SCIENCE INDUSTRY AUSTRALIA INC.

SUBMISSION TO THE

PARLIAMENTARY INQUIRY INTO THE

FUTURE OF MANUFACTURING INDUSTRIES AFTER THE RESOURCES BOOM

1. Introduction

On 3 May 2006 the Treasurer, The Hon. Peter Costello MP, asked the House of Representatives Standing Committee on Economics, Finance and Public Administration to inquire into and report on the state of Australia's manufactured export and import competing base now and beyond the resources boom. The terms of reference for the inquiry are, but not limited to:

- Australia's dominance in commodities exports and the impacts of this on the economy following the resources boom;
- the state of the country's manufacturing sector (and the goods and associated services) including opportunities and challenges from the expansion in global trade (in particular by China); and
- policies for realising these opportunities.

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

Science Industry Australia Inc is the peak body for the Australian science industry. Its members are responsible for more than half the science industry's exports and a significant proportion of science-related imports.

3. The science industry and the Australian economy

In February 2004, the Australian Government announced an Action Agenda for the science industry. The Department of Industry, Tourism and Resources and the Department of Education, Science and Training collaborated jointly with Science Industry Australia Inc to develop the SIAA and are continuing this collaboration in the implementation of the SIAA.

In launching the Science Industry Action Agenda (SIAA) and its report 'Measure by Measure' on 31 August 2005, Industry Minister Ian Macfarlane said:

> 'Australia's science industry punches well above its weight. It is outperforming many other sectors in its commitment to innovation, exporting and workplace excellence. And it is the kind of industry that Australia needs more of if we are to maintain our international competitiveness'.

To achieve its 10-year vision to 2015 of being export oriented and recognised world wide for its quality, innovation and commercialisation of leading edge technologies, the priorities of the SIAA are to:

- commercialise more Australian innovation;
- grow exports;
- improve quality;
- progress regulation reform;
- attract and retain a skilled and flexible workforce; and
- improve the industry's internal and external linkages.

The full SIAA report 'Measure by Measure' is available on the web at: http://www.scienceindustry.com.au/pdf/measure_by_measure_full.pdf.

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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. 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. Australia's market represents an estimated 2 per cent of the global market, compared with Australia's gross domestic product (GDP) being around 1 per cent of global GDP. Australia's production of science services is estimated to be one-half of its production of science goods and services. Employment, including researchers and laboratory and technology service providers, was approximately 47 000.

Science 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. Manufacturing production was $930 million, exports $670 million, imports $2820 million and employment 8 000. 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 laboratory and technical services companies invest 5.9 per cent of their turnover in R&D. 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. 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.

The science industry is well integrated with global supply chains. Its scientific instruments, clinical diagnostics and laboratory services are globally recognised as the best available and used extensively in by the world's best companies. Its larger science manufacturing companies export up to 95 per cent of their production. Australian science industry manufacturers that compete globally include Ai Scientific, GBC Scientific Equipment Pty Ltd, Invetech Pty Ltd, SGE International Pty Ltd and Intellection.

Australia's laboratory and technical services companies provide a range of laboratory-related services that involve measurement, analysis and diagnosis. Companies that provide product maintenance and service are also included in this industry segment. The main types of services sold by laboratory and technical services companies are environmental and chemical analysis, technical services, and pathology/diagnostic services, and materials characterisation. The main customers of laboratory and technical services companies are environment, engineering, mining and healthcare (pathology testing and medical/health).

Significant Australian companies with international operations engaged in providing laboratory and technical services include Amdel Pty Ltd, Australian Laboratory Services Pty Ltd, Gribbles Group and Sonic Healthcare Ltd.

Case studies of successful Australian science industry companies are included in **Attachment A**.

This knowledge-intensive global industry 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.

Innovation services, such as research and development (R&D) from universities and publicly funded research agencies (PFRAs), necessarily support the industry's sustainable competitive advantage. 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.

With the growth in off-shoring of low technology manufacturing, Australia's science industry technology services offer significant potential to generate growth and prosperity of Australia during all economic cycles of Australia's resources industry. Laboratory and technology services either bundled with scientific equipment or as scientific services in their own right, are a growing component of science exports.

The SIAA priorities of particular relevance to this inquiry are commercialising more Australian innovation, growing exports, progressing regulation reform, and attracting and retaining a skilled and flexible workforce. The impediments and policy developments necessary for Australia to realise greater opportunities for its science industry laboratory and technology services are described below.

4. Impediments and policy developments needed

4.1 Commercialising more Australian innovation

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.

For the science industry to take advantage of Australia's global research expertise, government programs require more flexibility in facilitating such engagements.

The key issues affecting innovation services and the science industry's commercialisation of more Australian innovation are:

- Bridging the 'innovation gap;
- Eligibility of larger science companies for Australian Government R&D support; and
- Compliance costs of Government's innovation support measures.

4.1.1 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. The science industry 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.

The science industry 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, the science industry 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 need to be outcomes focused with deliverables to ensure that universities did not redirect the funding into other activities.

4.1.2 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 science industry considers that this turnover criterion which confines eligibility for programs such as Commercial Ready to SMEs with an annual turnover of less that $50m is unrealistic for science industry companies that operate is 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.

While it is certainly necessary to provide SMEs with innovation assistance, R&D is an on-going high risk process for larger enterprises as well.

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, the science industry 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.

The science industry 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.*

4.1.3 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.

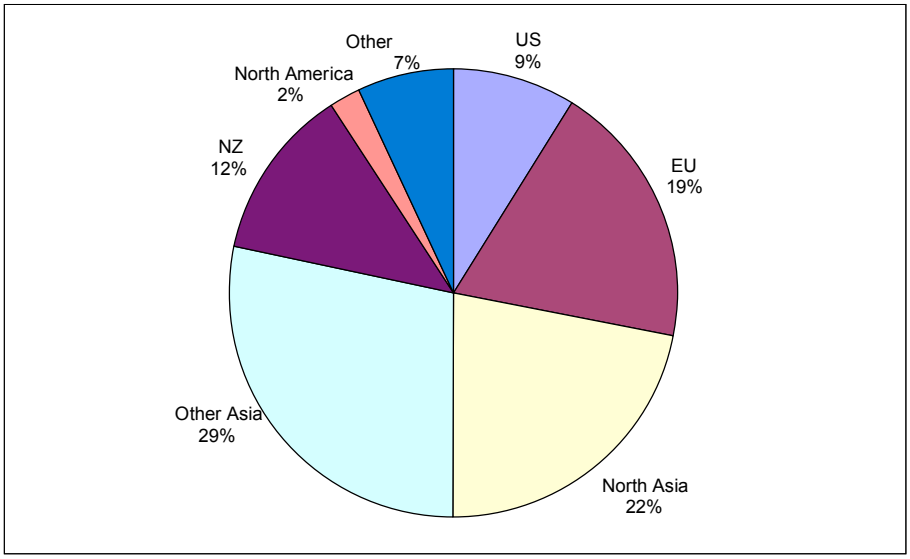
With the internationalisation of Australian industry, and industry's greater use of open innovation, government should provide additional support to encouraging international linkages between manufacturers and offshore R&D. The Australian Industry Group's "Manufacturing Futures" report supports this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

4.2 Growing exports of laboratory and technical services

A survey of the science industry in 2004 found that while laboratory and technical services are traded largely domestically, there are encouraging signs of growth in exports. Having established themselves in Australia and New Zealand, Australia's leading laboratories are expanding their operations into Asia, EU and the Americas, as shown by the case studies. Figure 1 shows the destination of exports of laboratory and technical services companies. 'North Asia', combined with 'Other Asia' now account for more than 50 percent of exports of laboratory and technical services.

Figure 1: Destination of the exports of laboratory and technical services companies



Source: Department of Industry, Tourism and Resources survey of Australia's science industry 2004.

Significant barriers to trade in services exist and exports of laboratory and technical services, as well as research and development activities, are no exception. These barriers take the form of regulations and standards. The European Union is particularly hostile to trade in services. Although it is understood that there are initiatives to harmonise the regulations and standards affecting trade in services.

Laboratory and technical services companies must comply with the globally recognised regulations and standards, as well as the local ones required by individual countries. Australia's global laboratory and technical services companies such as ALS, Intellection, SGS Australia Holdings Pty Ltd (see case studies) have overcome these barriers by establishing subsidiaries of their companies in foreign countries to be close to their customers.

Mergers and acquisitions are often the means by which this is achieved. For example, on 17 January 2006, Campbell Brothers (the parent company of ALS) acquired two laboratory groups: Enviro-Test Laboratory Group (ETL) in Canada and Ecochem a.s. in the Czech Republic. For further details see http://www.campbell.com.au/article_details.asp?Article_No=200601171.

Another option for Australian laboratory and technical services companies to export their services is to establish a 'bridgehead' in the foreign country. Agrisearch Analytical has recently established a presence in China with the aim of offering analytical testing services for the export of fruit and vegetables from China.

4.3 Attracting and retaining a skilled and flexible workforce – 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, sales and management staff.

The SIAA has a working group for this issue. SIAA 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 SIAA 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 SIAA 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.

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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 – Rapid instrument development for Australia's wine industry

The Australian wine industry's rapid growth during the past decade is well documented with continued success in the export markets of the US, UK and Asia. Currently, wine is Australia's fifth largest rural export.

Driving this growth is the ability of Australian wine producers to deliver a quality product at a competitive price. While increased competition both internationally and locally looms large, technology is enabling Australian grape growers and winemakers to deliver quality wine grapes consistently with minimal inputs of water and chemicals.

The techniques for measuring grape quality using sugar content, pH and acidity are straightforward and can be done quickly and efficiently. However, the current technique for measuring the colour of red grapes, another vital indicator of potential quality, is slow and requires skilled technical staff. Finding a quick, reliable, accurate and cheap technique to enable Australia's hundreds of small wineries to measure red grape colour has proven challenging.

The first step to solving this challenge was to find a suitable technology. Research by the Cooperative Research Centre for Viticulture (CRCV) showed that near-infrared (NIR) spectroscopy offered the best potential for measuring the colour in the skins of red grapes using total anthocyanins as the indicator. To ensure the instrument yielded accurate results CRCV calibrated it against thousands of grape samples. This technology has been adopted by many of Australia's large wine producers and commercial laboratories.

The next step was to develop a cheaper, portable version of the instrument.

CRCV, in collaboration with the Sydney-based company, Integrated Spectronics, are currently developing a prototype of a portable instrument for measuring colour, pH and total soluble solids in red wine grapes. The instrument will be designed for use at the vineyard, the weighbridge and the winery, enabling the industry to monitor grape quality more closely and rapidly at each stage in the logistic chain. Integrated Spectronics is providing expertise in developing the hardware and systems for operating the equipment. The CRCV is developing the calibration, software and a sampling technique that will make it as easy as possible for the end users while providing quality data.

The prototype is expected to be completed in mid-2005, with testing to commence in the latter half of the 2005. The commercial product is expected to be ready in 2006.

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.

Case study - SGS Australia Holdings Pty Ltd

SGS Australia Holdings Pty Ltd is a significant player in the laboratory and technical services industry in Australia. It is a subsidiary of the Swiss-based SGS Group, founded in 1878. SGS Group provides independent inspection, verification, testing and certification services for international trade in agriculture, minerals, and petroleum and consumer products. SGS Australia's commitment in excellence in providing its services is backed by ISO 9002 quality certification.

The SGS Group operates around 1 000 laboratories with over 39 000 employees in over 140 countries in Africa/Middle East, America, Asia/Pacific and Europe. Its Australasian operations were established in 1950 and now have over 1 000 employees in 44 establishments in Australia, New Zealand, Papua New Guinea and Fiji. Lakefield Research Ltd, referred to in another case study, is also a member of the SGS Group. It is a CA$40 million per annum Canada-based company. Lakefield has facilities in Canada, Australia, South Africa, Brazil and Chile.

To build its brand, network and market presence, the SGS Group acquired the publicly-listed Scientific Services Ltd (SSL) in 2001. SSL's network of laboratories specialises in the testing of soil, mineral ores, water, agricultural commodities and food based products. SSL has become a major earner for SGS Australia with revenue of AU$58 million in the year ending December 2003.

Case study – Australian Laboratory Services

Australian Laboratory Services (ALS) is a diversified international analytical laboratory group with laboratories in 20 countries including Australia, North America (USA, Canada and Mexico), South America (Peru, Brazil, Bolivia, Ecuador, Chile and Argentina), Africa (South Africa and Tanzania), Europe (Sweden and Turkey) and Asia (Hong Kong, Singapore, China, Taiwan, Indonesia and Malaysia). After commencing operations in Brisbane in 1975, and joining with the Campbell Brothers Limited (market capitalization $400 million) in 1980, ALS has grown to be one of the largest analytical laboratory groups in the world with revenues in excess of $150 million in 2004. ALS employs 1700 staff globally, with over 750 of those being tertiary qualified.

ALS laboratories provide a broad range of sophisticated state-of-the-art services that help consulting and engineering companies, industry and governments to make better informed decisions. Their services include physical, inorganic, organic, bacteriological and toxicological analyses for mining and minerals exploration, environmental monitoring, equipment maintenance, commodity analysis and certification. ALS Environmental for example, can provide analytical information on more than 2 000 individual parameters to ultra low detection limits in a wide variety of sample types using a range of scientific equipment that includes:

- gas chromatograph mass spectrometers (GC-MS)
- high resolution gas chromatograph mass spectrometers (HRGC-MS)
- gas chromatographs (GC)
- liquid chromatograph mass spectrometers (LC-MS)
- liquid chromatographs (HPLC)
- inductively coupled plasma mass spectrometers (ICP-MS)
- inductively coupled plasma optical emission spectrophotometers (ICP-OES)
- atomic absorption spectrometers (AA)
- X-Ray fluorescence spectrophotometers (XRF)
- ion chromatographs (IC)
- infrared (IR) spectrometers
- ultraviolet and visible spectrophotometers (UV/Vis)
- flow-injection analysers (FIA)
- a variety of automated instruments for titration, colour, BOD, and other tests

ALS has grown organically and by acquisition. Between 1999 and 2001 ALS acquired key minerals testing service companies in Canada. Its strong growth in this market niche has been on the back of the mining boom. Miners like to deal with reputable analysts, particularly for work as sensitive as testing mineral exploration prospects. ALS' micro contamination testing services complement Campbell Brothers' other activities of the specialist food hygiene division Cleantec, which cleans critical equipment such at breweries and supermarket freezers. ALS' latest start-up location is in Shanghai (China) where it is initially offering environmental and commodity testing services and plans to move into minerals work. New laboratories are also currently under development in Taiwan and South Africa.

ALS now has in excess of 20 percent of the global market for laboratory testing of minerals. This has enabled it to achieve the economies of scale so essential where high fixed costs have to be spread over many services to achieve sustainable profits which small laboratories find difficult. ALS sees the growth prospects for environmental testing and general analytical services as extensive. Driving this is stronger demand for these types of services as well as the outsourcing of laboratory services that were previously performed by companies in-house.

ALS' services are backed by a solid commitment to quality and customer service. Its quality systems are based on ISO 17025. Its analytical methods are the well-established internationally recognized procedures of US Environmental Protection Authority, the American Public Health Association, as well as regionally and locally prescribed methods and regulations.

Case study – Vision BioSystems Ltd and the Victorian scientific instrument manufacturing cluster

Vision BioSystems Ltd, an Australian clinical diagnostics company, is a significant player in the A$1 billion global market for clinical histological instruments and reagents. This market is growing at an annual rate of 8 per cent.

Vision BioSystems has designed and manufactured state-of-the-art clinical histology instruments used for the microscopic examination of cells and tissue sections for over 20 years. It has built a reputation for innovation, reliability, safety and ease of use, particularly for the automated diagnosis of cancer. Vision BioSystems is a subsidiary of the publicly listed Vision Systems Limited, and is part of the Victorian cluster of scientific instrument manufacturers in Melbourne.

To build its global leadership in the rapidly growing clinical diagnostic market, Vision BioSystems' strategy has been to provide its customers with total system solutions. The solution includes the complete instrument and a continuous supply of consumables such as reagents used for tissue preparation and staining. As part of this strategy, Vision BioSystems acquired the United Kingdom-based Novocastra Laboratories in 2002. Novocastra Laboratories is recognised globally for its range of advanced diagnostic instruments used for detecting the presence of specific proteins in cells or tissues. It is now the world-wide distributor for all Novocastra products.

Vision BioSystems' strategic R&D program recently produced several histology instrument platforms that increase laboratory productivity significantly. Notable amongst these instruments that have been successful launched are three to automate the staining of tissue samples and one that automates microscope slide handling for image processing systems.

Vision BioSystems has a dedicated customer support team to manage the needs of individual client, a high-quality cost-competitive contract instrument manufacturing service, and world's best practice manufacturing processes.

Being part of the Vision Systems group has enabled Vision BioSystems to draw on its resources to develop new products. One such resource is Invetech Pty Ltd, which is collocated with Vision BioSystems. The core business of Invetech is to design and develop integrated systems and advanced technologies for analysis and laboratory automation.

Case study – SGE International Pty Ltd

SGE International Pty Ltd (SGE) is one of the significant global suppliers of chromatography components used in chemical analysis. The technique of chromatography is used for environmental monitoring, food, petroleum, pharmaceutical, chemical industry, biotechnology and many other areas where materials have to be analysed for their molecular constituents.

SGE was founded in the early 1960s by Ern Dawes who was taught his craft of glass working as a technician in the glass shop at Melbourne University. While working at the ICI Central Research Laboratories in Melbourne he was involved in pioneering work on gas chromatography.

As a very capable technician, he was able to meet the needs of scientists working in chromatography and SGE was founded in the garage of his house in Sunshine in Melbourne's western suburbs. Starting with high precision microlitre capacity syringes, SGE has expanded across many areas of analytical chemistry through innovative design and development of new technologies. From the earliest stages it was clear that the Australian market was very limited and the first export sales were achieved from the garage operation.

The values driving SGE have always been a requirement to be the best in the world at the chosen field of ancillary equipment used in analytical chemistry and in particular for chromatography and mass spectroscopy. In addition to a commitment to good manufacturing practise there has always been a substantial commitment to product development. At times CSIRO assistance has been critical in helping SGE learn new technologies. Sometimes this assistance has been in the form of specific development projects and just as importantly at other times has been through informal advice. Through its strong values in product design, manufacturing and recruitment of the right people to the organisation, SGE has grown consistently over 40 years.

In addition to the SGE sales and distribution offices in the United States, United Kingdom, Germany, France, Italy, China, Japan, India and United Arab Emirates there are in excess of 200 distributor partners throughout the world. All but three per cent of SGE's production is exported. The proportion of sales to each market matches each market's proportion of the global GDP. The SGE group currently employs 350 people with the development and manufacturing operations located in Melbourne and Sydney.

Case study – Thermo Electron Clinical Chemistry

Thermo Electron Clinical Chemistry (TECC), a Melbourne based producer of *in vitro* diagnostic reagents and media for cell and tissue culture, was born globally as Trace Scientific Ltd. in 1985.

By the early 1990s, the company was successfully supplying its core technology products to laboratories in North and South America, Europe and Asia. To support these markets, the company had established a distribution network that included a fully owned subsidiary in the United States and joint equity ventures in China and Eastern Europe.

In 1998, the company was purchased by Thermo Electron Corporation, one of the world's leading scientific instrument companies. It is an integral part of the Clinical Diagnostic Division of Thermo Electron's Life and Laboratory Sciences sector.

In 2004, its turnover was over $30 million. TECC employs around 100 staff in Australia, the United States and Europe, 60 per cent of whom are tertiary qualified. It conducts R&D, and supports a variety of external R&D projects with leading Australian universities and researchers. These projects have a high success rate.

To sustain its well established reputation in the market, TECC's manufacturing operation meets the demanding quality standards of the United States Food and Drug Administration and the European Union *In vitro* Diagnostic directive.

TECC has positioned itself as a leading supplier of *Infinity*™ diagnostic reagents through the design and development of unique differentiated products that have a clear technology advantage over the competition. Its reagents are used for diverse applications such as the treatment of dipolar depression, the diagnosis of liver disease, and the identification of lymph node disease.

TECC designs, develops and manufactures a range of sterile media for use in cell and tissue culture that are used in the laboratory, or in the large scale production of proteins for use in the therapeutic, food and beverage industries. Because Australia is free of 'mad cow disease', TECC has developed a strong niche market for its Foetal Bovine Serum culture media.

On the back of its success in manufacturing diagnostic reagents, and the emerging trend for laboratories to demand 'ease of use products', TECC embarked on a strategic R&D program to develop and patent a state-of-the-art process for manufacturing liquid reagents that remain stable. The aim of the R&D program was to further develop TECC's sustainable competitive advantage and fuel its next growth phase.

TECC strengthened its market position in the burgeoning biotechnology industry by leveraging its market assets of a well developed distribution network, emerging licensing opportunities, collaborative relationships with public/private research institutes, experience in the increasingly complex regulatory environment and world-class reputation for quality products.

TECC's OEM customers include industry giants in the *in vitro* diagnostic market such as Bayer, Beckman Coulter, and Olympus.

Case study - A&D Mercury Pty Ltd

A&D Mercury Pty Ltd is a Japanese owned SME manufacturer of industrial weighing equipment established in 1946. The company, which has a production facility in Adelaide, is a dominant supplier to the Australian market, and exports to Japan, United States, South East Asia and Europe.

Prior to July 2003, A&D Mercury was unprofitable, struggling to satisfy the quality requirements of its parent company and was in danger of losing its manufacturing rights in Australia. To recover the situation, company management had to change its attitude to quality, and manufacturing methods. Since implementing its quality improvement and management program none of its products have been rejected by customers.

A&D Mercury's quality improvement and management program has the following elements:

- Improved communication between the parent company, local management and employees. This includes having:
    - Clearly defined quality goals;
    - An aspirational company vision; and
    - Improved use of information technology for communication with the parent company that enables teleconferencing and digital image transmission of products and processes.
- Quality training by the parent company to improve A&D Mercury's understanding of:
    - Japanese market requirements; and
    - A&D Mercury's understanding of head office's expectations.
- Stable employment to retain expertise and the quality culture developed in A&D Mercury.
- Implementation of the Japanese 5'S program that focuses on improving shopfloor layout, production line flow and maintaining a clean and tidy production area.
- Semi-automated production line for testing and calibrating scales.
- ISO9001:2000 accreditation with regular audits by BVQI.

Case study – impact of Australia's regulations on Eppendorf South Pacific and Merck Pty Limited

Eppendorf South Pacific and Merck Pty Limited belong to two highly reputable multinational science industry companies, and supply markets in Australia and Oceania.

Eppendorf is an importer and distributor of laboratory equipment and consumables. It must comply with the regulations and standards covering electrical equipment, refrigerants and biological reagents.

Some universities in Queensland impose specifications in addition to those required by the Queensland Government regulations. These additional specifications impose a burden on suppliers such as Eppendorf who consider it to be more appropriate if there was consistency of all electrical equipment regulations across the Commonwealth, and all states and territories. By having consistency, suppliers would be able to distribute their products more readily without incurring the cost of making alterations for each client.

Merck is an importer, manufacturer and distributor of life science products, analytical reagents, pigments for paints, plastics and cosmetics, and electronic chemicals used for semiconductor manufacture. Its product range is in excess of 10 000 lines. Of these, it stocks more than 2 500 in its purpose built, state-of -the-art facility in Melbourne.

The company must comply with Australia's requirement for dangerous goods transport as well as the storage and handling regulations. Occupational health and safety regulations include plant, certification of plant users, confined spaces, hazardous substances, incident notification, manual handling, first-aid and the latest, prevention of falls regulation.

Their regulation compliance staff must remain conversant with the regulations covering each of these areas not only in Victoria, but also in Australia's other states and territories and the countries in Oceania. In some instances, Australia's states and territories have adopted the Australian Government's regulations and standards and then modified them for their own purposes. Merck must remain up-to-date with the frequent changes to the regulations and standards, and deal with a multitude of different government agencies administering them. This is a costly exercise.

Eppendorf and Merck believe that a strong national regulatory system is essential to ensuring high quality products and services, and to maintaining public confidence in the companies and their products and services. A rigorously enforced national regulatory system provides the companies with a degree of certainty in their business environment, and ensures that they operate on a level playing field in Australia.

They also desire a nationally harmonized system of regulations and standards affecting the scientific products that Eppendorf and Merck sell in Australia as this would significantly reduce the cost of compliance, enhance their competitiveness and improve the value of their goods and services to Australian customers.

Case study – Regulation reform and other action agendas

Regulatory reform was one of the key issues of Chemicals and Plastics Action Agenda which concluded in 2004.

The Chemicals and Plastics Leadership Group (CPLG) was formed at the invitation of Minister Macfarlane to implement the Action Agenda's recommendations. It comprised 11 individuals from a broad range of segments and firms across the industry.

The chemicals and plastics industry is Australia's fourth largest manufacturing sector with an annual turnover of over $27 billion. Compliance with Commonwealth, state and territory chemicals regulations imposes significant business input costs on the industry, and as such is an impediment to the industry's growth and international competitiveness.

To ensure that the chemicals and plastics industry can continue to contribute to the social and economic well being of Australians, the CPLG identified the need for a revised and streamlined regulatory system that is more timely, accountable and cost-effective. The regulatory system also needs to be consistent with national and international best practice, particularly in ensuring the rapid use of overseas technology to facilitate growth of chemicals and plastics manufacturing opportunities.

To progress the reform of regulations affecting the plastics and chemicals industry, the then Parliamentary Secretary to the Minister for Health and Ageing, the Hon Trish Worth MP, coordinated the Australian Government's work with industry across all relevant regulatory bodies.

A substantially improved regulatory regime was introduced by the *Industrial Chemicals (Notification and Assessment) Amendment (Low Regulatory Concern Chemicals) Act 2004*. This initiative for chemicals of low regulatory concern is focussed on achieving regulatory efficiency and positive incentives to drive improvements in the safe and sustainable use of chemicals in Australia. They reflect a balance between developing actions to reduce the regulatory burden and actions to strengthen compliance, transparency and access to chemical safety information.

These reform initiatives demonstrate that significant progress has been made against the milestones set by the Chemicals and Plastics Action Agenda and the process of their development, consultation and commitment are a possible model for other action agendas.

Case study – Ai Scientific

Ai Scientific offers specialised laboratory automation products for sample preparation, delivery, and sample tracking through the laboratory process. The company's international head office, design and manufacturing facility is located at Clontarf in Brisbane. Ai Scientific has offices in Sydney, Melbourne, Auckland, Pittsburgh (United States) and distributors throughout North America, Europe and Asia. Since 1985, Ai Scientific has generated over $30 million in export sales and grown its revenues at a compound rate of 24 per cent per annum on average.

Ai Scientific's international success is based on the following well-established business practices to secure and maintain strategic competitive advantage:

1. Customer focus. Ai Scientific's priority is to provide its customers with innovative, cost-effective solutions that improve laboratory efficiency in the processing of increasing numbers of samples. It complements this with complete and ongoing after-sales support.
2. Research and development efforts focused on niche markets. Ai Scientific is one of six global manufacturers of auto-samplers for inorganic analysis, and one of 14 companies providing pathology sample management systems.
3. Mobilise the experience, skills and creativity of its staff. Ai Scientific uses multi-disciplinary workplace teams of staff from sales, and research and development areas in the company to share ideas on how to improve product and service delivery.
4. Think globally and act locally. Ai Scientific's strong international market focus is built on accurate market intelligence and the identification of emerging trends. The company encourages its business unit managers to travel overseas six to eight times per year to attend international trade shows, develop relationships with European and USA companies, and to promote international market awareness of the Ai Scientific brand.
5. Dedication to reducing costs while continually improving product and service quality. Ai Scientific uses strategic purchasing policies and key supplier agreements to ensure the highest quality from its suppliers.

Case study – NIR Technology Australia

NIR Technology Australia (NIRTech) is a wholly Australian owned company that specialises in the design and manufacture of near infrared (NIR) spectrophotometers and spectroanalysers used to measure certain properties of agricultural products, foods, drinks and medicines. The instruments do this by analysing the near-infrared light reflected from the specimen to determine its characteristics.

In the late 1980s, the Australian Wheat Board (AWB) identified a need for a better way to determine the protein and moisture content of the wheat it was buying from growers around Australia. AWB needed this information to determine the price it offered growers and the storage requirements for the grain. It was proposed by AWB that it make an initial purchase of 400 such spectro-analysers.

At the time, Phillip Clancy, the managing director of NIRTech had just returned from four years working with the United States company Pacific Scientific. He was well placed to develop an analyser in Australia to meet AWB's requirements.

In 1996, Phillip Clancy partnered with Cooperative Bulk Handling (CBH) in Western Australia to develop the analyser. The Australian Government's Industrial Research and Development Board assisted the project with a grant.

A prototype instrument, the Ceres 2000G, was trialled in 1998 and sales commenced in 1999. The Ceres 2000G brought new innovations to existing instruments available from other manufacturers. The prototype had virtually no moving parts. It was light weight, portable, and simple to manufacture at a much lower cost.

In 2000, NIRTech was formed to continue the development of the technology. Later that year the Cropscan 2000G analyser was launched. Like the Ceres 2000G, the Cropscan 2000G was designed for Australian conditions. NIRTech has continued to develop, manufacture and market NIR analysers. It now has seven models designed for use in the field; on the laboratory bench; in bulk handling equipment used to move grain such as pipes, augers and conveyors; and on harvestors. The instrument can be coupled with a GPS system to produce yield maps of paddocks.

The Cropscan 2000G is now NIRTech's principle revenue earner. NIRTech sells its instruments directly to users in Australia and through distributors in North America, Italy, France, United Kingdom, Eastern Europe, Asia and India. The company has sold over 380 instruments, half of which Australian farmers have purchased, and the remainder have been exported.