them divert their attention from your own organisation in order to do the commercialisation that might be coming from elsewhere. So they are the two impediments that would have to be thought through very carefully. But I agree with you; I think it is something worth thinking about.

CHAIR—The ARC also said that despite the success of programs like the linkages program and Comet there is still a gap there somewhere, particularly for funding the development of a prototype. There seemed to be still a gap in the programs that would enable you to get out of that research area to a prototype which would then allow you to get into the Comet program, I suppose. Do you have any comments on that? How would we fill that gap if there is a gap there?

Prof. Siddle—First of all, let me say—and I am sure Les will back me up on this—I think the Comet program is terrific. I think it was one of the best things that has been done to help in the commercialisation process. The second thing is that there may well be a problem at the prototyping stage. There is also still a problem, but it is being overcome at the pre-seed stage.

CHAIR—Sorry, I meant to mention the pre-seed stage.

Prof. Siddle—The \$78 million in Backing Australia's Ability for the pre-seed funds was a good move. The University of Queensland and Melbourne University have set up their own pre-seed fund, UniSeed. So I think there is now much more of a culture that we do need to get at

that pre-seed stage and that we need to get the proof of concept for some of these ideas. But Comet is good.

Mr FORREST—With regard to the comparisons made with the OECD as a percentage of GDP, I have seen these charts before. In Australia, GDP has grown enormously. In a sense, I would like somebody to present to me what our R&D funding looks like. Do you get my point? It is not as a proportion of GDP. I accept that it has not kept pace as a proportion, but that is because GDP has grown so much as compared with the OECD. Do you have anything you could put before me to satisfy me on that?

Prof. Siddle—I do not know whether there is anything in the figures here. There might be something in here. If you do not anchor it to GDP, then I do not know how it is meaningful to make comparisons. I take your point; our GDP has grown. So even if our R&D investment in dollars stayed the same, it would appear that it has not grown as much. But there are other countries with whom we would wish to compare ourselves whose GDP has gone up as well and in a comparable fashion. So even expressing our gross expenditure as a proportion of GDP, if you look at some of those other countries, like Korea, Singapore and so on, I do not think it makes us look all that flash in terms of our investment.

Mr FORREST—I wanted to know how much we should despair. Anyway, if you have something, I would be grateful for it. You can take it on notice.

Prof. Siddle—If we can provide you with figures on that, we will.

CHAIR—While we are speaking on that, would you like to table that document?

Prof. Siddle—Yes.

CHAIR—If there are no other questions, I thank you very much for your submission and for this extra document and for coming along this afternoon to answer questions. We appreciate it.

Prof. Siddle—We appreciate the opportunity.

CHAIR—We will send you a copy of the *Hansard* so that you can check it for correctness. Thanks very much for your time.

Prof. Siddle—We wish you well in your deliberations.

Resolved (on motion by **Mr Ticehurst**):

That the following document presented by Professor Siddle on behalf of the Group of Eight be received as evidence in the committee's inquiry into business commitment to research and development in Australia: *Benchmarking Australia's investment in R&D*, dated 21 October 2002.

[5.33 p.m.]

BAGHAI, Mr Mehrdad, Executive Director, Business Development and Commercialisation, CSIRO

RYMER, Dr Les, Principal Policy Adviser, Government Business, CSIRO

STEELE, Dr Jack, Chief of Staff to Executive Director, Business Development and Commercialisation, CSIRO

CHAIR—I welcome representatives from the CSIRO. I point out that while the committee does not swear in witnesses, the proceedings here today are legal proceedings of the parliament and warrant the same respect as proceedings in the House. The deliberate misleading of the committee may be regarded as a contempt of the parliament. The committee prefers that all evidence be given in public. However, should you wish at any stage to give evidence in private, you may ask to do so and the committee will give consideration to your request. Would you like to make an opening statement before we proceed to questions?

Mr Baghai—I would. Thank you, Mr Nairn, for the opportunity to contribute to what we believe is a very important inquiry for Australia. There is no doubt that innovation is a major driver of economic growth. The most recent *Economist Technology Quarterly* in September 2002 noted that innovation is now recognised as the single most important ingredient in any modern economy, accounting for more than half of economic growth in America and Britain. In short, it is innovation more than the application of capital or labour that makes the world go around.

Technological innovation is one of the most important forms of innovation, and it is clear that without research and development there would be no technological innovation. However, research is not innovation. To capture the benefits of research can involve a long, complex and very expensive process. In examining business commitment to research and development in Australia, it is important to take a holistic view. This means placing business research in the context of a firm's operations, considering where business research fits within Australia's overall research and development system and then considering how the research system interacts with the broader innovation system.

In advocating this approach, we emphasise that research is not an end in itself. A business benefits most from research when a research strategy forms an integral part of a firm's technology, marketing and business development strategies. This is because the main drivers for business research are factors such as the need to improve productivity and grow market share to increase profitability. It is necessary to take a long-term view because it can take a significant time before the research outputs generate increased financial returns. Moreover, the investment necessary to capture the benefits of the research is usually much more than the cost of the research. It is usually associated with higher degrees of risk. Apart from anything else, this means that in most cases only profitable firms have the capacity to invest in research.

We need to recognise that around the world it is the larger firms that account for most of the nation's business expenditure on research and development. The majority of firms use forms of

technological innovation that do not require them to conduct their own research. At the same time, however, some of the most creative and innovative research comes from smaller specialist firms. These usually service a particular well-defined niche or sell their research outputs to larger firms that have the necessary resources to commercialise them.

While international comparisons demonstrate that business expenditure on research and development is low by OECD standards, this may reflect differences in industry structure as measured by sectoral representation and firm size. It may well be that business commitment to R&D is no different in Australia from that in other countries if one compares like with like. However, even if this is the case, encouraging business to invest more in innovation would be in the national interest and is essential if we are to grow more world-class, world-scale companies.

Studies of technological innovation, especially in the more rapidly growing industries, inevitably conclude that business research and innovation depend to a very high degree on public sector research. This linkage appears most directly in patent citation studies. Such studies have also shown that patents from Australian inventors have a high dependence on Australian science. This is why it is necessary to consider business research in the context of our overall innovation system.

The dependence of business on public sector research takes many forms, direct and indirect. These range from the use of research findings published in the scientific literature and the employment of staff trained in the public sector research system through to the use of public sector research facilities, to contracting out research to university or government laboratories and the development of joint projects. The relative lack of large firms in Australia means that Australian business may be more dependent on other parts of the research system than is the business sector in most other OECD countries. Small firms cannot afford expensive facilities. They may not have the financial capacity to maintain the laboratory and employ research scientists on an ongoing basis. They may lack the expertise necessary to monitor the technological development in Australia or overseas that has the potential to affect their industry, and they do not have the capability to spread their risks by maintaining a portfolio of research projects, only some of which will succeed.

As Australia's largest public sector research agency, CSIRO recognises that it has a role in helping to address some of these market failures. As described in our submission, we are working to improve and develop new partnership arrangements with the business sector that respond to some of the particular difficulties Australian firms face in investing in research. We are also working to spin off small technology intensive start-ups that have the potential to become high-growth companies operating in global markets.

One of the important themes in our changing approach is to recognise that CSIRO's size and multidisciplinary operations provide an ability to spread risk across a more diverse portfolio of projects than is possible for most firms. This means that we can play an especially critical role in helping to share the risk of innovation. We are moving to further refine our co-investment model to facilitate cooperative as distinct from purely commercial relationships with business. Our broad strategy is to work with business to bridge the gap between research and innovation. In doing this, we use partnerships and other commercial arrangements to identify and respond to developing market opportunities. We are also examining ways to achieve the more effective application of existing research outputs. We are doing this without diminishing our investment

in the emerging science areas that will create the commercial and other opportunities that at this stage we cannot even anticipate.

CHAIR—Thank you. You heard the evidence early on from the Group of Eight. One of the aspects they raised concerned capital gains tax and fringe benefits tax. Within CSIRO, do you have a similar problem with respect to employees and their potential involvement in some of the spin-off companies that come out of the CSIRO?

Mr Baghai—We have an issue about how to motivate and provide incentives to our scientific members in the promotion of the commercial work. The nature of the problem we face is a little different from what you would face in a pure spin-off. Because we have such a large body of work and because we have to consider in every single case what the optimum technology transfer path is, it may be that licensing is more appropriate. It may be that publication is more appropriate. It may be more appropriate to convey that information to SMEs through consulting work. So it is important for us as a public agency to ensure that we are not creating incentives that will guide the work of our institution into a particular technology transfer path that may not be the optimal result in terms of technology transfer. So we have to solve this problem not just from the point of view of the micro incentives for the scientific employees but also from the macro perspective of optimising technology transfer into society. So it is a little different. It goes beyond tax for us.

CHAIR—I will take that one step further. There are quite a number of companies that have spun off out of research within CSIRO. Perhaps you could give us a couple of examples of some that have worked well. Who has been involved and how has it worked—from straight out of the research area within CSIRO to the operating company?

Mr Baghai—I have only been with the CSIRO for three months, so on historical issues rather than forward-looking policy issues I will ask one of my colleagues to answer.

Dr Steele—It is the combination of both those questions that you would like an answer to. If you would like to explore the tax issues and the capital gains tax issues when we think about the examples, I suspect the answer is going to be a bit of a disappointment because we have not run into an occasion when we have provided equity to our staff members as a consequence of the founder's equity that has gone into the company. That has not been a methodology that we have employed in our commercialisation activity in the past.

It is certainly the case that we have been aware of the CGT and fringe benefit tax issues in considering our various scenarios and the way in which we might go forward with the spin-off company. Were we to go forward in the pathway that the universities have used in a number of their companies, where staff members have had founder's equity in spin-off companies, we would have had precisely the same sorts of issues as the universities have. I am aware that a number of the universities have looked at a number of different structures to try to minimise those downsides and maximise the incentive that is produced for their staff members. We have not had an occasion like that to date. CSIRO's present policy does not contain a component of, in spin-off cases, providing equity for staff members for the founding equity. However, when staff members go off into that company, they may well participate in an employee share option scheme as an employee of that spin-off company.

Ms CORCORAN—On a point of clarification, you use the term ‘founding equity’. Does that mean the employee puts their own money into the spin-off company?

Dr Steele—No. For clarity, I meant that portion of the equity in the company which is related to the intellectual property or the opportunity that is being made available to attract financial capital that comes in to make the new spin-off company.

Ms CORCORAN—And that is CSIRO?

Dr Steele—Often that would be CSIRO’s intellectual property that has gone in there or intellectual property developed by CSIRO and its research collaborators, which very often can be a university. The intellectual property goes into the company; there is a component of the equity, which is in recognition of that intellectual property opportunity going in, which is founder’s equity.

Ms CORCORAN—So the intellectual property always belongs to the CSIRO? There is no element of it belonging to the member of staff?

Dr Steele—That is correct.

CHAIR—It would be interesting to hear of a couple of examples anyway, irrespective of that issue, and how they have worked.

Dr Steele—We might work through an example of a company that has taken a little bit of time to develop but in which CSIRO intellectual property has been built up over a 10-year period. It is a company that we are presently in the process of commercialising called ATM Technologies. The background is that intellectual property has been developed by CSIRO over approximately an eight- to 10-year period of time. It is protected by a portfolio of patent applications. A number of patent applications have been applied for internationally.

In a situation like that where CSIRO determines that the intellectual property has got to the point where there is a strong commercial prospect for the company, we might determine that we wish to participate in the formation of a spin-off company. Usually our criteria for that is that we can see that that company has a reasonably strong prospect of commercial viability in the fairly near future. That is actually quite an important criterion to us because we want to make sure that, as we have a spin-off company, there is a fairly high probability that the commercial case for it really does support the development of a separate entity.

In that particular case, the intellectual property is presently in a vehicle. CSIRO is seeking investor capital to go into that entity at the moment. We expect that that is likely to be a fairly successful business proposition, getting a significant portion of its commercial benefits out of licensing scenarios. We anticipate that some staff members are likely to leave CSIRO and go off and join that company. That is an example of the sort of commercialisation processes that we are involved in with spin-off companies at the moment.

I make the point that it has therefore been on the basis of very significant research and development expenditure by CSIRO over a number of years. I cannot give you the figure in that case at the moment, but it is not a situation where we are setting up a spin-off company at a very early stage of the proceedings on a relatively slight research and development spend base where

there is huge commercial risk. That is probably a fairly important criterion to understand in the way in which CSIRO involves itself in spin-off companies.

Ms CORCORAN—So is ATM going to be owned or partly owned by CSIRO at the end of the day?

Dr Steele—Today it is a company that is wholly owned by CSIRO because the company shell has been formed for the purpose of this commercialisation. We anticipate that it will be a company that will be partially owned by CSIRO immediately after the first capital raising and in time.

Ms CORCORAN—And that is a common pattern?

Dr Steele—That is a pattern that is becoming—

Ms CORCORAN—Becoming common?

Dr Steele—It is a pattern which we are choosing for effective commercialisation in company formation. It is not a pattern that has been uniformly common over the last decade.

Mr Baghai—For CSIRO. But in industry it is common.

Ms CORCORAN—What has made you move to this new pattern?

Dr Steele—I do not know that there has been a step change in our decision making process. I can point to CSIRO companies that were formed over 10 years which had some of the same sort of elements and in which CSIRO had an equity position. But I think we are understanding that this is an increasingly important part of commercialisation in the Australian environment whereas I think in earlier stages of the proceedings it was probably a little more novel. But I would not want to give you the impression that a cataclysmic change has occurred here, because it has not.

Ms CORCORAN—No. I just want to understand the evolution.

Dr Steele—I would like to emphasise once again the comment that Mr Baghai made earlier, which is that a crucial aspect for us is to select the correct commercialisation pathway and the correct way of getting our research and development outcomes into our clients' hands. It is certainly not the case that company spin-offs are anticipated by us to be the premier way of doing that in every case. There will be selected cases.

Mr TICEHURST—You say now that you are moving towards cooperative research rather than commercially based research. How would you find a way of encouraging existing SMEs to develop their products or assist with the research?

Mr Baghai—I did not want to give the impression that cooperative did not mean commercial. The proposition we have for various groups is trying to become more collaborative in nature. For example, if you are a small to medium enterprise, traditionally the only way you

could have interacted with the CSIRO was through fairly rigid professional fee arrangements for contract work. There is a limit to how much R&D you could access.

That is one of the reasons why in our submission we point out one of the differences between research and development in Australia and other parts of the OECD, where we have a lack of continuity. In 25 per cent of the cases, research is just on a one-off basis as opposed to having an ongoing program. Small to medium enterprises in particular have that issue because they do not have the scale to dedicate large amounts of money to R&D work. If CSIRO's proposition for SMEs is fairly rigid, we are limited in how much work we can do. One thing we have tried to do is revisit the nature of our relationship with small to medium enterprises given the importance they have in driving R&D in Australia as a group and figure out whether there are other ways we could engage with them.

For example, because the number of contracts with SMEs is rather large, it may be possible for us, instead of accepting strictly professional fees for work done by CSIRO, to have some kind of share in upside from the work of the SME in lieu of full fees. In other words, we would become a partner in the success of the technology and the growth of that R&D within the context of the SME. We could afford to do something like that because the large number of cases would allow diversification of the risk and allow CSIRO in that way to be a partner to SMEs. What would assist that even further is if, for example, the government subsidisation of R&D in situations where SMEs could not afford to create the kind of facilities they need encouraged the use of some of those dollars within the CSIRO system. Then we could put together a really compelling proposition for SMEs to make R&D a more continuous part of their expense as opposed to it being of an episodic nature.

Mr TICEHURST—So an SME would really be looking for an easy way to contact CSIRO. What sort of avenues would you have available for these sort of companies to approach CSIRO? Maybe they want to develop an existing product and take it to a higher level and for the reasons you mentioned they may not have the facilities and the expert scientific staff to actually do it. How could they go about approaching CSIRO on the basis that CSIRO is a large organisation and they are often quite small?

Mr Baghai—Perhaps a good example would be the work being done out of our manufacturing and infrastructure technology division. A few weeks ago I attended a roadshow by that division held for small and medium enterprises. It is a roadshow that is being carried out in multiple cities around Australia. I attended the one in Sydney. Some 100 representatives from relevant SMEs were there. They received a briefing about that division's capabilities in five areas and their willingness to engage with SMEs. I thought it was a fairly successful event in bringing that to their attention.

Another place this might be reflected is this: as SMEs apply for government funding either through Australian industry or other agencies, they might be told of opportunities to work with CSIRO to ensure they are not reinventing the wheel and they are not trying to come up with years of research knowledge from other parts of the world and so that they get world-class science at an affordable price.

Mr TICEHURST—This roadshow you mentioned, is there any intention to take it to regional areas rather than capital cities?

Mr Baghai—I do not think it was just in capital cities. I would not be able to tell you exactly all the cities they went to.

Dr Rymer—We also have a general inquiry number so that anybody can telephone the general inquiry number with requests and be put in touch with people who may be operating in the area and who may be able to help them.

Mr FORREST—I should declare my hand. I have just come back from the chamber where I was busy giving the CSIRO a major pull-through because of its lack of interest in weather modification in Australia. I am really motivated by this. I hope Mr Baghai makes note of it. I will mention it because I am pretty pumped up right now. Mr Baghai, you mentioned that the size and multiplicity of the CSIRO is a great advantage because you can cover all. Frankly, from my observation on the subject I have just mentioned, I think it is a legacy. The CSIRO is so bureaucratic and filled with scientists who cannot think outside a rigorous scientific box to take the necessary risks to pick the winner. That is my observation. I am not an enemy of the CSIRO. I see great advances in a whole range of other things. My experience in what is probably the nation's most vital issue right now is that you have dropped the ball because you are not prepared to take a risk. How is that an asset as you describe? You are too big.

Mr Baghai—With due respect, let me speak a little more from my experience with some details on some of these issues. The first thing I would like to point out is that if you are forward looking about where innovation is going to take place in Australia, I think what needs to underpin this whole issue of the impact of the R&D in Australia is how we are going to be on a world scale and attract true world-class R&D in particular areas. The place where Australia has some distinctiveness relative to the world is at the intersection of different branches of science. What we are beginning to see, for example, is the application of nanotechnology or biotechnology to traditional industries like mining, agriculture and livestock industries. They provide some remarkable breakthroughs. Because they are building on a position of strength that Australia and CSIRO have historically had, we are able to compete with the best in the world. That is why we are seeing, for example, IP services and just plain services in the mining and exploration sector being a major export for Australia. It is in the application of these newer sciences to an existing field where we are very strong.

I think we are beginning as an organisation to break down some of the barriers that existed among divisions and trying to identify vehicles where we force that kind of interdisciplinary thinking. One of the best examples of this is our flagship program that we have launched, which is relatively new. We have picked eight public policy areas which we feel are incredibly important to the nation's agenda. What we are trying to do is organise scientists from across the different divisions to focus on those areas. That includes, for example, a flagship on the topic of a healthy country. That includes work on water resources. I think your point about historical barriers among divisions is partially well taken in the sense that these barriers did exist and programs like the flagships are going to be ways of drawing those resources together and pushing forwards the work.

I should add one other point. I think it is important in a large organisation like the CSIRO to appreciate the difficulty that we have when you have over 1,000 projects going on and many different factors that come into being in terms of deciding where the investment dollars need to go and what to invest in. It may seem from the outside that a particularly important opportunity which suited CSIRO's capability was not addressed. On the other hand, it may have been that

there were a number of internal reasons why that project did not look as attractive as a number of other ones. CSIRO's impact should be considered in terms of a broad set of areas where it has focused its activities. I think that over the next four to five years in particular the flagship vehicles will allow us to return to some of the public policy agenda issues that you have raised that I agree with you are incredibly important and allow CSIRO to contribute to them.

To that end, as we look at the triennium funding that CSIRO approaches, one of the issues that will be on the table is the extent to which the triennium funding package could support multiple flagships to take an accelerated start. In other words, within the current budget, if there are eight important policy areas, it may not be possible to address them all within the first or second year of the flagship program without additional funding. Part of an exercise that CSIRO is going through right now is figuring out exactly how we can shift resources from some of the traditional sectoral work to some of these collaborative areas and to engage on these other important policy issues.

Perhaps I will mention them for the sake of the record. They include e-Australia, which is an effort on regional and electronic infrastructure to effect some important changes in rural areas. They include working on preventative health as the ageing population in Australia creates a cost burden for society. For their efforts they can reduce the cost from some of the top five killers of Australians, which would extend lives and improve productivity. There is wealth from oceans. We have one of the largest 200-mile zones per capita in the world. To figure out how to derive some additional economic benefit from that could be of long-term policy importance to Australia. Another would be to create a light metals industry in Australia that is world-class. These are just some of the areas where these flagships would target their efforts from across the divisions.

Mr FORREST—Put climate and weather up there, please, as a flagship

Mr Baghai—We have looked at the idea of healthy Australia. Healthy Australia is going to include work on various aspects of climate. I will point out one other thing: occasionally we get comments and reactions from various quarters about specific technical solutions to certain problems. Part of an approach that an organisation like CSIRO takes is the evaluation of alternative technologies and looking at the efficiency of various solutions. These solutions that may generally be talked about as being appropriate may have some technical risks or sustainability issues or other kinds of cost issues. There may be technical risk issues that may not be in the public debate but they may have been part of CSIRO's internal deliberations in terms of the focus of resources.

Mr FORREST—That sounds like a breath of fresh air. You have been there for three months; good luck. You will come across some hard noses and little empires there. The CSIRO is riddled with a bureaucratic process that is very hard to crack.

CHAIR—Mr Forrest should have been at our meeting last Monday when we had an informal discussion with the head of the CSIRO.

Mr FORREST—That is the one I wanted to be at.

Mr Baghai—I am happy to speak further about CSIRO's internal plans, but I am not sure that is the purpose of this meeting. I will point out that a significant amount of resources have

gone into trying to change this organisation along some of the lines the honourable member is raising. I joined the organisation only three months ago. My background is that I have several degrees from Princeton and Harvard, experience in the United States and eight years at McKinsey. I have been the CEO of a company. I have assembled a group in the business development and commercialisation area which includes investment bankers, senior attorneys and people who have been CEOs of companies. Most of these people have only joined CSIRO in the last month. We are optimistic about the potential of this organisation.

More importantly, I cannot imagine an innovation scenario that is optimistic for Australia that does not include a large role for the CSIRO. I say that not because I have been in this organisation for a long time, but because, in evaluating the different job offers I had, I elected to take one with a much lower salary in order to contribute to that future of Australia. I do see the role CSIRO has to play. I think it is important for government to get fully behind CSIRO and make sure that that role is played to the best of its ability.

Dr WASHER—I think CSIRO is a pretty good organisation and we are delighted you are here. Dr Steele, you mentioned the project that you are about to launch in investment capital. What impediments are you finding to getting good investment capital, or are they minimal, in your opinion?

Dr Steele—It is not clear to me that we are actually finding any impediments to getting good investment capital at present. It may be in this circumstance that it is fairly well-developed technology which is pretty close to market entry and the technology is already being implemented in a number of beta licence circumstances, so it is fairly advanced. In that circumstance, there is actually, even in a relatively depressed market at the moment, a pretty good appetite amongst the venture capital community for investment opportunities.

CHAIR—What sort of money are you after for that particular venture?

Dr Steele—We are asking for approximately \$5 million in the first tranche, so it is a fairly sizeable lump compared to what the venture capital community would commonly put into a new company circumstance. So it is a bit of a test of the marketplace. But it really is absolutely critical that you have pretty well-developed intellectual property and proven technology and that therefore you have taken a significant portion of the technical risk out of it.

Dr WASHER—Basically, you are saying that CSIRO's credibility plus the fact that you have marketed this extremely well and can demonstrate the feasibility of this opens the market to capital investment pretty readily?

Dr Steele—I cannot see any downside to agreeing with that sentiment, to be perfectly honest.

Dr WASHER—Where would this investment capital normally flow from? What is the source? How does it work?

Dr Steele—You would normally look for investment capital of that variety in the local venture capital community of established venture capital firms. For lesser amounts you would be looking at either the pre-seed fund schemes or alternatively angel investors. Once you get maybe to amounts a little above that, you are also in a position to potentially attract venture capital investment from offshore.

Mr Baghai—The capital is available. One thing to note in terms of barriers is the transaction costs of accessing that capital. Some of the deals—for example, the one Dr Steele was describing before—can take 12 to 18 months. That is an issue because there is a cost to maintaining that company. Part of the reason for that is the increased conservatism in the venture capital community following the decline in the markets in the last year and a half. A study of venture capitalists in the United States—I have no reason to believe the numbers would be markedly different in Australia—would suggest market valuations of companies have fallen tenfold in the last two years or so. The average amount invested in that first round is down by a factor of three. The time it takes to close that has gone up by a factor of three to four. That means that the relative attractiveness of seeking venture capital relative to a licensing deal has changed. In many ways, an organisation like CSIRO is constantly re-evaluating the relative attractiveness of different technology transfer paths. So the increased transaction costs and lower prices being attributed to our spin-off companies can make it less attractive to access that capital, even if it is available.

Dr WASHER—With regard to innovation and commercialisation, it seems that CSIRO is offering a service to industry to assist them in that. Is that the impression which I got from you? It is not only a research organisation; it is also a business assistance agency in terms of the innovation and commercialisation of products et cetera. Is that a part that CSIRO now plays?

Mr Baghai—It is not solely a research organisation, yes. It is broader. The reason for that is that the research into technology transfers suggests that the single most effective way for technology transfers is through consulting because the knowledge can be transferred to as many firms as possible and transmitted into the industry. That may mean that CSIRO itself does not capture as much of the value, but in terms of the benefit to Australia and industry as a whole, it might be greater.

Dr WASHER—Would one of these services include checking patent type purity or commercialisation? One of the common things I hear is that Australians take out a lot of patents. But the purity of the patents and the multiple patents required to get to that level—for example, in biotech—means that really they do not have an internationally commercialised product. Do you look into that or assist in any way with that?

Mr Baghai—I think we need to ask an intellectual property attorney to formally be sure of these things. But I can tell you what I believe. To the best of my knowledge, establishing an internationally recognised patent position means pursuing efforts both in the United States and in the European Union in addition to anything you do in Australia. That process is costly and time consuming. It also requires meticulous evidence in the form of prior art, lab notes and things like that.

CSIRO is not in the business and does not have the capability to help small to medium enterprises do that. It is not one of our services; legal firms do that. However, in cases where we might be in an alliance, joint venture or partnership with a small to medium enterprise, we would certainly have more experience on that front than they would. It would be something we would offer to take the lead on. But it is an expensive process. One thing we are noting is that we are becoming a bit more systematic and strategic in choosing which areas of intellectual property we pursue an aggressive patenting strategy on and which areas we let go. This is an important debate also in the context of a number of proposals that have been raised with respect

to the Bayh-Dole Act in the United States being transferred in some way to the Australian scene.

One of the problems in the United States with respect to that act is that there has been a chilling effect on collaboration between scientific agencies and universities and larger corporations. The reason is that it pushes towards a patenting approach whereas many large companies prefer a trade secret approach. Overall, an IP strategy needs to take into account a number of things: how important is this area; is patenting the right way of going about it or would you prefer to go a trade secret route along the lines that many larger multinational companies prefer to go?

Dr WASHER—Another criticism I have often heard is that our patent magistrates and attorneys are not up to scratch. I was wondering what CSIRO's experience was in running through its multiple patents. Does it reflect that, or is that a totally untrue statement? In other words, there have been some bad judgments made, I have been told. I was wondering what CSIRO's experience has been on that.

Dr Steele—Probably the general comment I would make is that CSIRO uses a number of external patent attorneys in an Australian context. It also has an overseas panel of patent attorneys that it uses for specific cases. Our general comment would be that the Australian based patent fraternity are very good in an Australian context and initially can get you overseas. But if you have a significant case and you want to do it properly, it is a very good idea to reach out and get locally based patent attorneys, particularly in the United States, for US jurisdiction stuff, but also in Europe for European jurisdictions. So I think it is a case of choosing the right horses for the right courses rather than assuming that a locally based attorney can do worldwide jurisdiction stuff at the level of the local patent attorney. It is unlikely to be the case.

CHAIR—Mal, weren't you also referring to—

Dr WASHER—Also to magistrates. It is not only the mechanism; it is also challenges to judgments on some patents in Australia. Some of those judgments could be questionable scientifically in their validity.

Dr Steele—I think I am going to decline to answer the question. I would like to talk to our general counsel about that.

Dr WASHER—That answers my question—the fact that you decline to answer.

Dr Rymer—Two or three years ago, the advisory committee on industrial property, which advises IP Australia, conducted a review looking at IP enforcement and ways to strengthen the IP system to ensure that the granted patents would have a high level of validity. I believe the recommendations from that review are in the process of being implemented. IP Australia would be able to provide information on that.

CHAIR—That needs some sort of confidence in the judicial system, doesn't it?

Dr Rymer—I think part of the problem is related to the actual definitions used in the legislation and some of the issues in terms of how the courts had to handle the IP issues.

Dr WASHER—I will ask that question in a slightly different way because I think it is important. Could you say, then, that our magistrates perhaps should be trained a little better in patent law? Would that be a fair way of putting it?

Dr Rymer—My understanding is that it is not magistrates who handle IP matters; it is in fact judges of the supreme courts that handle IP matters.

CHAIR—I should remind witnesses that if you feel there is information you would like to provide but not on the public record, that is possible.

Dr Steele—I think it is a question that we would like to take on notice and give mature consideration to. It would appear to be a matter of some concern and interest to the committee. We would like to give you a considered opinion.

CHAIR—You could provide that confidentially to the committee.

Dr Steele—Yes.

Ms CORCORAN—I want to return to business R&D. I am assuming that small businesses are really interested in research which is going to give them an almost immediate product or innovation or whatever and that the blue sky stuff does not really appeal to a small to medium enterprise.

Mr Baghai—For the most part. There are some exceptions. I cannot give you a straight yes or no. The exceptions would be in certain sectors. Look at the ICT sector, for example. There are 20,000 small companies in Australia in that sector, from what I understand. For any of them, having a product breakthrough is the core of their business. So it might be that the original purpose of that company is some kind of breakthrough innovation but for the most part in their life in trying to commercialise it they become more and more interested in incremental research as opposed to substantive research.

Ms CORCORAN—That is the terminology I was looking for. In your submission you state that public expenditure promotes business expenditure in R&D and that business expenditure in R&D is prevented somehow or obstructed by management attitudes and things like that. We are hearing a lot that business R&D would be better if the public purse were opened a bit wider, either in the form of tax concessions or direct expenditure. I am trying to find other obstacles, if you like, as well as the monetary one.

Mr Baghai—I think the obstacle in terms of management varies depending on the stage of a company's life. Look at publicly listed entities. Many of them are under what you would expect to be quarterly earnings pressure. That means that if they do not show profitable returns every quarter and an improvement in that, the share market does not look favourably upon that company's stock and management. Therefore, management's attention is on the bottom line. In order to be able to fund significant amounts of R&D, it is going to have to come out of significant earnings. In an environment where those earnings are under pressure, the market usually forces management to cut the easiest thing to cut, which is long-term spending like R&D. That can show up in lab closures and things like that, which try to bolster the bottom line of a company through a difficult economic climate. So this is not a skill issue on the part of

management for the most part. It is about the kind of pressures that CEOs and managing directors find themselves under as par for the course of running a large company.

The same pressure exists in a different way as you go into smaller companies. There is very little discretionary income, and projects that might take five to six years of commitment to come to fruition are really make-it-or-break-it decisions for some of these smaller firms. If they are going to dedicate a significant ongoing stream of earnings to funding that kind of research, they need a degree of both confidence and courage that many of them do not have. It is easier just to keep going without it.

This leads to a couple of observations, if I may share them, more broadly about the Australian dilemma. This is a personal opinion offered in the spirit of assisting the committee. I think that there is a gap of confidence on the part of Australian entities when faced with the dilemma of competing on a global scale. The challenge of crossing the ocean and being successful in larger markets is hard; it is a difficult challenge. So Australian ventures not only have the normal technical and commercial market risks that are associated with building a successful entity; they also have to face a daunting challenge of a geographic nature—going to a new country, establishing themselves and being successful in order for the company to be fairly large. While we see it in certain industries, it is not an overarching pattern. That challenge itself may be a barrier against significant R&D expense. If Intel spends more on R&D than all of Australia, how can you compete? There is a challenge that comes just by the nature of who we are.

There is a second point, which is that if you compare the numbers in that OECD table, one of the factors that leads to that disparity is that certain countries have very clearly articulated priority areas that they are pushing. You begin to see, for example, that wireless communication was a very important growth area not just for Finland but also for Sweden and parts of Scandinavia. It grew out of a problem that they had to address given the cold weather. If you look at Nokia's history, it was as much in manufacturing boots and toilet paper as it was anything to do with technology, but it focused. That became a driving centre of focus for development for that whole country and that whole region.

Israel is another example. The security work and technical software development grew out of competencies that had been developed out of necessity over many years. But it is a pattern that multinational companies and others look for—that is, centres of significant critical mass and expertise in a particular area. It is difficult in Australia to point to those. There is significant duplication among regions in certain capabilities. We have multiple biotech centres. We have multiple ICT centres. We have multiple centres for research into various things, which means a difficulty in establishing critical mass from a global scale.

What you see in Silicon Valley, in Boston, in Austin, Texas or in Scandinavia or Israel is a critical mass of business, government and industry and education collaboration in a particular area, which leads to all kinds of virtuous cycles of growth. I believe that as much as we look at the amount of R&D spend, we have to look at the quality and concentration of it and make a decision around specific areas that Australia wants to be world-class in. Going back to my earlier comment, I suggest that that is going to come at the intersection space of the new sciences like nanotechnology and biotechnology with Australia's former strengths in primary industries.

CHAIR—Your submission provided some really interesting figures. We have had all sorts of different statistics in submissions, but you have provided some new things there, which is interesting. The figures showing historically the percentage of R&D funded by business and the percentage of R&D performed by business I felt were particularly interesting. We talk about our low levels Australia-wide as a percentage of GDP. The facts are there. It is not something that is new in any way. It has always been there. It has always been that sort of circumstance. In those two tables that I mentioned, we saw almost a doubling of the percentage of R&D funded by business between 1981 and 1989 and similarly performed. What happened through the 1980s which led to this flattening off since then? Is there something we can point to?

Dr Rymer—I do not know. I suspect it may simply be the level of R&D you might expect given the nature of the industry and the sectoral and size structure of the Australian industry. There is a level of research and development which is appropriate for particular businesses. Presumably, at the beginning of the 1980s they were very much under-performing. As they have increased their level of research and development, the levels which are appropriate have become more normal, given all the other investment opportunities available to them.

CHAIR—It is almost as if Australia came of age or something in that decade. The OECD figures went up, but not by much—precious little, really. But we had this huge jump in Australia.

Mr Baghai—I do not know the policy framework in the 1980s in Australia so I cannot comment knowledgeably on that question.

Dr Rymer—I guess in part it may just be the opening up of trade and companies being subject to high levels of competition which was requiring them to invest more to remain competitive not just within Australia but internationally, because they were having to compete with international companies in the domestic market in a way that previously they had not. It might well have been that.

CHAIR—The inquiry secretary reminds me that it was in the mid-eighties that tax concessions were introduced for the first time as well. While we do not have figures for each of the years, the big change may have only started in the middle of the 1980s.

Mr Baghai—It may also be important to note that research in general, from what I understand, grew across the world. In the OECD you have the percentage not going up as much. If you look at a boom in terms of a shift from primary to more high-tech kind of research, that was an important shift in that period. That may have also had something to do with the shift from government to business in Australia. There was the research in ICT; the biotech era was beginning to come together in that early part and in the very early stages of it with pharmaceuticals. It lends itself more to business research than pest control, for example. You see that sectoral shift.

CHAIR—The other figures that are interesting basically demonstrate this problem of short-termness. You show that 800 businesses reported total R&D expenditure of \$356 million in 1999-2000 but none did in 2000-01. Then there were another 900 that did nothing in the earlier year but lots in the next. There is a very uneven pattern in the figures. If, at the very least, that could be evened out, it would make a huge impact in the overall investment by business. Is that fair enough to say?

Mr Baghai—Absolutely. It is going to be reflected in the proposition that CSIRO is going to put to business, which is that if you take a 10-year view of growth for any firm, innovation and technology in most industries is going to be an important part of that growth platform. We would like CSIRO to be the technology and innovation partner for some of these businesses, where science and innovation is an important part of their long-term growth, and allow that continuity to take place. That is when we are going to see real growth as opposed to the cyclical, episodic investments.

CHAIR—One of the case studies concerned benefit-cost ratios, which I also found quite interesting. Did you have any median levels there? You show quite dramatic differences within projects from virtually no benefit-cost ratio through to quite substantial ones. Where would the median fall in a lot of them?

Mr Baghai—I can try to get that for you. I do not know offhand. The way we have looked at these projects is that even if you take the projects that are only on the extreme positive, they represent multiple returns on the CSIRO investment. That is the nature of research and development—a handful of breakthroughs create such large-scale benefits that you have to live with some failures or areas that you have to cut, as part of a portfolio approach. But if you prefer, we could try to look that up for you.

CHAIR—That answers my question. I looked at it and thought, ‘Does it mean that if 17 manufacturing projects, for instance, had benefit-cost ratios from 0.5 to 72, there was one at 72 and 16 at 0.5 or 0.6.’

Dr Rymer—That was a review of many previous studies, so they may have been using different methodologies and so on. I am not sure to what extent there was any standardisation involved. It was a benefit-cost analysis of some particular studies and then a review of a whole range of previous studies as well.

CHAIR—Thank you very much for your submission; it contains some very good information. Thank you for your time this afternoon.

Mr Baghai—Thank you.

Resolved (on motion by **Mr Forrest**, seconded by **Ms Corcoran**):

That this committee authorises publication, including publication on the parliamentary database, of the proof transcript of the evidence given before it at public hearing this day.

Committee adjourned at 6.31 p.m.