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Official Committee Hansard

**HOUSE OF  
REPRESENTATIVES**

STANDING COMMITTEE ON ECONOMICS

**Reference: Productivity growth in the Australian economy**

FRIDAY, 20 NOVEMBER 2009

MELBOURNE

BY AUTHORITY OF THE HOUSE OF REPRESENTATIVES

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**HOUSE OF REPRESENTATIVES**  
**STANDING COMMITTEE ON ECONOMICS**

**Friday, 20 November 2009**

**Members:** Mr Craig Thomson (*Chair*), Mr Andrews (*Deputy Chair*), Mr Bradbury, Mr Briggs, Mr Fitzgibbon, Ms Jackson, Mr Morrison, Ms Owens, Mr Anthony Smith and Mr Turnour

**Members in attendance:** Mr Bradbury, Mr Briggs, Ms Jackson and Mr Craig Thomson

**Terms of reference for the inquiry:**

To inquire into and report on:

The key factors influencing Australia's productivity growth rate, focusing on, but not limited to:

- a) trends in Australia's productivity growth rate during the past 20 years and reasons for the recent trending decline;
- b) trends in productivity growth rates against other OECD countries;
- c) the adequacy of productivity growth measures;
- d) the contribution made by microeconomic reform to the permanent improvement in the growth rate of productivity and the continuing effectiveness of the microeconomic reform agenda;
- e) the willingness and ability of small and medium enterprise to adopt best practice technology;
- f) the adequacy of the level of investment in physical capital;
- g) the adequacy of the level of investment in public infrastructure;
- h) the level of resources devoted to research and development;
- i) the adequacy of resources devoted to training and development of the labour force; and
- j) the key reforms and measures that can be undertaken to lift Australia's permanent rate of productivity growth.

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**Committee met at 9.15 am**

**CHAIR (Mr Craig Thomson)**—I declare open this public hearing of the inquiry by the House of Representatives Standing Committee on Economics into raising the rate of productivity growth in the Australian economy. To date the committee has received 27 submissions to this inquiry. Submissions have been comprehensive and have raised numerous issues. Today is the fourth public hearing of the inquiry to allow the committee to consider these issues in more depth.

As part of the inquiry's terms of reference, the committee will investigate productivity growth trends in Australia and other OECD countries over the last 20 years, the adequacy of investment levels in physical capital and infrastructure, the levels of resources devoted to human capital in research and development, and the strategic reforms and measures that could be undertaken to lift Australia's productivity growth. We will also consider the appropriate measurement of productivity growth. Today we will hear from the Australian Mobile Telecommunications Association, the Australian Institute of Mining and Metallurgy, and Mr Michael Rice.

[9.16 am]

**ALTHAUS, Mr Chris, Chief Executive Officer, Australian Mobile Telecommunications Association**

**CHAIR**—Welcome. Although the committee does not require you to give evidence on oath, I should advise you that these hearings are legal proceedings of the parliament and therefore have the same standing as proceedings of the respective houses. We have received a written submission from you to this inquiry. Do you wish to make an opening statement in relation to that submission?

**Mr Althaus**—Yes. Thank you for the opportunity. I want to very briefly introduce AMTA. We are the peak group for the mobile sector representing all carriers, handset manufacturers, infrastructure vendors and down into the retail sector. The industry and its relevance to this inquiry go to the emerging and growing digital economy in this country and around the world. We are particularly focused on the mobile sector in that context.

The mobile industry in this country is a success story. There have been 22 million plus subscriptions in 22 years of operation, currently running at 105 per cent—probably a little more—which is beyond saturation point in this market. Clearly they are the subscription numbers; not every man, woman and child has a phone but there are that many subscriptions in this market. With that size and penetration, this sector has enormous potential and enormous opportunity to contribute to not only the productivity of Australia but also the connectivity that society enjoys and of course, by the nature of our particular technology, the mobility that we add into that equation.

In this day and age telephony as a stand-alone entity, which is where our heritage lies, has got a new partner and one that is asserting itself in very vigorous terms—that is, mobile data. Mobile data is something that was long anticipated with the growth of mobile networks, the capability of networks, the speed of networks and the partnership with emerging mobile devices. The safest way to describe this new trend is our much used term ‘convergence’, where we have areas of our industry converging with other areas of what up until now have been other industries. But those boundaries are breaking down.

The important opportunity that we want to talk about today is how the marriage of some of these technologies is going to manifest itself in the economy and society. The obvious union is perhaps two of the most powerful entities in the digital age, that being the internet and the mobile phone. If you bring those two together you have mobile broadband, and broadband is without question going to be the centrepiece of our digital economy and digital economies around the world.

To give you an idea of the growth of mobile broadband, there are a range of estimates around the world. Some say that, by 2010, globally perhaps two-thirds of broadband subscriptions will be mobile. The numbers are getting increasingly impressive. The latest one that I have observed is a global estimate suggesting that mobile broadband subscriptions are currently increasing at a rate of nine million per month. That is of course as a result of many economies not deploying

fixed networks and relying very heavily on mobile. With that level of activity around the world, not surprisingly we are following suit. Mobile broadband subscriptions increased by over 100 per cent in 2008-09. That growth trend is continuing. We are again looking at global forecasts. One of the main consulting groups is suggesting that in 2008 we had around 180 million mobile broadband subscriptions in the world; by 2014, which is not far away, that will have increased to two billion—a growth of about 1,024 per cent. This is a very, very central part of our theme in terms of productivity.

The ubiquity of mobile services, the technological advancements of networks and handsets, and particularly the arrival of the so-called smart phone have seen the linkages into other sectors of the economy expand dramatically. We are now seeing this technology as a primary enabler throughout the economy, including the health sector, the education sector, the business sector and the finance sector—there is virtually nowhere it does not go.

To try to get a handle on the impact of the mobile sector, my association has commissioned on a couple of occasions work by Access Economics to look at the economic contribution of mobile. We have traditionally looked at it in the sense of what the industry does, but we have of course in latter years expanded that analysis to include not only the direct impact—employment, gross industry product et cetera—but the indirect impact or the flow-on. The modelling of Access Economics, which we are in the process of repeating, reveals that the indirect contribution is actually larger than the direct contribution. The enabling capacity of this technology to add value to business and enterprise in the economy is recognised by that indirect contribution, and there have been a range of analyses around the world that have supported this.

To give you another group of fairly impressive numbers, at the G20 summit earlier this year, global leaders of mobile companies estimated that there was around about an \$800 billion investment going on, with \$500 billion of that is likely to be directed at mobile broadband. In their estimation the economic gain to economies could be in the order of a three or four per cent boost to GDP. That is a global perspective, so there are lots of qualifiers in there. Research here is certainly indicating this very strong productivity link.

In our submission we have given you some case studies to consider in this regard. There are case studies of small to medium enterprises. A Plumbing Doctor business in Newcastle employs 11 plumbers. This chap is saving in the order of \$40,000 a year by use of mobile broadband services. Another example is the collection of data from research buoys in the Barrier Reef, which is now transmitted using mobile broadband, saving around \$150,000 a year and a lot of effort in going out to collect data from these buoys. Similarly in the health sector we have remote diagnosis. Even in the Top End we have remote surgery. It is one of the technologies that are difficult to predict as to where it is going to land or if indeed it is going to land at all. In this sector if you are standing still you are going backwards. So we are constantly on the move in both technology applications and content. I guess a good example of how quickly things move is that 24 months ago if you were heavily into social networking you were probably on the geek end of the spectrum. Now of course we run election campaigns on social networking sites and it is a pervasive, new aspect of the digital world that people are adopting.

Having given you a picture of the growth and the environment in which we operate, I turn to constraints that we may face. Like anything, infrastructure to our sector is as vital as it is to others—the track to the train, the road to the truck—and of course our road is radio frequency

spectrum. Given the global growth and given the domestic growth in mobile broadband services, we rely on the advice of the International Telecommunication Union and our own industry partners to get a sense of where the constraint might come. To put it simply, spectrum is what carries mobile signal. The more activity on spectrum the more congestion. We are, in another feature of this digital world, seeing a huge increase in appetite for vision, not just voice. People want to see things as well as hear them. That has got a capacity impact on networks. Bandwidth-hungry applications are common. This all means essentially that we are anticipating constraints on our infrastructure, and that is our level of spectrum access.

To put it simply, we and the government at this moment in time have three key issues confronting us in this regard. Firstly, the current carriers have 15-year licences which are about to fall due. Secondly, new spectrum opportunities are arising from the analog switch-off, and the digital dividend will be an opportunity that is very important. Thirdly, there is a band in the 2.5 gigahertz area that has been globally harmonised for mobile. The rest of the world is getting on with planning for that and we are too, but we are in danger of falling behind because of the time that it is taking. The government is currently considering all of these things—licence renewals or reissues, the digital dividend and 2.5 gigahertz. Given that we are facing potential constraints and that in the world of spectrum and mobile network planning nothing happens terribly quickly, contrary to the market, it is a lot of planning, a lot of investment. The hundreds of millions of dollars and in some cases billions of dollars involved need substantial lead times.

We have said to the government, and it is particularly important to reiterate, that we are in danger of running out of time to stay in touch with the trends around the world, so we are urging the minister and the government to expedite processes around renewal of licences and we are very close to the process around digital dividend and 2.5 gigahertz, but those too need to be given a kick along, and we are hopeful that that will take place in the near future.

I think spectrum is probably the biggest issue in terms of investment, in terms of capacity, in terms of meeting future demand. I will close on another observation in relation to demand. One of AMTA's members, Ericsson, is looking at a global perspective on data traffic. It is their estimation that, while we are currently talking about connecting two to three billion people globally via mobile broadband, the other aspect is what we call machine to machine applications. The Great Barrier Reef one I just gave you in terms of data collection is one. It could be smart infrastructure, it could be a whole range of things. Their estimation is that going forward you could well see globally in the near term 50 billion machine to machine subscriptions. This is all about efficiency and productivity in many ways. Against that new world of machine to machine conductivity, the spectrum equation, the infrastructure equation, becomes very compelling.

In addition to the productivity aspect there are key environmental issues that we have touched on in the submission. We have also done some substantial work in the area of social research. That goes to the connectivity opportunities and work-life balance and such things. There are observations in the submission about that. It is not classically productivity related but I guess in a social cohesion sense workplace opportunities, work from home and telecommuting all link into environmental outcomes, productivity incomes and social outcomes. I will leave it at that.

**CHAIR**—Thank you. Firstly, in terms of a housekeeping issue, you mentioned an Access Economics work that is coming out later this year. How far away is that?

**Mr Althaus**—It is work in progress. It will hopefully be done by the end of the year. The analysis is going to repeat the analysis we did in 2008 but with one key difference. It will focus more on the mobile data growth phenomenal and of course will make some observations about the link to infrastructure. But the mobile data growth is the area that is going to be a notable difference from the previous report. Once we have concluded that, we are very happy to provide it to you.

**CHAIR**—We would be keen to get a copy of that if we could. We have had evidence before from Dr Baker, who is the director of the Centre of Law and Economics, about the difference in terms of ICT capital uptake as opposed to the diffusion of the ICT technology in the economy. He was saying to us that in the 1990s, while we had a big uptake of the technology, its diffusion was less than other countries and hence the difference in productivity growth particularly compared to, for example, the United States. With the obviously very rapid growth in terms of mobile subscriptions and the way in which that is operating, what sort of time lags do you see being there for the diffusion of that technology to business innovation and those sorts of issues that are directly going to affect productivity in the economy? Is there any work that has been done on those aspects?

**Mr Althaus**—There has been, and I liken the current environment to somewhat of a paradigm shift. I mentioned that we got 22 million subscriptions in 22 years. That was an evolution along a path of telephony based service. What we are currently seeing is the relative familiarity, particularly in the business environment, with the tools of the digital economy: the internet, the mobile phone et cetera. That has developed over time. What is leading us to see a more rapid uptake, as technology is now becoming more enabling in terms of speed and the utility of handsets, is the quick matching of that with a supply of new applications and services. In the past there has been a little bit of a lag, a bit of a disconnect, there but the relative familiarity with the technology and the opportunities, particularly in a broadband context, is well established. So we are seeing that as a signal that things are moving quite quickly. Lags, I believe, are reducing. The nature of digital economies, the global reach of the technologies is leading us to an opportunity to absorb applications and services from anywhere in the world and apply them here. So, in short, I think we are expecting adoption to be faster, given the platform of familiarity that already exists.

**Mr BRIGGS**—Just on the 105 per cent subscription rate; do you have percentages of what are data services in that and what are just pure mobile—in other words, what is the potential percentage increase? What is there that you are able to tap into?

**Mr Althaus**—Again, with the evolution of products and how people consume data services it is classically, for want of a better term, a bundle situation. You are now buying—

**Mr BRIGGS**—An i-phone with an \$80 plan type thing?

**Mr Althaus**—Yes, and you have a plan with a certain amount of data capacity built into it. So there is a blurring of the boundaries on what is a data service and what is a classical sort of telephony plan. I could ask industry about the delineation, but I do not think it is readily obvious.

**Mr BRIGGS**—You have been in the industry for a long time. Breaking that down even further, putting aside the young person who wants data and so forth and their own plan, how

many businesses, particularly small businesses where I see a real productivity opportunity, are getting into the data—

**Mr Althaus**—We will probably have a better feel for that on the other side of this access survey. However, we are observing trends that are starting to be a little more even across the community. The emerging retiree environment is becoming a lot more tech savvy. Mobile, particularly mobile broadband, in retirement is delivering a new dimension to connectivity. Obviously, the kids are into it big time.

**Mr BRIGGS**—I get text messages from my father; I agree with that.

**Mr Althaus**—You are seeing a lot more usage, even if it is a request: ‘Please send money.’ The connectivity that it delivers is a major feature and it is quickly becoming ubiquitous not only in terms of its availability but in terms of who is using it.

**CHAIR**—You spoke about that three to four per cent growth in productivity globally as a figure that is there, and we will come to spectrum in a minute. But, given your upbeat assessment about take-up and diffusion, are those the sorts of figures that we can be expecting in terms of productivity growth from this sector for the economy and, if so, over what period is that three to four per cent growth?

**Mr Althaus**—I believe that in the G20 the suggestion was that it was going out to about 2020. It is difficult to tell. Obviously you look at the prevailing economic conditions and how they might change et cetera. One thing that we can look at is that in the mobile sector particularly we have observed during the global financial crisis a phenomenon that led to countless conference presentations: is this sector recession-proof? The answer is no, it is not, but the answer is also that we see that the communications service, particularly mobile, has risen up the order of priorities within discretionary expenditure in the average household to a point where perhaps it will be reduced much later than it ever was. We are seeing people in their demand for these services regarding them as central to how the family and the business et cetera operate, so the spend continues. Regarding the productivity implications for this economy, there has been an estimate in one survey that with mobile broadband in play you might expect a 1.9 per cent boost to GDP. That was again in the time frame of around 2020. I am not aware of any extensive modelling or survey that goes beyond that, but it is of that dimension.

**Ms JACKSON**—There are some limitations, if you like, in the measurement of productivity—and that is one of the discussions we have been having—particularly if you have, like I do, a view that it should be a broader measure that is about the wellbeing of the community and not just market based and market related issues.

**Mr Althaus**—Indeed.

**Ms JACKSON**—To that extent there are a number of things about your industry that I think are a little problematic to date. Rather than a planned, creative expansion it has been spasmodic. It seems to me that there is no notion of it being a service that is in any way being given universally, that it is very much driven by where the profits and the markets are best. For example, I am a Western Australian, and access to sophisticated mobile broadband is still a joke in most of the state, yet when it comes to productivity growth I argue that Western Australia is,

along with Queensland, the engine room of the economy. There are significant issues I think—though hopefully they have just been resolved—associated with the recycling of your products, the handhelds, for which, really, the industry itself did not appear to come up with any solutions. Forgive me if I am being a bit arch in dealing with those issues. I worry about those issues.

Apart from customer service related issues, which I suspect are going to be a bugbear in any industry, the other thing that is raised with me regularly by constituents is privacy related issues. Do not get me wrong. I understand the significance of broadband—I think we all do—and I think it has taken the Australian business community and economy a while to come to terms with just how significant this vehicle is for improvements in productivity, but there is still a grab bag of issues that do not appear to be being well addressed.

**Mr Althaus**—Let me make a couple of comments in response. Obviously, the universality of this from a mobile point of view is that we are looking to deploy networks that will cover the whole country. In recent times I think all carriers have invested billions in the extension of their networks, to a point where in, 99, 98 and 96, we have three primary carriers. They are all in that zone. We obviously have an amazing geographic challenge, as you would know only too well, being from the west. In one example I know it went from 97 to 98 or from 98 to 99. I cannot remember but it involved the addition of some 900,000 square kilometres. It was a huge undertaking.

In terms of access, and this features in the government's NBN plan, delivery of service by one method or another to all Australians is certainly our aim. The mobile networks have a phenomenally good reach at this point. I am not saying that there are not any black spots or that there are no challenges out there to be addressed and fixed, but certainly the majority is there.

I think you are quite right to mention the social dimension. We did a three-year research project with the Academy of Social Sciences, under a research linkage grant, to look at the impact of the mobile on work-life balance. There have been follow-up surveys to that.

**Ms JACKSON**—Even a very recent one; I think it was in the last couple of days.

**Mr Althaus**—Yes, it was quite recent. Without going to the detail, the general theme is that, on work-life balance, your immediate assertion might be, 'I take work everywhere now, so the balance is skewed.' Another way of looking at it is, 'I can stay in contact with my family and environment in the same constant way.' So the balancing element of that led to that research overwhelmingly saying, 'Yes, I might work a little harder and, yes, I am more productive, but it has a positive impact on the balance of my life.' We all have examples where that is not the case, but that is what the research of 3½ thousand respondents revealed. But it is important that we constantly look at that social dimension. That is the connectivity element that I am referring to. We want people to be connected, and that is an important facet.

Turning to the recycling, my organisation and the industry spend about \$4 million on a recycling program. It is probably the best in the world. It is streets ahead of the ICT sector generally, which has nothing. We were challenged by government five years ago to address the burgeoning numbers of handsets that were not being used. We estimate that there are probably 11 million to 14 million in drawers and cupboards around the country. There is not an environmental burden while they are sitting there, but if they all went to landfill there would be.

We have had a 50 per cent plus reduction in the numbers of handsets going to landfill through that program and, of course, there is a very high level of resource recovery of things such as plastics, precious metals and batteries. But what is very pleasing to see in recent days in the emergence of a national waste policy, because in the broader context e-waste is a growing issue, and the government is now moving to address that in a more holistic way. We will plug into that very happily because we have been shouldering the burden in our little sector.

**Ms JACKSON**—Is that working with local government?

**Mr Althaus**—Yes, absolutely.

**Ms JACKSON**—So, where I have been giving local governments credit for some of the work they are doing, you are saying that in fact your organisation has been behind them, driving it.

**Mr Althaus**—Yes, that is us. That is Mobile Muster. We do a lot of work with the ALGA and local councils as drop-off points for mobiles.

**Ms JACKSON**—Including funding them?

**Mr Althaus**—We do not fund them per se, but it is a free service that we offer to them in terms of both collection and promotional materials.

**Mr BRADBURY**—I want to ask a question in relation to the availability of spectrum and whether with the take-up of, for example, the next '4th generation LTE' technology, which your submission refers to, we are facing a prospect of exhausting the available spectrum that can be accessed. I know that the digital dividend will be a component in freeing up spectrum. That is the general question but, in answering that, can you also provide a little bit of detail in relation to 2.5 gigahertz? I have read that part of the submission but I do not completely understand what is currently being used in that spectrum and how that might be freed up.

**Mr Althaus**—In the general capacity context what we are having to engage in some sort of future analysis and try to anticipate what is going to happen. The graph that is in the submission is a global graph and it gives the ITU, the International Telecommunication Union's, assessment of where demand for mobile spectrum is going. We are going to be falling below that curve. That is a reality as spectrum is a scarce resource and it is fully occupied. Any changes mean that someone else has to give up a bit so that someone else can have a bit.

In amongst that there is efficiency and that is what is going to drive the digital dividend. Through technology you will be able to be more efficient in your use of spectrum. Whether we actually get to a capacity point where there are severe constraints is something we want to avoid, obviously. Similarly, we cannot just go on and on adding spectrum to our resources. It is going to be one of the technological challenges to balance efficiency with access. But right at this point in time we are looking at efficiency measures, but there are also key aspects of both 700 meg, which is the digital dividend, and 2.5 that are critical. It is a phenomenon that is happening around the world; it is not just Australia. But Australia is most dependent on particularly the 700 meg spectrum to solve one of our core issues which is travel of signal over distance.

It is beachfront spectrum in a sense. It will go a long way before it needs to be boosted again so your business case to get it into rural and regional Australia is a much better one. It is also useful in metropolitan environments, believe it or not, in building penetration, in building coverage. This goes to the point of the industry which is now dealing with technology both in terms of network design and chipsets inside phones that are intelligent to the degree that your phone might operate on 2.1 gig out in the CBD of Melbourne. You go into a building and it thinks, okay I have to go to 850 here because there is an issue. You jump into the car and drive out into the country and you may well ultimately flick to 700, which is where that spectrum is operating. So it is a mosaic of spectrum that is needed.

In relation to your point on 2.5, one of the key characteristics that we anticipate most particularly in this mobile data growth phase where high bandwidth applications are in high demand and other people are active, you need more for want of a better term strong, heavy-lifting capacity in metro environments; 2.5 is that. It is a much higher frequency, much higher load-carrying capacity, so you would not expect a 700 meg to carry that sort of data load. It still will be a part of a mix of spectrum that we use. The other key thing about 2.5 is that it has been globally harmonised. The ITU has accepted that this band globally, and it is the only one in this category, will be mobile.

The current users of 2.5 are the broadcasting sector and they use it for electronic broadcasting, doorstops, outside work. We have absolutely no problem with that; that is an important aspect of technology to continue. The reality is they are swimming around in a very luxurious 190 megahertz of prime spectrum that is being used for those applications.

I am not putting the applications down; I am simply saying it can be done more efficiently and that will plug Australia into the global trend. It is not only where we are using spectrum; it is that we are a technology taker because we are a small market in terms of devices. We need to align so that, when we buy handsets and bring them to Australia, they are configured to the spectrum that the rest of the world is using, which we have also applied to mobile application.

**Mr BRADBURY**—What capacity is there to trade spectrum rights?

**Mr Althaus**—Within the sector as a secondary market? The secondary market is there in theory, so there is capacity to trade. The reality is spectrum is very expensive and obviously, in this industry, it is a critical element. You go home if you do not have it. A secondary market has not been working particularly. That has probably got something to do with the cost and the lead times over which people buy the licence. In my member's case it was 15 years.

**CHAIR**—Dr Barker suggested to us that by giving these property rights to spectrum and being able to trade them and providing incentives for that means there will be a better allocation of the spectrum and that is a low-cost way of assisting productivity growth.

**Mr Althaus**—Again, in theory that might be the case. In reality there are hundreds of millions and sometimes billions of dollars invested in networks and systems to use a certain band. That is what happens in mobile, broadcasting et cetera. That is one of the reasons it is relatively difficult to envisage a freer flow of secondary trading.

**CHAIR**—You see more of a government allocation of the spectrums than the market playing that role?

**Mr Althaus**—That is the history. Government is the manager and allocator. The market price is set typically by auction processes and so on. Given the scarcity, given the demand and also given that some applications are obviously of strategic importance in national security and other defence related areas, I think the government will retain that role without question. People have got to recall the sorts of technologies and complexities in this environment and the lead times involved. It is one of the key stress points right now with demand increasing and decisions not being made on spectrum. We have major telecommunications investment just getting close to that tipping point where decisions will be deferred because there is no certainty. It is a particular moment in time now, particularly relating to 15-year licences.

**CHAIR**—Given what you are saying, it is the government rather than the market that does it—the inefficiencies or the potential drag on productivity could well be a product of government inaction or delay in this area?

**Mr Althaus**—That is correct. Again, it is a fine balance. Government has got to manage the scarcity issue. The industry is putting forward a case in terms of the implications for both productivity and connectivity for more spectrum. The other obvious element is it is very expensive. In Europe there has been experience where through an auction process in a heated economy you could argue too much was paid for spectrum. It ripped the innovation and ongoing investment out of the enterprises concerned for the next couple of years while they digested the hit on their capex. Government has a role there in management as well. But it is getting to the point where it is so fundamental that great care has to be taken with how this allocation is undertaken.

**Ms JACKSON**—The NBN rollout is quite critical to that as a broader picture.

**Mr Althaus**—In the broader picture, yes, and thank you for reminding me. We often get asked about the relative relationship between mobile and fixed, particularly in the NBN debate. The industry certainly sees this as a complementary situation. People will do things with a fibre-to-the-premises network that involve high numbers of users on the same connection downloading high bandwidth applications that it will be capable of servicing, but perhaps the mobility factor deals at a different level in terms of its capacity. However, one of the technological links which is vital is an element we call backhaul. That is the ability of wireless activity, mobile activity, to be carried to and fro from the main network. The backhaul capacity and the opportunity that the NBN will deliver in that regard are very, very important, given the sorts of demand and usage patterns that we are expecting over mobile networks.

**Ms JACKSON**—And some certainty in how that is going to be done is tied intimately to greater certainty when it comes to new spectrum and how that is regulated, for example.

**Mr Althaus**—The new spectrum is in addition to the NBN. There is a symbiotic arrangement. There is a partnership and a complementary relationship here. But at the end of the day, between 2007-08, when mobile data and mobile broadband really got going, to when someone flicks the switch on an NBN, mobile broadband will do a lot of the heavy lifting in that period, as well as fixed. It is a re relationship that is going to be complementary.

**Ms JACKSON**—So it will not be like the rail tracks in this country.

**Mr Althaus**—No.

**CHAIR**—Thank you for your attendance here today. That was a very valuable submission. In the short time available, we were only able to touch on some of it, but I think we concentrated on the key areas that you raised. That was very helpful for us. We did speak to you about the Access Economics study. If you could get in touch with the secretariat about that, that would be valuable for us to have as well. You will be sent a copy of the transcript of your evidence. If there are any corrections that you need to make, could you get those back to us as soon as possible. Once again, thank you for your attendance here day.

**Mr Althaus**—Chair, would you like me to leave a couple of the documents that are referenced in the submission? Is that of any use at this point?

**CHAIR**—Yes, that would be great. Thank you.

**Mr Althaus**—I will leave you with the 2008 Access Economics report and the summary of the research we did with the Australian National University on the impact on work-life balance. That is the social research project.

**CHAIR**—Thank you.

**Mr Althaus**—Any other things that you would like, please do not hesitate to ask.

**CHAIR**—Terrific. Thank you.

[10.03 am]

**CATCHPOLE, Mr Michael, Chief Executive Officer, The AusIMM**

**SARDER, Ms Monika, Manager, Policy and Professional Standards, The AusIMM**

**CHAIR**—Welcome to today's hearing. Although the committee does not require you to give evidence on oath, I should advise you that these hearings are the proceedings of the parliament and therefore have the same standing as proceedings of the House. We have received your written submission to this inquiry. Do you wish to start with an opening statement in relation to that submission?

**Mr Catchpole**—Thank you to the committee for the opportunity to speak with you directly, and we certainly appreciated the opportunity to make a submission. As we have outlined, the institute is the professional body representing predominantly geologists, geoscientists, metallurgists and mining engineers within the industry but also a range of senior managers within the industry some of whom may come from those professional backgrounds or may have been drawn from a much broader range of backgrounds. Our role is very much to represent the interests of the professionals within the industry. Our membership of almost 10,000 represents the largest single grouping of professionals within this industry sector. Those members work obviously not only in operational and managerial roles but also in research, corporate or institute research or academia, and also in consultancies, which are a growing feature of our industry, and very much in the industry technology and services area, which I think committee members may be aware alone represents something like a \$2 billion export industry for Australia. So Australia's predominance within the global mining sector is very much driven by the technology and the professional expertise of the people within the Australian sector.

As you would have seen from our submission, we really range across a number of areas that are quite specific to our industry and our members, very much focusing on areas such as exploration and our concern that the rates of exploration are dropping. Certainly the ABARE figures for the last financial year show a drop of more than 30 per cent in base metals exploration and 26 per cent in gold exploration. The only area where there has actually been an increase in exploration has been iron ore. Perhaps that is not surprising given the focus particularly in WA. The concern is that Australia is falling behind in its exploration effort and we risk losing our position in relative world terms.

Other areas that we would like briefly comment on and certainly seek your inquiries are around minerals research and development. We certainly see some very positive work being done by governments state and federal in this area but there are some areas of concern we have flagged. Higher education is very much a concern for us given that much of our membership is based in the engineering and science professions, also workforce participation. Once again the social impact of our industry on families, on communities is of concern to us and our members and how that might be best managed through policy tools and adjustments. Areas that we also work with our members on are seeking further support and quite specific support from government for the development of low emissions technologies. We see that as being a most

important response to the carbon constrained future that we see and the difficulties that governments and political parties have in tackling this area.

Those are the broader areas and I guess the committee would also be aware of comments by the Prime Minister, other ministers and other leading parliamentary figures, also leading bureaucrats such as Ken Henry, on the role of the minerals industry and the resources sector within Australia. There have been some comments made, or at least reported, that there may be some thoughts in government that the minerals sector is responsible for boom and bust and that it is not a long-term contributor to productivity. I think that Ken Henry has pretty much given that an answer in his most recent speeches and particularly talking about the longer term contribution well into the foreseeable future of the minerals sector to Australia's productivity and productivity growth. I think we need to be careful not to be confused between fluctuations on the stock exchange and fluctuations in the true value of this sector to the Australian economy.

I suppose they are our broad-based areas and the committee might have initial questions, or I will ask Monika to briefly summarise again the key points from our submission, if I may.

**CHAIR**—We will hear from Monika first and then we will probably go to questions generally.

**Ms Sarder**—I do not have anything specific to add. Just as an overview, to capture all of the main areas that we included in our submission, I want to highlight that our overarching goal as a professional institute, with members as individuals who work here, is to have a minerals industry in Australia that delivers long-term prosperity; that is sustainable economically, environmentally and socially; and that also maintains a comparative advantage, which is one of the huge challenges. We have previously seen comments, as Michael mentioned, that it is not sustainable. We are now moving towards a place, thanks to China's infrastructure bonanza, where we are looking at a situation where it is driving our economy, but the feeling of our members is that mining capital is highly mobile and this really is not something that we can take for granted. The mere fact that we have resources does not mean they are going to be developed for our benefit. That is what we really want to achieve with our recommendations: a competitive comparative advantage.

**CHAIR**—I want to start by asking you some questions about your comments on higher education and the need for resources there. You are seeing some impending capacity constraints there; is that essentially where you are coming from?

**Mr Catchpole**—We have already experienced capacity constraints. There was probably a short hiatus over the last nine to 12 months; it was not unexpected and I am sure it was felt in other areas. But already the major companies and recruitment firms are reporting difficulties in again securing young professionals to come into the industry. Our feeling is that this is really a result of possibly eight to 10 years of deterioration in the number and standard of courses that are being offered that are specifically mining and exploration oriented. There are a number of concerns around that and there are some policy recommendations that we will make that we hope will help to address this.

**Ms Sarder**—The main point that was made with regard to higher education, and it has been an ongoing one, is that as long as funding is tied to, I suppose, bums on seats, mining courses

will tend to be disadvantaged within universities. Mining is a relatively small course, as it should be, since you do not need a massive number of professionals but you do need a certain number of highly skilled professionals. Mining courses are not particularly viable to run, the experiences that the students are able to access—equipment, field courses et cetera—are very low. We have seen a high number of closures. This is common across all industries but in mining particularly the salaries for academics are so much lower than what they could be getting in industry. There is a real concern about the continuing viability of the courses and the dilution of the course content, which has happened with courses like metallurgy being absorbed into chemical engineering and geoscience being absorbed into earth science. We then wind up with a cohort of graduates who have some of the basic skills but who are not necessarily going to be able to innovate at the same level that they would have if they had more specialised knowledge. They just kind of perpetuate the processes into which they were inducted.

**CHAIR**—I suppose that the problem in addressing these issues is the time lags that are there. If there is a problem now it will be well down the track, even if we address it now, before those issues or constraints are resolved, because of the nature of higher education.

**Ms Sarder**—Yes, it is tricky. One of the key problems is how to make it attractive for universities to give the resources to minerals education that it deserves. We have previously recommended the sorts of mission based compacts that you have had for nursing and teaching. Of course, the pressures that have created a shortage there are very different. We have received feedback that if an industry needs the people then it should pay for the people. We have seen our companies sponsor courses for short periods of time but that makes the funding very unstable and it also makes universities reluctant to commit to long-term infrastructure. In some cases where you have had really high-quality schools that has been purely because of an objective decision by a vice-chancellor to heavily subsidise the course.

**Ms JACKSON**—There is the model in Western Australia, for example, in the oil and gas industry, with the collaborative new institute, or whatever it is called, with Curtin university. Obviously there are employment issues for that. The industry is making sure those engineers and others are going to stay in the oil and gas industry, which does not help iron ore or any other metal industry, I accept. But is there that sort of capacity in the industry? People assume mining is prosperous. The companies have got the money. Maybe it is that partnership with industry.

**Ms Sarder**—There are collaborative mining schools, and we have received mixed feedback—I certainly do not want to offend any of our members—about how well they are working. They do require quite a bit of relocation early in the education process. That is something that is being developed as well as it possibly can. Again, how sustainable it is depends on funding and sponsorship from global companies. There is a bit of a question mark on that as to when they can increase and resource engineers from places like South America et cetera. People, again, might be likely to stay because there are more readily accessible deposits there. So that gives them an additional edge in terms of having people.

**Ms JACKSON**—Are there possibly some answers by funding at the VET level, so that we almost get them at a different level of their education and training and through their involvement in the industry skill them up within the industry?

**Ms Sarder**—Yes, that is certainly something that the industry does—it pays to skill people up. Even so, we are still seeing massive shortages of the people required and the training capacity to skill them up.

**Mr Catchpole**—Certainly the Western Australian School of Mines, again at Curtin, is a successful model and has operated very well historically. There is still some suggestion that the federal funding model almost works counter to how that school can best operate and puts it under some particular difficulty. And that is in a resource-rich state and a state that is obviously very focused on education in this particular field. So it is probably common across all the science disciplines that there is a need for a funding model that possibly is somewhat skewed, or at least structured, to recognise the particular needs of fairly narrow but very important fields of expertise. Mining engineering is certainly one. Geoscience, within the broader earth sciences, is another. Certainly the companies, on our understanding, take on their responsibilities at the other end with graduates in terms of their further training, but I guess the companies are saying, ‘Look, we put in that first three to five years of graduate professional training to bring them to the level that we need, the next level mine manager and so on.’ What they are looking for, of course, is a tertiary education system that provides that more specific qualification at the end of study.

**Mr BRIGGS**—Does that cause any problem at the exploration end as well? Is that one of the reasons you point to for the drop in the figures you talked about in your opening statement?

**Mr Catchpole**—It does, again because in some cases universities, simply on the numbers and on a funding basis, have had to broaden their courses, so what were pure geology courses became geoscience courses and then earth science courses. So a three- to four-year degree has a much smaller component of pure geology, if you like. Companies are recruiting graduates and then finding they have never been in the field in a geology sense. That makes it extremely difficult. There are a large number of graduates with a broad based education but without the specific professional expertise that is sought.

**Ms Sarder**—A well-qualified geoscientist is absolutely critical to making those discoveries. It will be new theories about geology and how deposits form that will lead to the breakthrough discoveries. We have seen a decline in the number of honours students that are supported by their universities when they finish earth science, so there is a real decline in quality there. There is also a lack of industry focus. We have seen people coming into employment without even basic field skills. We are running a course to try to fill some of those gaps.

**Mr BRADBURY**—I want to pick up on the point that you identify in the submission in relation to the Productivity Commission’s analysis. I know that one of the limitations of the concept of multifactor productivity growth is that it does not necessarily always bear a direct connection with the outcomes that might be achieved throughout an economy, whether they be in the form of income derived or employment generated. You also make a point about investment more generally. Clearly because of the need for your sector to become more innovative in identifying and exploiting resources that are becoming more and more difficult to find and extract, the equation between inputs and outputs does not always tell the story of the overall prosperity that might be generated by your industry. I note that you make that point in the submission. Notwithstanding all of that, there must be a tipping point where inputs reach a level vis-a-vis outputs that creates a disincentive for further mining and exploration in the industry. I

wonder if you could explore that idea and make an observation as to whether you believe there is a tipping point. Could you please answer that in the context of just the broader drivers of demand, because clearly that is an important part of the equation.

**Ms Sarder**—My first answer is going to be somewhat humorous—or perhaps not that humorous. Perhaps our tipping point is when the nickel price dies, because it is so driven by price and by demand. Currently, we are seeing in countries such as China and India—this point has been made by Ken Henry and we have made it in our submission—rapid industrialisation and huge demand for minerals, to the extent where there have been controversial takeovers to try and guarantee supply from Australia. I think that tipping point, in terms of mining not being economically viable, for most commodities is quite far away—short of substitutes coming online or something unforeseen happening such as the Chinese economy collapsing. I think reaching a point where we see reserves depleting and countries frantically trying to come up with ways to substitute and recycle is actually more of a potential issue.

At this stage, the demand is going to continue to be there and provided there is continuous investment in R&D which improves the efficiency of processing, uses keyhole methods of extraction, provides better prediction and utilises automated mining and these sorts of things, the costs will come down radically, as they have across time. I do not think that that is so much an issue at this stage in the global context in which we find ourselves.

**Mr Catchpole**—It is more a concern that we will not reach the tipping point because the capacity constraints will stop us getting that far.

**Ms Sarder**—Our concern is more about the slice of the pie we get as Australians.

**Mr BRADBURY**—In terms of securing capital in Australia there are limits to what we can secure locally. There is a need for capital to come in from offshore. Can you comment on the extent to which the sector is dependent upon capital coming in from offshore?

**Mr Catchpole**—A couple of days ago Marius Kloppers made much better qualified comments than perhaps we could make in that area, but yes it is dependent.

**Mr BRADBURY**—You would endorse those comments?

**Mr Catchpole**—As far as I understood them and as they were reported. He is heading up such a global company and if that company experiences those constraints then our individual members, whether they are working for the majors or mid-tier mining companies, will experience it to an exaggerated extent. To some degree, that is shown in a much more narrow area in that field of exploration. Again, the case made for the flow-through shares or exploration tax credits is one small way within one part of the industry to address that shortage of capital purely in exploration. But, yes, for developing and proving up a major resource and bringing it to market, there is no doubt that the Australian financial market does not have the capacity to drive the sorts of projects that are already in the pipeline much less those in prospect.

**Mr BRIGGS**—There are some other significant challenges at the other end as well, are there not? For instance, I am a South Australian member and we have Olympic Dam, which is the biggest known deposit of uranium and there is potentially a bigger one further north, as I

understand it, which is at a lower stage of development. With Olympic Dam, we are seeing the huge challenges BHP are facing with energy and water—the two major inputs. Firstly, where are they going to get the energy from? It appears they are unsure—and that is before a carbon restrained economy, which is the point you made earlier. Secondly, the other issue which befuddles my state is water. How do you see the impact of those challenges on potential growth and productivity as well as the challenge of access to capital for the hard infrastructure? Look at the power that is required for Olympic Dam, which is north in South Australia but nowhere near as north as where a lot of the uranium and other deposits are.

**Ms Sarder**—We have traditionally left the infrastructure advocacy to the chambers and the national bodies since that is something that they are closer to and have the figures on. Certainly there is a need for much better coordination of infrastructure and water and power usage. We have seen plans in South Australia to look at the capacity for Olympic Dam that have not necessarily factored in a lot of the other smaller mines that might come on stream. We have seen different models of public/private transport infrastructure on one side and privately owned rail networks on other side overcommitting—

**Mr BRIGGS**—And port facilities, as well.

**Ms Sarder**—Yes. There is a real risk of stranded assets if that planning is not—

**Mr BRIGGS**—But I guess the issue is, before having the need for rail and road infrastructure, getting the mine to the point where you can actually develop it, because you do not have the power or the water to access. It gets back to the issue of the carbon constrained economy. How are we going to develop the baseload capacity? Do you see that as a challenge as well for the industry as far as productive capacity goes?

**Ms Sarder**—Yes.

**Ms JACKSON**—And whether trained professionals might find mineral deposits closer to major infrastructure—

**Ms Sarder**—Yes.

**Mr Catchpole**—Or perhaps, more likely, trained professionals through increased R&D might find ways of meeting that, particularly water. It is very much a case in almost all of our wealth, our proven resource areas, that water is a particular constraint, with energy not far behind it. The cost of energy of course is a major factor. We saw major goldmining operations, and the Super Pit was one, that reached marginal operation purely because of the price of fuel when the price of fuel hit its peak less than a year ago. Yet the price of gold has now outstripped that. You would almost think that the price of gold is rising faster than the price of crude oil possibly could. But there was a tipping point when that was almost a week-to-week situation. That was a really interesting situation, and at that stage, less than 12 months ago, the goldminers were looking with envy at the nickel miners just up the road in WA. Now there has been such a massive turnaround that not only is the case reversed but the nickel miners are the poorest of the poor by comparison. So the constraints are across the industry but they also will fluctuate depending on commodity prices and metal prices.

**Mr BRIGGS**—So just to the logical conclusion—presumably an introduction of a carbon price, which looks inevitable in Australia, will impact obviously on both future exploration and future development of resources.

**Mr Catchpole**—Based on the models that we see and that are being reported at this stage, yes. I do not think there is any doubt. Perhaps the Minerals Council has done more detailed work than we have. Again, it is an area that our members have a strong interest in. I have to say there are a range of views.

**Mr BRIGGS**—You mentioned it in your opening statement. That is why I am interested.

**Mr Catchpole**—That is right. But, yes, there is no doubt that there would be a cost impact.

**Ms Sarder**—Certainly it will influence some commodities more than others—obviously, aluminium and copper smelting. I still would not see that the minerals sector is alone in being concerned about the lack of a forward plan. I know that there is another energy white paper. It is very difficult for companies that are contemplating making long-term investments not to be able to see a long-term forward plan for emissions baseload power, whatever that matrix of sources may be.

**Mr BRIGGS**—Do you have a view on what that matrix of resources may be?

**Ms Sarder**—Our members have a strong view that we should not rule out nuclear. They do not believe necessarily that we should have nuclear but they believe that it should be considered within its risks and economic liability alongside all of the other potential energy sources. There is obviously a view that geothermal can fill some of the gaps near operating mines. There is definite concern that, without a forward plan, introducing emissions trading will hamper investment. This is also due to different technologies that might be used at the processing stage. With processing technologies you can lower your direct emissions by using more electrothermic processes, so overall you will reduce your emissions if you focus on that. But if you do not have access to low-emissions baseload power there is no incentive to do that. Having emissions trading and not knowing where your baseload power can come from is not a great idea.

**Ms JACKSON**—Do you know what the level of research and development is from companies going into alternatives to using existing baseload power?

**Ms Sarder**—Into alternatives?

**Ms JACKSON**—Yes, by your members. I guess what I am saying is that it is not just the responsibility of someone else to find the solution. With these companies, traditionally, the nature of their industry is such that to develop a project involves sometimes a 10-, 15- or 20-year projection.

**Ms Sarder**—A number of companies are involved in collaborative research. There is the Coal21 fund. There are a number of geothermal companies starting up. Australia is a participant in a lot of the next generation, nuclear modular technologies. We have a lot of work being put the energy efficiency of mining and production generally. Energy is a cost, regardless of whether there is an emissions price on it or not.

**Ms JACKSON**—Exactly. They would just like to know what the rules are for the emissions trading scheme, for certainty.

**Ms Sarder**—Yes.

**Ms JACKSON**—Wouldn't we all?

**Ms Sarder**—Yes.

**Ms JACKSON**—I just want to reassure my colleagues that this is not a dorothy dixer but I did notice that three of the recommendations in your submission talk about government subsidisation of child care, particularly in regional centres, special tax treatment and the like. I would just like you to outline why this is such an important factor for increasing productivity.

**Mr Catchpole**—I guess what we are looking at there is very much the nature of the workforce and the nature of our membership. Without being at all apologetic, what we are looking to do is to address the shortage of professionals within our industry by attempting to make the most productive use of those who are trained and experienced. A significant number are women, professionals who have gained significant experience and expertise working operationally and then often corporately. But for various reasons, and particularly on operational sites, we are finding our members are withdrawing from the industry. One of the problems is the broader issue of carer leave and cost, and it is certainly a problem in regional and remote areas.

What we are looking at is a policy mechanism that will specifically target those groups, not just mining professionals but service professionals as well, working in regional and remote areas that do not have particularly child care—and other forms of services, but let us focus on child care—that recognises the shift work and the type of work that is done. Again, it is not just mining professionals, it is also medical professionals and other service people. So, yes, we put a fair bit of emphasis on it, but only because it is a feedback from our members that this would be a very significant factor in more effective use of the expertise that does exist and that is being lost to the industry.

**Ms JACKSON**—There are some inconsistencies, in the sense that if I am an employer and I build a childcare centre and my staff go there it does not attract fringe benefits tax, but if I offer a subsidy or I pay for childcare places for an employee who is out the back of Warburton or Leonora then there is fringe benefits tax.

**Ms Sarder**—Yes, we have seen that as a particular problem. It is a kind of self-perpetuating thing, where the majority of women still take on primary care responsibilities and the numbers are not enough to justify building a childcare centre, but if you try to choose a more flexible option then you get hit with the fringe benefits tax. Increasingly, it is not just female participation. Our latest remuneration in employment survey has indicated that something like 20 per cent of the members, I cannot remember how many, identify themselves as carers. It was the majority. Twenty per cent had actually downshifted to roles with lower salary and responsibility just because of caring arrangements. So the lack of accessible and decent care is a huge issue. The point does need to be made as well, though, that we do not rely purely on government to solve this issue. Introducing greater flexibility and more consistent use of things like telecommuting et cetera would also take some of the pressure off. Nonetheless, child care is

an issue: you have to put the kids somewhere, no matter what you are doing or where you are doing it from.

**Ms JACKSON**—Thank you.

**CHAIR**—Thank you for your participation in the inquiry and for coming along today. It was most informative, and your members work in an industry that is so important to the Australian economy and future productivity growth. It was great to have you here today. You will be sent a copy of the transcript of your evidence. If there are any corrections, please get those back to us as soon as possible. Once again, thank you for your participation here today.

**Mr Catchpole**—Thank you very much. Monika mentioned that remuneration and employment survey. We have done it for several years and we are just completing the latest one. I wonder if the committee might find that of use.

**CHAIR**—That would be terrific. If you could liaise with the secretary in relation to that, that would be great.

[10.48 am]

**RICE, Mr Michael Robert, Private capacity**

**CHAIR**—Welcome. Although the committee does not require you to give evidence on oath, I should advise you that these hearings are legal proceedings of the parliament and therefore have the same standing as the proceedings of the respective houses. We have received a written submission to this inquiry from you. We invite you to make an opening statement in relation to that submission.

**Mr Rice**—First of all I would like to make an apology for a rather bad mistake on page 4, where it reads ‘an almost significant level’. That should be ‘insignificant’. That makes quite a difference. Before I start to talk about my submission, I should point out that I have had some years of experience in R&D. I worked with Aeronautical Research Laboratories for quite a few years, in my first job. Later on, in my employment by the Australian Public Service, I worked at the engineering development establishment which is part of DSTO, on research into alternative fuels for internal combustion engines. I also worked in the Department of Civil Aviation using some of the capabilities I had acquired at Aeronautical Research Labs. I was involved in investigations into the fatigue of aircraft structures, including the development of methods of non-destructive testing to find structural flaws that could not be found by visual or other means.

On leaving the Australian Public Service I was employed as a consultant by a number of organisations, including the department of science, the Victorian Post-Secondary Education Commission, the Association of Professional Engineers and the Institution of Engineers. I have authored and co-authored over 40 books, reports and other publications on the issues that are addressed in my submission.

Essentially, as indicated in the introductory section, my submission is that Australia’s recent productivity growth has been mediocre, which is substantially attributable to a low rate of productivity growth in manufacturing. From my investigations it appears that productivity growth in the manufacturing sector appears to be, among other things, dependent on the level of R&D in manufacturing. Australia is notable in that its manufacturing R&D is relatively low compared with, perhaps, domestic product.

The other interesting thing is that if one excludes manufacturing R&D from consideration it may come as a surprise to many people that Australia expends a greater proportion of GDP on R&D than do most OECD countries. Additionally, few countries expend a greater proportion of GDP on basic research than does Australia. The relevance of this I can discuss later.

It appears that one avenue for increasing manufacturing productivity would be to increase the level of manufacturing R&D. That may be debatable but that is my belief. To achieve an increase in manufacturing R&D there would need to be a commensurate increase in a number of R&D personnel. Expenditure and personnel are closely tied. Roughly speaking, \$400,000 of R&D in manufacturing equates to one researcher year. So any significant increase in expenditure on R&D will demand more people qualified to be researchers. I have found that the majority of

researchers in manufacturing in every country that I have looked at are engineers, not scientists. That is detailed in the submission.

Australia is notable for the extremely low number of annual engineering graduations compared with most OECD countries, and this could act as a brake on any attempt to increase the level of manufacturing R&D. I think that is the issue that I principally address. It may not directly relate to productivity but it is a fundamental issue in any attempt to increase manufacturing R&D. I might add that, so far as I can determine, the number of graduations in engineering has not changed in the last 10 years; if anything, it is decreasing. The demographics of the engineering profession are such that the rate of growth of the engineering profession will decline by about 2015 or 2016 to something less than the rate of growth of the Australian population. This is a first. Like most countries, Australia, since the Second World War, has increased the number of engineers by three to five per cent per annum. This will not happen from now on. To me, the consequences are quite apparent. I think that is all I would like to say at this stage.

**CHAIR**—Thank you. The issue of R&D is squarely one of the terms of reference here, so your comments about the reasons, in your view, for declines are welcome and very much on track.

**Mr Rice**—I am sorry; I am a little hard of hearing. My early years of work in a laboratory damaged my hearing. If you could speak up a little I would appreciate it.

**CHAIR**—Sure. I was just reassuring you that the areas you are addressing the committee on are squarely in the terms of reference. I just wanted to make that general observation before we start. R&D is an important component when looking at how productivity growth can increase.

I want to start with the question you spoke about and focused on—R&D. You said that that is largely the reason why Australian productivity has declined in recent years. We have had evidence from a variety of sources that in some senses supported your proposition about a decline in R&D. But principally what we are being told is that one of the major reasons for the decline in productivity has been the drought and the investment in the mining sector and that, if you took those two sectors out of the productivity equation, productivity has not changed dramatically. Do you have any comment to make in relation to that specifically?

**Mr Rice**—I do not think I am equipped to comment really. The only thing I will say about mining R&D is that it is quite unusual. As I said, expenditure on R&D is roughly \$400,000 per researcher head in manufacturing; in mining, it is \$2.5 million. That is exceptional. It is unbelievable in fact. If you go back a shade over ten years, you will find that it was nowhere near that. It jumped quite dramatically in a short period of time. I cannot explain why that happened. Whether that diverts funds from R&D in manufacturing, I would not know. But there are other issues in manufacturing other than R&D. There is enlightened management who sent us to take on R&D, which might not be sufficient at the moment.

**CHAIR**—What sorts of suggestions do you have for the committee in terms of policy issues and what sorts of recommendations we should be making to encourage R&D?

**Mr Rice**—I think the incentives that exist now in relation to taxation are much more beneficial than the previous tax rebates, because a lot of firms in the early stages of their development—we are talking about young firms developed by entrepreneurs—do not make profits in their early years and therefore any taxation relief is no help to them. What they need is some sort of a credit that will keep them going until such time as they are profitable. Of course, the other thing is that venture capital in Australia is scarce—extremely scarce—and not venturesome. It is quite surprising. There is quite a lot of accumulated capital in Australia—in things like superannuation and so on. I guess, because the trustees of some of these things are subject to the law and to their responsibilities to the superannuants and so on, they are not adventurous in how they invest. Yet I think you might find that in a country like Singapore it is quite different.

Singapore is a very interesting case. It is different in a number of ways. As you know, they have a very good superannuation system—government run—which diverts funds to all sorts of useful economic purposes, including lending to the superannuants late in their working lives to buy apartments. That is quite an interesting one. The other thing about Singapore is that they—on the surface anyway—graduate more engineers per head of population than any other country in the world. That is not quite correct, because I have been told by somebody from the National University of Singapore that 30 per cent of their engineering graduates are from other countries, such as Malaysia and so on. But, even if you take that out, Singapore is quite remarkable—with around seven per cent of their males graduating in engineering.

**CHAIR**—So, going back to sources of R&D, you are suggesting that, as a policy issue, superannuation could be better accessed or encouraged to look at investing in R&D in manufacturing?

**Mr Rice**—Yes, but I think there would have to be some protection for the investors because it is a risky business. Venture capital in the Silicon Valley in America is very risky, as you know. The venture capitalists there invest in a large number of entrepreneurial activities. The risk is high and the failure rate is high but they score on the few per cent that are successful. That is one of the problems that have to be faced up to with venture capital.

**CHAIR**—On the number of engineers, the Australian Institute of Mining and Metallurgy—you were here to hear the last part of their evidence—had a discussion with us about how they saw capacity constraints in their industry through not enough investment in higher education. They were talking about engineers with specific skills for their industry and there being a tendency in recent years for universities to, to use their words, be more interested in bums on seats. So more generic engineering courses were developed, which they think will present a problem for them down the track. Are they the type of issues that you think are leading to a decrease in the number of engineers through our universities? Can you make some comment in relation to that and perhaps some of the solutions you think we need to look at?

**Mr Rice**—The best thing I could do is quote the retired Vice-Chancellor of RMIT University. He has said, ‘The reasons that school students do not opt for engineering are: it is too hard, the course is too long, the HECS is too expensive and it is nerdy.’ That is what he said. There is a community aversion to studying engineering. Until the global financial crisis, it was quite curious that a relatively small number of people went into engineering courses when there was a scarcity of engineers, which may no longer exist. When there was a surplus of scientists, people

were opting for science at a spectacular rate. There were 12,000 graduates per year—the highest number in the world relative to population. That says something about the public image of those courses.

**CHAIR**—If a lack of engineers is causing these capacity constraints in manufacturing R&D, what do we need to do, in your view, to address this issue?

**Mr Rice**—Partly it is an issue of the public perception of engineering and the perception of engineering in schools. People like me, who do engineering, go into it because they are interested. I was fascinated by aeroplanes from an early age. I wanted to work with aeroplanes and therefore I studied a course that took me in that direction. For most of my working life I have been in some way or other occupied by and worked with aeroplanes.

There are a large number of people who could be attracted if they realised that engineering is not what the public perception is. There are two problems as I see it. At one end you have a perception that engineering is related to the metal trades or something like that. At the other end you have the perception that a lot of high-tech activity is the activity of scientists when in fact it is often the activity of engineers. The person who won the Prime Minister's science prize is an engineer. Repeatedly in the media people who are cited as doing something rather spectacular in the technology world are identified as scientists and not as engineers.

**CHAIR**—We are particularly interested in how to increase productivity in Australia. You have put forward the issue of our relatively low number of engineers compared to other countries—today you used the example of Singapore—affecting our productivity. Do you know what are they doing in Singapore that is encouraging engineers? Are there government policies or businesses saying, 'This is where we need to be putting our R&D money'? Are there particular programs there that you know of? If there are not or you do not know, is there anything you can suggest we should be doing in terms of this?

**Mr Rice**—I do not know what happens specifically in Singapore, but I did have the opportunity to talk to the president of the National University of Singapore at a meeting. We were talking about the high rate of graduation of engineers in Singapore, and that is when I learnt that 30 per cent of the graduates are not Singaporean. I said, 'Notwithstanding that, you have a high graduation rate. Is that a matter of national policy?' He said, 'Yes.'. On another occasion, my colleague Dr Brian Lloyd and I visited Singapore, and we had the opportunity to meet the secretariat for the minister for industry, technology, and trade, I think it was. It was some years ago. We were talking to them about human resource issues. Because of my interest in engineering supply and demand, I said, 'What are you doing about engineering graduations? This was quite some years ago. He said, 'We are going to increase them to a level where two per cent of our workforce have engineering qualifications.' I said, 'Why?' and he said, 'Because that is where Germany is, that is where America and Japan are, and we want to be there too. Then I said, 'Are you going to achieve that?' and he said, 'Yes.' And they did—by the year 2000.

**CHAIR**—So your suggestion to us is that we need to be putting in place active investment in higher education that encourages more engineering graduates.

**Mr Rice**—Particularly in attracting people into engineering. It appears to be a matter of policy in Singapore. My memory is a bit tricky on some of these percentages, but I think about 50 per

cent of male graduates in Singapore each year are engineers. In Sweden it is very high. In Taiwan it is very high. In China, around 35 per cent of university graduates are engineering graduates. We are an unusual country. It is about five per cent or less here. If you go to a lot of other countries, it is much, much higher. How you achieve it, I think, is the \$64 question. I think it is probably one of these multifactorial things where you have to look at image, the attractiveness of the profession—and, dare I say it, salary. An interesting thing about salaries for engineers: as we heard a year ago, there was a severe shortage of engineers, which I believe there was. It had been there for a few years. The median salaries of engineers had moved up relative to average weekly earnings by four per cent over at least a 10-year period. That says that the signals that the salary should respond to are not being seen. That is the only way I can describe it. I do believe that engineers' salaries are not attractive. Why do engineering when you can do accountancy and, if you have any sort of ability at all, you can do better? A lot of engineers leave engineering. I know of a number of cases of people who have left engineering and have done better. My own son studied materials engineering, and he is no longer an engineer.

**CHAIR**—Ms Jackson, do you have any questions?

**Ms JACKSON**—No, I think I am pretty clear.

**Mr BRIGGS**—I have got one issue. In relation to manufacturing, you talk about increasing the spend on R&D in manufacturing as a potential productivity gain. A lot of the money we spend in this country on manufacturing goes to the car industry. In my state of South Australia there is a lot of government money spent on Holden in particular. In Victoria it is Toyota and Ford. Do you think that is well placed spending?

**Mr Rice**—I think it is out of my sphere of expertise. I have a feeling about it, but I cannot back it up with information. My personal view is that it is, because one of the interesting things about manufacturing is that there is a spin-off to other jobs. One manufacturing job on average, according to the Office of Technology Assessment in America—now defunct—spins off roughly 1½ jobs in other sector. In high-tech areas it is more than four. So there are indirect benefits which may justify that expenditure.

Unfortunately, I have tried to find the source of the ratio of four to one and I cannot find it in the material I have got, but I have seen it. The Office of Technology Assessment does not exist anymore; it was abolished in the Clinton era, but it produced a lot of studies of manufacturing which you can retrieve from the National Technical Information Service, in America, and they are worth reading.

**Mr BRADBURY**—From the opening statement that you made, I understood you to be making the point that, whilst there is not as much investment in R&D in manufacturing as there should be compared to other OECD countries, we are actually spending more than other OECD countries on R&D in other spheres. Am I correct in interpreting what you said that way?

**Mr Rice**—At least equally, and I think probably more than most, yes.

**Mr BRADBURY**—Given that that is the case, why do you believe that to be the case? What is it specifically about manufacturing that has made it less attractive for R&D investment in this

country? I understand that you spoke about particular forms of incentives and how they may play out, but why do you see manufacturing as not being a sector that has received the same share of R&D dollars?

**Mr Rice**—There are a number of factors, as has been pointed out by the Productivity Commission. The structure of manufacturing in Australia as it is to some extent leads to less demand for R&D because we do not have as much high-tech industry as other countries. That is one factor. I think the incentives to invest in R&D have not been so good, though they have improved.

**Mr BRADBURY**—But those incentives are the same, whether it be in manufacturing or in other sectors.

**Mr Rice**—I do not quite get the point of that question.

**Mr BRADBURY**—The incentives that are available for R&D are applicable whether it be in the manufacturing sector or in other sectors. I would have thought that that is a constant between the different sectors, so what is it that is peculiar about manufacturing that means that we are not getting the level of R&D investment that we should?

**Mr Rice**—I think foreign ownership is a big factor.

**Mr BRADBURY**—Foreign ownership of what?

**Mr Rice**—Of manufacturing. I think it is quite high. Why should a foreign owned firm invest in R&D in Australia when they can bring the designs here and manufacture them?

**CHAIR**—We did have some evidence of that before—that a multinational company will tend to do their R&D in the headquarters of that company. That is what you are alluding to?

**Mr Rice**—Unless they can gain some benefit by doing it here because the wages are lower, and they will do it then. I think there are a number of factors, and the incentives are the other thing. There has been a large study of incentives in various countries. I think the OECD ran it. I have not had a chance to look at it; it is a fairly lengthy document, and there are limits to what I can download with my computer. I think it is a complex factor.

The interesting thing is that there is so much R&D going on in higher education. My own studies have shown that it does not necessarily pay off, and I cite the cases of the laser, the transistor and the charge-coupled device, all of them developed in America—not all of them in higher education, I might add. The countries that have benefited are Taiwan, Korea, Japan and China. Basic research, which is essentially what higher education is doing, is beneficial. It is necessary; it should be done. But it should not be done under the hypothesis that it is going to benefit the nation that it is done in.

I do not know whether or not it is appropriate to produce it, but this is an interesting lecture given by Professor Nathan Rosenberg from Stanford University, one of the David Rivett memorial lectures. I think it was given in 1991, although it is not dated. It cites the fact that most R&D that is done outside the manufacturing sector does not necessarily benefit the economy. I

have done statistical studies using the data from a lot of countries, and have found this is so. But that is not a very popular finding.

**CHAIR**—Thank you, Mr Rice, for your submission and your participation here today. That was most appreciated in the context of this inquiry.

**Mr Rice**—Thank you.

Resolved (on motion by **Ms Jackson**):

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

**Committee adjourned at 11.16 am**