SCIENCE INDUSTRY AUSTRALIA INC.
SUBMISSION TO THE
PRODUCTIVITY COMMISSION REVIEW OF
PUBLIC SUPPORT FOR SCIENCE AND INNOVATION

1. Executive summary

Without public support for science and innovation, Australia would not have its $6 billion per annum science industry which arose from CSIRO, other research agencies and the education system.

Major breakthroughs in medical and scientific research require the best laboratory technology, scientific instrumentation, and people skilled in the sciences. Government has a vital and active role in maintaining a vibrant 'business environment' that enables the effective operation of the supply and value chains that generate the ideas, create the IP and bring them to commercial realisation. Government's continued support through, for example its *Backing Australia's Ability* framework series of initiatives, is essential to this process.

The science industry is a key enabler of many other industries. It involves research and development, design, manufacture, sale and distribution of laboratory-related goods and services used for measurement, analysis and diagnosis.

Science Industry Australia Inc. (SIA) promotes the interests of its members in the science industry.

Supporting its strong growth of 10 per cent per annum and significant propensity to export is its heavy investment in research and development – nearly 6 per cent of turnover, and its highly educated workforce, 50 per cent of which has at least a bachelor degree.

To capture a greater share of expanding global markets in scientific equipment and analytical services, the industry has recently developed and is implementing its 10 year strategic plan – the Science Industry Action Agenda (SI AA), in collaboration with the Australian Department of Industry, Tourism and Resources and the Department of Education, Science and Training.

Major breakthroughs in medical and scientific research require the best laboratory technology, scientific instrumentation, and people skilled in the sciences. Continued Government support focused on addressing impediments to the efficient functioning of Australia's innovation system is required to maintain and enhance Australia's international reputation for scientific discovery and innovation, and to generate greater economic, social and environmental returns from Australia investment in research and development and innovation more generally.

To overcome the impediments to the efficient functioning of Australia's innovation system, SIA recommends that the Australian Government:

- Encourage universities and PFRAs to increase their focus on developing applied research to the proof of concept stage funding by providing the necessary support;
- Develop a business case for third stream funding to universities;
- Implement additional support mechanisms to specifically assist the progression of innovation through pathways other than the formation of start-up companies;
- Continue its support for commercialisation intermediaries;
- Extending the eligibility of the Commercial Ready Program to Australian based subsidiaries of foreign owned companies; and increasing the turnover threshold limits to between $100 million and $150 million;
- Redesign its program design and application processes to lower the administrative overhead on industry applicants, particularly small and medium sized enterprises using as a model the R&D support measures offered by agencies in the United States of America;
- Improve the promotion of Government industry support offerings;
- Designate science and engineering as a national priority for concessional HECS;
- As part of its broader initiatives, harmonise regulation and standards relevant to the science industry across Australian, state and territory governments, and align them with relevant international standards; and
- Expand the international showcasing element of the International Science Linkages program to enable the continuation of the promotion of Australia's scientific and commercial interests at international events;
- Support a CSIRO SME engagement strategy; and
- Introduce a greater range of Action Agenda-based measures modeled on the Industry Cooperative Innovation Program designed to support Action Agenda initiatives.

2. Introduction

On 10 March 2006, the Treasurer announced the Productivity Commission's review of public support for science and innovation in Australia. The Commission's study will consider all key elements of the innovation system, including research and development, and especially:

- the economic impact of public support for science and innovation, including impacts on Australia's recent productivity performance;
- impediments to the effective functioning of Australia's innovation system; and
- the broader social and environmental impacts.

The terms of reference for the review are in **Attachment A**.

3. Science Industry Australia Inc – the science industry peak body

Science Industry Australia Inc. (SIA) promotes the interests of its member companies involved in the manufacture and/or marketing of scientific products in Australia. It also includes a number of research entities and providers of technology service to the sector.

SIA's members are responsible for more than half the science industry's exports and a significant proportion of science-related imports.

4. The science industry and the Australian economy

The Australia's science industry's leading manufacturers and exporters of scientific equipment which include Varian, SGE International, GBC and Intellection arose from the successful commercialisation of publicly funded research such as CSIRO experimental instrumentation – spectrophotometers, gas chromatography columns, mass spectrometer detectors, and more recently X-ray detection equipment.

The leaders, managers and technicians of Australia's leading manufacturers and companies that deliver laboratory analytical services to global markets gained their scientific, engineering and technical education from Australia's top universities.

Without public support for science and innovation Australia would not have the $6 billion per annum science industry. Major breakthroughs in medical and scientific research require the best laboratory technology, scientific instrumentation, and people skilled in the sciences. Government has a vital and active role in maintaining a vibrant 'business environment' that enables the effective operation of the supply and value chains that generate the ideas, create the IP and bring them to commercial realisation. Government's continued support through, for example its *Backing Australia's Ability* framework series of initiatives, is essential to this process.

The science industry is defined as research and development, design, production, sale and distribution of laboratory-related goods, services and intellectual capital used for measurement, analysis and diagnosis.

Australia’s science industry comprises manufacturers and importer/distributors of scientific equipment, laboratory and technical service companies and the scientific research community.

Measurement matters. Australia's science industry is a key enabler of many other industries. It produces high value-added export products such as spectrophotometers and laboratory automation equipment. Its equipment and laboratory services provide for the measurement and identification of very low quantities of substances to ensure the quality of our food, water, air, environment, health and many other aspects of our daily lives. Its products and services are used

by industries such as agri-food; resources; environmental monitoring; manufacturing; medical and health care; research and development and education.

Australia's domestic market for scientific equipment and laboratory-related services was estimated to be $6 billion in 2002/03. Employment, including researchers and technology service providers, was approximately 47 000.

Manufacturing production was $930 million, exports $670 million, imports $2820 million and employment 8 000. Services production was $3070 million, of which exports were $110 million, and employment was 39 000. Australia's publicly-funded researchers also provided significant services to the industry. Australia's scientific product manufacturers produce $260 million of the $3 billion domestic market for scientific products.

Australia's science industry is outperforming many other industries in terms of its growth, innovation, exports and workplace excellence.

The industry is growing at an annual rate of 10 per cent. Its manufacturers invest 7.9 per cent of their turnover in R&D, which is 10 times Australia's manufacturing industry average. This is consistent with high performing manufacturers in Canada and United Kingdom. Its laboratory and technical services companies invest 5.9 per cent of their turnover in R&D. The larger science manufacturing companies export up to 95 per cent of their production. Almost 50 per cent of the industry's workforce has a university degree, and the industry spends more than 5 per cent of its turnover on training.

In February 2004, the Australian Government announced an Action Agenda for the science industry. The SI AA report 'Measure by Measure' released on 31 August 2005 is a strategic plan that blueprints the expansion of the industry to 2015. The Department of Industry, Tourism and Resources and the Department of Education, Science and Training are collaborating with jointly with Science Industry Australia Inc to implement the SI AA.

The priorities of the SI AA are to:

- Commercialise more Australian publicly funded innovation;
- Grow exports;
- Improve product and service quality;
- Progress the harmonisation of regulation and standards relevant to the science industry across Australian, state and territory governments, and align them with relevant international standards;
- Attract and retain a skilled and flexible workforce;
- Increase the use of assistance measures available from government and industry; and
- Improve the industry's internal and external linkages.

5. Outcomes and outputs from commercialising Australian publicly funded innovation

5.1 Science industry's role as an economic agent

The science industry is a knowledge-intensive global industry that relies heavily on its investment in research and development, and innovation more generally, to provide a continuous supply of high value-added world-competitive products, processes and services. This investment must continue for the industry to remain globally competitive.

With the growth in off-shoring of low technology manufacturing, Australia is now more than ever reliant on the development of the local science industry to support the vibrant growth of high technology manufacturing here. A current underpinning research direction is the development of "lab on a chip" measurement devices that will take a low-volume high-value production to high-volume low-cost with the potential to spawn a new industry in Australia. Supporting the emergence of this technology are global security issues and the need to have cheap, mobile devices that can check for all types of contaminants.

The world-class laboratory technology that the science industry provides to many industries and researchers improving productivity and the quality of management decisions in myriad of industries and research institutions in Australia, generating economic, social and environmental benefits. This enhances Australia's global reputation for its scientific and medical breakthroughs, quality of life and the products, processes and services that we produce.

This is demonstrated by Australia having only around 1 per cent of the world's scientists and technologists[2], but their scientific publications were 2.93 per cent of the world's published scientific papers in 2004. In terms of scientific publications per million by OECD country, Australia was placed 9th with 1,114 publications per million.[3]

The distribution of Australian scientific publication by field of research indicates that clinical medicine, plant and animal sciences and chemistry are the top three disciplines. All these disciplines are extensive users of laboratory technology[4], which the 2004 survey of the science industry also found.

It is no coincidence that the relatively strong up turn in citations/publications has occurred during the period of substantially increased science and innovation funding immediately prior to (Wills Review outcomes) and subsequent to the Government's introduction of the *Backing Australia's Ability* programs.

5.2 Connection between public funding and commercialisation of science and innovation

Major breakthroughs in medical and scientific research require the best laboratory technology, scientific instrumentation, and people skilled in the sciences. Government has a vital and active role in maintaining a vibrant 'business environment' that enables the effective operation of the supply and value chains that generate the ideas, create the IP and bring them to commercial realisation. Government's continued support through, for example its *Backing Australia's Ability* framework series of initiatives, is essential to this process.

Science is a global business. Similarly, scientific research is global in nature. The best scientific brains are courted aggressively by the best research centres (both industrial and academic). While salary is a factor, having access to the best research tools and strong academic teams are at least equal if not more important motivators to encourage scientists to locate themselves in Australia. Recently the Queensland and Victorian Governments have recognised this factor by committing considerable new funding to life science and medical research, and creating the new Institute for Molecular Biology in Brisbane and Bio 21 Institute in Melbourne.

The Australian Proteome Analysis Facility (APAF) is an example of what can be achieved by Australian scientists, when they are provided with the very best research tools available in proteomics that enable them to perform leading-edge scientific research of international significance. For further information on APAF see the case study at the end of this submission.

Other institutes and their host universities have received substantial new funding to expand laboratory infrastructure, equipment and to develop world-class multi-disciplinary research teams.

Complementing additional state government funding are Australian Government initiatives that have increased significantly the funding of NHMRC and ARC over the past 5 years, with strong forward estimates going through to 2011.

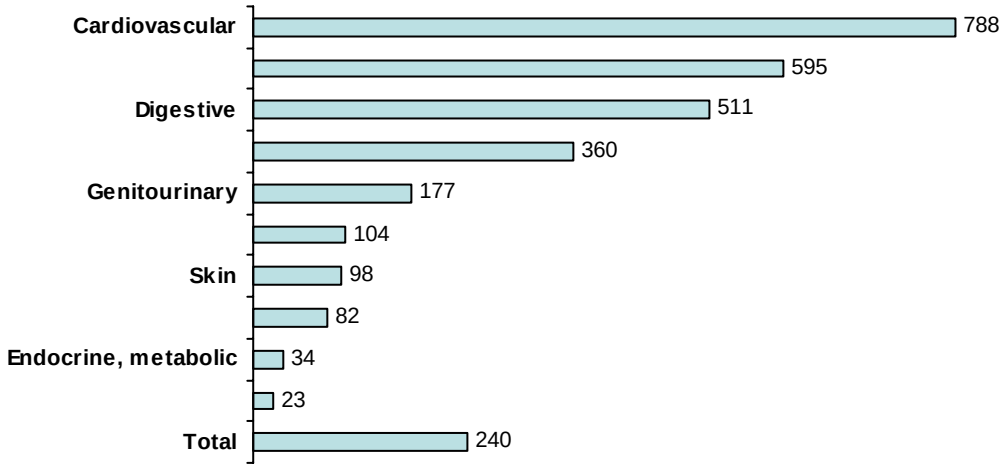
Major cost savings are generated in health care provision by advances born in medical research laboratories using state-of-the-art tools.

The report "Sustaining the Virtuous Cycle for a Healthy, Competitive Australia" provides data sets that support greater investment in science and innovation, particularly for health and medical

research. Amongst its data sets is Figure 1 which that indicates the very high economic returns from investment in health and medical research.

Continuing support from Australian and state governments for emerging technologies in material sciences, nanotechnology and chemistry will see Australia remain at the forefront of scientific endeavour and provide products, processes and services that Australia can sell into world markets.

Figure 1. Australian economic analysis show very high returns to health and medical research [5] (Rate of Return from R & D %)



(Source: "Sustaining the Virtuous Cycle for a Healthy, Competitive Australia" report http://www.health.gov.au/internet/wcms/publishing.nsf/Content/health-hsid investreview/$FILE/Executive_Summary.pdf)

6. Impediments to the effective functioning of Australia's innovation system

The SI AA identified the main institutional impediments to the effective development and commercialisation of intellectual property from research as:

- Poor alignment of public research with science industry needs, and poor interaction between the industry and researchers;
- Costs of transferring intellectual property from researchers to industry; and
- Eligibility requirement of some Australian Government R&D support programs that exclude larger science companies.

To improve the alignment of publicly-funded research with market needs, the SI AA's initiatives include:

- Improving communication and understanding between the industry and researchers;
- Facilitating greater collaboration between science companies and commercialisation intermediaries; and
- Raising the industry's awareness and use of the available support measures, such as those of the Australian Government's *Backing Australia's Ability* initiative, which complements the science industry's initiatives.

The SI AA has developed and is implementing a strategy for improving the industry's engagement with universities and publicly-funded research agencies (PFRAs).

While the SI AA is industry-led, there is a continuing need for the Government to review and adjust its policy settings, particularly for science, innovation and regulation, to enable Australia's science industry to respond most effectively to market dynamics.

The key issues affecting the effective functioning of Australia's innovation system and areas where there is scope for improvements are:

- Bridging the 'innovation gap;
- CSIRO collaboration with industry – a potential powerhouse for innovation;
- Skills shortages;
- Regulation;
- Enhancements to Action Agenda policy; and
- Industry's awareness of Government support offerings.

6.1 Bridging the 'innovation gap'.

An 'innovation gap' exists between the research side of Australia's innovation system and the commercial side which impedes the effective and efficient flow-through of ideas from public researchers to industry. In so doing, the 'innovation gap' impedes the full realisation of economic benefits from Australia's significant investments in R&D and innovation. The 'innovation gap' is created by the research outputs from universities and PFRAs not being adequately developed to the point of being 'investment ready'.

To improve the flow-through of ideas across the 'gap' to the Australian industry, the science industry is collaborating with commercialisation intermediaries and peak bodies in the research sector to develop a set of framework guidelines for a proof of concept metric.

These guidelines are aimed at assembling the evidence necessary to demonstrate the technical and commercial viability of a research idea to potential investors. The metric would, if implemented appropriately by universities and PFRAs, encourage researchers to develop their ideas to a stage where they are of more interest to industry, particularly Australian industry.

The guidelines would enhance the role of the commercialisation arms of universities and PFRAs. The proof of concept metric would work backwards through the research supply and value chains to provide a clear framework for the activities of research faculties and researchers and to increase their focus on market needs.

The proof of concept metric work builds on the substantial research by the Department of Education, Science and Training into commercialisation metrics.

The Government provides support for proof of concept work in the research side of the innovation system through schemes such as NHMRC's Development Grants. The Commercial Ready scheme provides support to industry for proof of concept work. To encourage universities and PFRAs to increase their focus on developing applied research to the proof of concept stage funding support would be necessary. SIA endorses the intent of Recommendation 13 in the report of the recent Parliamentary inquiry *Pathways to Technological Innovation* which states:

> *The Committee recommends that the Australian Government introduce a funded proof of concept scheme, based on the Group of Eight Innovation Stimulation Fund proposal and providing the following for university research projects with high potential for commercial outcomes:*
>
> - *matched Australian Government and university funding investment in the suggested ration of 3:1;*
> - *a maximum funding per project of $100,000; and*
> - *funded for an initial three year period to a maximum Australian Government investment of $45 million.*

Any such funding scheme would need to be outcome focused with deliverables to ensure that universities and PFRAs did not redirect the funding into their basic and early applied research activities.

Universities and PFRAs engage in the commercialisation of their ideas with government support through start-up and spin-off companies. This can act as an impediment to the flow-through of ideas to industry.

The argument given for this activity is that universities and PFRAs are being driven to raise additional revenue from it. The down-side to this activity is that start-up and spin-off companies have a low survival rate. This is due in part to the lack of managerial expertise of the researchers who create the companies, the lack of adequate finance to develop, produce and market the product, process or service, and the attractiveness to cash-out the intellectual property (IP). These factors can lead to the IP being acquired by foreign interests, effectively creating a loss of the national benefits from Australia's public investment in the research and development of the idea. The countervailing argument is that Australia's established science companies are better able to commercialise research IP provided there is adequate evidence of the commercial potential of the idea.

SIA endorses the intent of Recommendation 14 in the report of the recent Parliamentary inquiry *Pathways to Technological Innovation* which states:

> *The Committee recommends that the Australian Government implement additional support mechanisms to specifically assist the progression of innovation through pathways other than the formation of start-up companies.*

Cultural issues at the organisational and researcher level in universities and PFRAs impede the transfer of research IP to industry. These are more than adequately explained in the evidence and report of the recent Parliamentary inquiry *Pathways to Technological Innovation*. To encourage greater collaboration between universities and the private sector and develop positive pressures for cultural change, SIA endorses the intent of Recommendation 11 in the report of the Parliamentary inquiry *Pathways to Technological Innovation* which states:

> *The Committee recommends that the Australian Government request the Business Industry Higher Education Collaboration Council to examine and develop the business case for third stream funding to universities.*

Third stream funding should be outcomes focused with deliverables, progress reporting and a review towards the end of each funding period to ensure that universities use the funding appropriately, effectively and efficiently.

There is growing evidence of the success of intermediaries in the commercialization of PFRA research.[1] SIA strongly supports the AIC Tech Fast model, whose pilot has recently concluded, and recommends that the Government continue its funding to AIC for Tech Fast.

6.2 CSIRO collaboration with industry – a potential powerhouse of innovation

CSIRO's stated purpose is:

> *By igniting the creative spirit of our people we deliver great science and innovative solutions for industry, society and the environment.*

It goes on:

> *We take a triple bottom line focus in our activities, between commerce and the public good. Great science is our foundation. Getting it out there is our aim.*

The SI AA has been and continues to be enhanced by the participation of senior CSIRO officers in its steering committee and working groups. The SI AA has a strategy for engaging with PFRAs, and we are encouraged by a number of recent cooperative initiatives between CSIRO and leading science industry companies which could produce quantifiable benefits for both CSIRO and the science industry.

CSIRO's Strategic Technology Roadmapping exercise is aimed at 'long term sustainable' industries, which the science industry clearly is. However, with some 98 per cent of science industry companies being SMEs, and CSIRO's charter from the Government to produce 30 per cent of its income from external sources, coupled with SMEs' lack of understanding of how to engage with CSIRO, are impediments to greater SME engagement.

A reduction in CSIRO's external revenue target and a more SME-friendly engagement strategy would produce better national economic and social outcomes from Australia's investment in CSIRO research. In this regard, SIA endorses CSIRO's proposal for an Australian Growth Partnerships program, and Recommendation 10 in the report of the recent Parliamentary inquiry *Pathways to Technological Innovation* which states:

> *The Committee recommends that the Australian Government give priority consideration to the Commonwealth Scientific and Industrial Research Organisation's proposal for an Australian Growth Partnerships program to engage small to medium enterprises in demand driven collaboration with publicly funded research agencies.*

6.3 Skills shortages

The science industry is a knowledge-intensive industry that is heavily reliant on its human capital to create its competitive advantages and respond to emerging opportunities. Almost 50 per cent of its workforce has a university degree, and the industry spends more than 5 per cent of its turnover on training. Surveys of the science industry indicate that the industry has shortages of laboratory technicians, technical trades, chemists, mechanical and software engineers, and sales and management staff with good knowledge and understanding of science.

The SI AA has a working group for this issue. SI AA initiatives to increase the supply of skilled staff focus on improving the industry's profile as a potential employer and improving the content of course curricula. The SI AA has contributed to government's initiatives such as the National Skills Shortages Strategy (NSSS) and is leveraging on government initiatives such as the NSSS Science Careers Project, Careers Network, and Local Community Partnerships.

Of particular concerned to the industry is that while science graduates possess good theoretical knowledge, they do not have sufficient practical skills, and require further practical training to be job-ready. Even the industry's sales staff must have a high level of knowledge and understanding of science and the equipment. The SI AA is considering an accelerated practical laboratory skills course for university graduates as a solution to the industry's skills shortages.

Another feature of science graduates and migrants with science engineering and technical skills is their lack of and/or limited verbal and written English communication skills. This limitation can make them unemployable.

We note that the Australian Industry Group has recommended that science and engineering undergraduate programs should be a national priority for concessional HECS eligibility. Encouraging students to undertake courses in science and engineering will help to make the Australian science industry a more skilful global competitor. Designating science and engineering as national priority areas, exempt from HECS fee increases, in a similar way to nursing and education, would assist in encouraging students to take up science and engineering at university.

6.4 Regulation

Regulatory requirements often add to the cost of undertaking innovation. For example, governments require the users of certain chemicals, precursors for drugs and explosives, and therapeutic substances to register themselves and the substance. This requirement exists even when the company uses the substances in small amounts. The burden is increased further in circumstances where there is no national harmonisation of regulations or regulators, so that different registration and compliance requirements exist when companies work across jurisdictions.

The science industry has a national and international focus. It makes little sense that a company would have to comply with the regulatory requirements of up to nine jurisdictions, each potentially having different regulatory requirements, compounded by many countries also having their own regulatory requirements.

Regulatory compliance involves direct costs, indirect costs and opportunity costs. The science industry is dominated by SMEs (estimated to be up to 98 percent), each of which has few senior managers. With such limited resources available to drive the company's success, having them consumed by a heavy regulatory burden reduces the resources available for the productive strategic activities of product development/innovation, marketing, and export opportunities.

It is noted that the Council of Australian Governments is considering regulation and its harmonisation as an issue of national competition policy.

6.5 Enhancements to Action Agenda policy

While the Government's Action Agenda program is excellent, it may be argued that it is a substitute for a more comprehensive industry policy.

Many smaller industry associations or groupings of industry associations that have been granted an Action Agenda are experiencing a shortage of funds that would ensure the successful implementation of their Action Agenda. This situation arises from their limited resources being focused on Action Agenda activities rather serving more immediate needs of their constituents.

We note that the Government's Industry Cooperative Innovation Program is designed to support Action Agenda endorsed innovation projects. The application of this model to fund additional cooperative Action Agenda initiatives during the implementation phase of the Action Agenda process would be beneficial for industry and Government. However, the majority of companies involved in industry Action Agendas are SMEs, and they are generally reluctant to make financial commitment to implementation initiatives. We also note that many SMEs (up to 41 per cent [7]) in industries that have an Action Agenda are not represented an industry association with an Action Agenda. This has the potential to jeopardise the Action Agenda outcomes that industry and the Government are seeking. Science Industry Australia Inc. would be pleased to discuss its proposals for such assistance measures further with the inquiry.

6.6 Industry's awareness of Government support offerings

SIA recognises that many assistance measures are available from government to address its impediments to growth. The SI AA implementation plan has a number of initiatives that will assist with raising the industry's awareness, including through the science industry's peak body. Nevertheless, the industry's lack of awareness of government support offerings remains an issue. The existence of the government website www.business.gov.au is a good initiative, but it should be complemented by other promotional measures.

7. Decision making principles and programme design elements that influence the effectiveness and efficiency of Australia's innovation system

The decision making principles and programme design elements that influence the effectiveness and efficiency of Australia's innovation system and guide the allocation of funding are:

- Eligibility of larger science companies for Australian Government R&D support;
- Support for high technology exporting industries; and
- Compliance costs of Government's innovation support measures.

The scope for improving these is described below.

7.1 Eligibility of larger science companies for Australian Government R&D support

The Government provides a range of support for small and medium enterprises (SMEs). SMEs are broadly defined as having an annual turnover of less than $50m. The turnover applies to the SME and the group to which it belongs.

The $50m turnover criterion for programs such as Commercial Ready is unrealistic. It confines the eligibility of programs to which it applies to SMEs with an annual turnover of less that $50m. But, science industry companies operate in the global business environment and rely on world-class innovation for their competitive advantages. The effect of this limit is that the relatively few larger Australian science industry companies that compete in world markets and contribute to Australia's economic and social welfare are denied access to many Government innovation support measures. The Australian subsidiaries of multinational companies are also denied access to these measures.

R&D and other innovation activities are an on-going high risk process for all science industry enterprises, and a higher more realistic turnover ceiling should be established in the range of $100m to $150m.

The Government's R&D Tax Concession Scheme provides larger companies with support for their innovation activities. It provides a tax concession for eligible expenditure of 125 per cent, and up to 175 per cent certain other conditions.

Industry and commentators have argued that since the Government lowered the R&D tax concession from 150 per cent to 125 per cent in 1996, business expenditure on R&D (BERD) as a percentage of Australia's gross domestic product has declined.

Larger companies in the Australian science industry argue that the compliance costs of obtaining R&D support under the Tax Concession Scheme exceed the financial benefits it provides. With the recent reductions in company tax, any benefits have been eroded further. As a consequence, Australia's R&D support measures have little impact on the competitiveness of the larger Australian-based science companies. A more realistic turnover criterion would be in the range of $100m to $150m. Raising the turnover ceiling would also improve Australia's attractiveness to foreign investment in R&D with the accompanying contribution to economic and social outcomes.

Furthermore, SIA endorses the intent of Recommendation 15 in the report of the recent Parliamentary inquiry *Pathways to Technological Innovation* which states:

> *The Committee recommends that the Australian Government asses the revenue implications and potential economic returns of extending the R&D Tax Concessions eligibility to include Australian based subsidiaries of multinational companies.*

SIA also endorses the intent of the following portions of Recommendation 17 in the report of the recent Parliamentary inquiry *Pathways to Technological Innovation* and proposes that:

> *The Australian Government review the effectiveness of the Commercial Ready Program by 30 June 2007, giving particular consideration to the following program amendments:*
>
> - *extending the eligibility to Australian based subsidiaries of foreign owned companies; and*
> - *increasing the turnover threshold limits to between $100 million and $150 million.*

7.2 Support for high technology exporting industries

Some high technology industries, such as consumer electronics[6], that are characterised by large production volumes and the continuous introduction of new products and models manufacture their products overseas, but have their product realisation centres that perform the design, R&D and prototyping in Australia.

In contrast, the Australian science industry sees its longer term sustainable competitiveness in the manufacture of high value-added products that have relatively small production runs, such as spectrometers, spectrophotometers and chromatography products.

The science industry is dominated by SMEs, many of which employ less than 20 people. The newer science industry SMEs tend to think globally, but act locally – initially at least before expanding to capture global markets. They aim to perfect their processes here in Australia before entering export markets where 97 per cent of the market for science industry products and services are.

However, science industry SMEs like all SMEs, face many challenges.

- How do they enter foreign markets?
- Where do they get market intelligence?
- Who might be interested in partnership?
- How should they gain the necessary international trade exposure?
- How do they finance all these activities?

A better solution to providing Australian researchers and commercial interests with the necessary international exposure at conferences and trade exhibitions is required to overcome a common shortcoming across many high technology sectors.

Austrade's services and its Export Market Development Grant program provide answers to the above questions and provide financial assistance. However, Austrade's performance in the delivery of its services varies significantly from post to post. Furthermore, there is no cohesive government program or other set of assistance measures that assist groups of SMEs in taking the important first steps into export.

Science Industry Australia Inc. has received government support to enable its members to attend international showcasing events such as PITTCON 2005 and Analytica 2006. In 2005, the Australian Government, through its Innovation Access Program, and the Victorian Government provided financial support to enable 22 science industry companies to showcase their products and services at PITTCON 2005 in the United States of America. In 2006, the Australian Government, through its International Science Linkage program, and the Victorian Government provided assistance to enable groups of science researchers and companies to attend Analytica 2006, a leading trade shows/conference in Germany. These opportunities confirmed that Australia can achieve greater impact from the collective exposure at these events of 15 to 20 companies and research institutes than would have been achieved individually.

We recommend that the Government expand the international showcasing element of the International Science Linkages program to enable the continuation of the promotion of Australia's scientific and commercial interests at international events.

In this context, SIA endorses the intent of Recommendation 16 in the report of the recent Parliamentary inquiry *Pathways to Technological Innovation* which states:

> *The Committee recommends that the Australian Government Department of Industry, Tourism and Resources extend the support available to provide for later stage commercialization activities, such as market identification, marketing and sales strategies.*
>
> *This support may be provided either by extending the range of activities eligible under the Commercial Ready program or by establishing alternative mechanisms of assistance which are compliant with World Trade Organisation and other trade agreement conditions.*

7.3 Compliance costs of Government's innovation support measures

The primary factor guiding the allocation of public funds to support innovation in the private sector should be the level of external benefits generated (that is national benefits beyond those captured by the firm funded). Australia ranks relatively lowly in its allocation of public funds to support innovation activity by firms, and for example graphs by Treasury and DEST (in the Mapping Report on Science) show an apparent correlation between the level of business performance on R&D and the level of public support for business performance of R&D. The few countries that are outliers on this graph (higher levels of business expenditure relative to the level of public support) include Japan, Israel and Switzerland which have a very different business-government relationship than that applying in Australia and other English-speaking economies.

Firms are required to provide a great amount of detail in applications. To quote one firm in the Australian Industry Group's "Manufacturing Futures" report:

> *"We've just finished an R&D Start Grant and the cost of applying for that was horrendous not in terms of having to pay for applying but in terms of the documentation required and the absolute finite detail that was applied."*

According to this report, many companies reported similar reservations about applying for grants. The additional workload in applying for grants, that is required to demonstrate that the company's R&D is adding value, instead can undermine the value being added, in terms of time and financial costs.

The view that Australia's industrial structure explains Australia's relatively low BERD can be only partly true. Australia has long had sophisticated chemicals, electronics, pharmaceuticals, aerospace, automotive, scientific instruments and medical devices industries that until the last decade were larger and more technologically advanced than those of countries like Ireland, Korea, Taiwan, Singapore and China. Innovation has driven the growth of many of these industries in other countries, and Australia has the potential to grow these industries also.

In terms of the application process for R&D grants, onerous and/or expensive application processes may provide a disincentive for companies to apply for funding. Firms are required to provide a great amount of detail in applications. This issue is raised in the Australian Industry Group's "Manufacturing Futures" report. Some of the administrative burden in applying for grants, is required to demonstrate 'additionality', that is that the R&D would not be undertaken without the grant. As the Productivity Commission's own work demonstrates, determining 'additionality' is very difficult and the additional costs associated with this reduce the value of the grants. It is not clear why the simple assumption cannot be made that if the cost of R&D is reduced, more will be undertaken. This would enable government R&D support to be allocated to the best ideas/projects, just as ARC and NHMRC grants are awarded to the best applicants without regard to 'additionality'.

Various R&D support agencies of the United States of America Government offer staged assistance for the development scientific instruments. Smaller grants are provided for the various stages and if the project proponent demonstrates their project to be viable, the government supports it to the next stage. This is enabled by a streamlined assessment and approval process and a risk management approach. Value and national benefits are generated by enabling resources to be allocated to initiating the project, rather than having them consumed in a complex and time consuming application process.

If the Australian Government were to redesign its program design and application processes, the objective would be to create a selection process with a lower administrative overhead that still ensured the integrity of expenditure of public money and managed the risks. A pilot program could be conducted and evaluated to determine the appropriate settings for the program control mechanisms.

With the internationalisation of Australian industry, and industry's greater use of open innovation, government should provide additional support to encouraging international linkages between manufacturers and offshore R&D. The Australian Industry Group's "Manufacturing Futures" report supports this and states:

> *"…remaining globally competitive requires industry to make better use of global supply chains. This extends not only to maximising supply efficiencies in the production process, but also in taking advantage of global human resources, including innovation expertise."*

Australia has a comparative strength in its high quality basic research. However, not all of this research will necessarily be of interest to the Australian science industry. Australia's quality basic research gives us entrée to access foreign basic research, which may be of interest to the Australian science industry. However, for the science industry to take advantage of this global research expertise, government programs require more flexibility in facilitating such engagements. Providing support for international collaboration, and other measures such as trade shows, will provide additional assistance for science industry companies to seek and use opportunities to access relevant foreign R&D.

Prepared by: Alan Lawrenson, on behalf of Science Industry Australia Inc.

Contact Details: PO Box 600 Eastwood NSW 2122
Ph: 02 9874 8830
M: 0414 483 373
Fax: 02 9874 5880
Email: actionagenda@scienceindustry.com.au and
sia@scienceindustry.com.au

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Case study – Australian Proteome Analysis Facility

The **Australian Proteome Analysis Facility Ltd** (APAF), the birthplace of proteomics in Australia, is Australia's premier core proteomics facility. APAF was established in 1995 under the Australian Government's Major National Research Facility Scheme (MNRF).

Proteomics is the study and identification of the thousands of types of proteins found in humans, animals, plants, bacteria and other life forms. The expression of particular proteins can be used as 'biomarkers' of health, disease and assist in finding protein quality traits in agricultural crops.

APAF's four partner organisations - Macquarie University, University of New South Wales, University of Sydney and TGR Biosciences Pty Ltd (Adelaide) possess synergistic technologies and expertise. This enables the consortium to offer a far broader range of services to industry and researchers and provides maximum return on Australia's investment in this venture. APAF has received funding in the order of $45 million from MNRF and its four research partners.

APAF was the first dedicated proteome centre established in the world and continues to co-develop many of the laboratory 'tools' in use in proteomics research worldwide. Australian researchers developed the concept of proteomics and APAF has remained at the forefront of technological development in this field ever since.

APAF engages a plethora of Australian and international science industry partners (around 350 in 2004) as a provider of proteomic R&D expertise, discovery partner, technology developer/licensor, technology educator, and market appraisal source. APAF has generated significant export dollars through royalties from products licensed to multinationals and overseas contracts.

APAF adds socio-economic value to Australia by cooperating with international and local pharmaceutical, biotechnology, agricultural and academic bodies to discover unique and specific markers of disease, agricultural quality and for product development. To this end, APAF collaborates with life sciences technology developers to keep Australia at the cutting-edge of proteomics research and development.

As a Major National Research Facility with a focus on service provision, APAF provides expertise in proteomics, functional proteomics and protein analysis, including the following services:

- Biomarker discovery
- Proteomics education & training
- 1 and 2-dimensional gel electrophoresis
- Image analysis
- Advanced mass spectrometry
- Protein and cluster of differentiation antibody arrays
- New MALDI biochip (Surface Tension Segmented) platforms
- N-terminal sequencing
- High-throughput G-protein-coupled receptor screening
- Bioactive screening technologies
- Metabolomics
- Amino acid analysis
- HPLC
- Bioinformatics
- Multiplex (luminex) assays
- Therapeutic protein production
- High abundance protein removal

Case study – Intellection and QEMSCAN

QEMSCAN is a new and highly innovative mineral analysis technology that is a prominent example of the successful commercialisation of CSIRO research. It combines x-ray detection equipment with sophisticated software to rapidly identify and analyse the different minerals in ore samples and process streams, improving the efficiency and profitability of mining and minerals processing operations. Intellection, a CSIRO spin-off company, is commercialising and licensing the technology to some of the world's mining giants. It is built on more than 20-year of rigorous scientific research and development by CSIRO in Brisbane.

By automatically analysing and characterising minerals 10 000 times faster and more accurately than traditional methods, QEMSCAN provides higher quality information that enables better commercial decision-making and problem solving.

Comprising a scanning electron microscope, four x-ray detectors and a software package, QEMSCAN is the fastest and most accurate particle analysis and quantification tool currently available. It eliminates the error-prone traditional method of a technician peering through an optical microscope to identify, quantify and estimate the composition of ore samples. QEMSCAN is also finding application in characterising minerals that reduce the efficiency of coal-fired power stations.

Global minerals companies such as Anglo Platinum (South Africa) BHP Billiton (South Africa), CVRD (Brazil), Falconbridge Noranda (Canada), Phelps Dodge (US), Rio Tinto (Australia) and SGS Lakefield have been using QEMSCAN for many years. A typical QEMSCAN system costs around $1 million, and these companies are achieving paybacks within a matter of months. Recognising the value that QEMSCAN offers, Phelps Dodge, the world's second largest producer of copper, and Anglo Platinum each purchased three systems in a three year period.

Intellection is aiming to be a global leader in the automation of the quantitative evaluation of minerals. It has developed a reputation of technology leadership and expertise which has allowed the company to develop a successful global business and valuable commercial connections.

Intellection has built strong relationships with its user companies by providing the highest standards of after-sales service. In 2003, this enabled it to partner with Phelps Dodge, Anglo Platinum and other 'power users' in a $500 000 program to accelerate the development of QEMSCAN's software. This improved QEMSCAN's user-friendliness by simplifying the time and effort needed to conduct analyses. In the future, Intellection will provide integrated systems support, consulting and testing services.

Technology such as QEMSCAN demonstrates CSIRO's excellent record of conducting world-class research ranging from basic to more commercially oriented research. The knowledge generated from such research has social and economic benefits, and reinforces Australia's reputation as a world leader in scientific research.

Many other case studies are provided in the SI AA report 'Measure by Measure' at http://www.scienceindustry.com.au/pages/action_agenda.asp.

TERMS OF REFERENCE FOR PRODUCTIVITY COMMISSION REVIEW OF PUBLIC SUPPORT FOR SCIENCE AND INNOVATION

The terms of reference for the review are:

1. Report on:

   - the economic impact of public support for science and innovation in Australia and, in particular, its impact on Australia's recent productivity performance;

   - whether there are adequate arrangements to benchmark outcomes from publicly supported science and innovation and to report on those outcomes as measured by the benchmarks.

   The analysis should cover all key elements of the innovation system, including research and development, taking into account interaction with private support for science and innovation, and paying regard to Australia's industrial structure.

2. Identify impediments to the effective functioning of Australia's innovation system including knowledge transfer, technology acquisition and transfer, skills development, commercialisation, collaboration between research organisations and industry, and the creation and use of intellectual property, and identify any scope for improvements;

3. Evaluate the decision-making principles and programme design elements that:

   a. influence the effectiveness and efficiency of Australia's innovation system; and

   b. guide the allocation of funding between and within the different components of Australia's innovation system; and identify any scope for improvements and, to the extent possible, comment on any implications from changing the level and balance of current support;

4. Report on the broader social and environmental impacts of public support for science and innovation in Australia.

   Although the Commission is not requested to review individual programmes, it can, where necessary, undertake case studies of particular types of public support for science and innovation. It should also draw on relevant international experience.

   The Commission is to produce a draft report and a final report within 12 months of the receipt of this reference. The report is to be published.