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 global as Trace Scientific Ltd. in 1985.

By the early 1990s 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 USA and joint equity ventures in China and Eastern Europe.

In 1998 the company was purchased by Thermo Electron, one of the worlds 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, USA and Europe, 60 percent of whom are tertiary qualified. It conducts R&D and supports a variety of external R&D projects with leading Australian universities and researchers which 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 US Food and Drug Administration and the EU *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 or beverage industry. 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.

The science industry's export strategy is aimed at increasing the volume of exports and the number of new exporters for Australia's science industry. It will achieve this by growing existing exporters and encouraging new SME exporters. To reach the export goal in the industry's vision by 2015, the industry proposes to increase the number of science industry SME exporters from the industry by a net 10 per annum. Further, the industry aims to increase the volume of exports of established exporters by 10 percent on average per annum for the next 10 years. The industry will target the US, EU, Japan and the emerging markets of China, other Asian countries, India and South America.

Science industry companies will be able to respond effectively to emerging market opportunities by using the market intelligence and other resources already available from industry and government. There is a need to ensure that the industry, and particularly relevant for SMEs and aspiring exporters, continues to take full advantage of the resources that are available.

Commonwealth, State and Territory Governments offer support for exporting. DITR, DEST, Austrade and the Victorian Government have assisted the science industry to showcase its capability at international exhibitions such as Pittcon 2005 in US. Austrade has a range of programs to develop new exporters, including partnering services to assist with in-market opportunities where Austrade resources are currently focused. The science industry has already used some of Austrade's program assistance and has suggested improvements to the Export Market Development Grants Scheme through the 2004 review of the scheme. The trade agreements that Government has and is currently negotiating enhance the business environment for export activity and present new opportunities. For example, the Australia-US Free Trade Agreement opens the government procurement market of both countries at federal and state levels.

The industry possesses a number of people who have achieved export success and who are willing to help aspiring exporters by playing the role of mentor. As part of the implementation of the action agenda, the industry will develop a mentoring program that includes exporting.

The implementation group will develop and publish a five-year export promotion plan that includes domestic and international exhibitions and other activities to showcase Australian science industry capability.

Break-through innovations such as spectrometry, spectrophotometry, genomics, proteomics and nanotechnologies lead to step changes in technology and create new commercial opportunities. To maximise these opportunities, the science industry needs to prospect the scientific equipment and the laboratory and technical services markets for unmet demand, match these demands with technologies emerging from publicly funded research organisations, and develop products and services using existing support measures available from government and industry. The industry has world-class clusters in Melbourne and Sydney that could enable companies, universities and publicly funded research organisations to leverage off one another's expertise to bring new products and services to market.

Recommendation 2

Increase the science industry's volume of exports and the number of exporters.

QUALITY IMPROVEMENT FOR PRODUCTS AND SERVICES

Profit in business comes from repeat customers, customers that boast about your project or service, and that bring friends with them.

W. Edwards Deming

Quality, along with price, support services, innovation and speed to market, is a key determinant of strategic competitive advantage. However, market needs are in constant flux and remaining at the leading edge requires companies and their suppliers to continuously improve the quality of their products, services and processes, including after-sales service.

The customer determines the quality of a product or service to meet their needs. The company that provides the product or service that not only meets but exceeds customer expectations will succeed in global markets.

Australia's scientific products supplied by the larger science companies are already globally competitive. They achieved this by understanding and applying the key determinants of product quality, namely performance, features, flexibility, durability, conformance, serviceability, aesthetics, and perceived quality.

Australia's laboratory and technical services companies are increasingly entering export markets, particularly in Asia. They are achieving this by understanding and applying the key determinants of service quality, namely timeliness, courtesy, consistency, convenience, completeness, and accuracy.

The pressure on Australia's scientific product manufacturers to conform to globally competitive quality standards is forced on them by the global markets into which they sell. This has a flow-on effect to their subsidiary component suppliers.

It is not enough to do your best; you must know what to do, and then do your best.

W. Edwards Deming

Managing quality in an outsourcing environment is particularly challenging for the original equipment manufacturer (OEM) and the component supplier alike.

In the course of raising their company's quality standards to meet global standards, Australia's scientific product manufacturers found that quality and how to achieve it in manufacturing operations is not well understood by industry practitioners. This was attributed to the lack of a quality culture in Australian industry and to a lack of its inclusion in undergraduate and vocational training.

The industry considers that a quality mindset should be an enduring aspect of industry culture. This starts with the education and training of the industry's workforce and is reinforced in the workplace.

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 has a production facility in Adelaide and is a dominant supplier to the Australian market, and it exports to Japan, US, 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 how to achieve it its manufacture of scales and balances. 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;
  - A company vision to aspire to; and
  - Improved use of information technology for communication with their parent company which uses digital image transmission of products, processes and teleconferencing.
- 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 to improve shopfloor layout, production line flow and maintain a clean and tidy production area.
- Semi-automated production line for testing and calibrating scales.
- ISO9001:2000 accreditation with regular audits by BVQI.

To become a preferred supplier to an OEM in a global supply chain, companies must adhere to a number of standards such as ISO 9000, relevant national and international standards accreditation and packaging requirements. Gaining accreditation to these standards is often expensive and time consuming. However,

the cost of not having a high quality product that complies with the relevant standards is also high. This cost arises from product recalls, returns, poor reputation and loss of customers.

Gaining quality accreditation should be seen as an investment decision. In such a framework the company can weigh up the costs and benefits of certain quality accreditations and decide which accreditations provide a net benefit.

Strategies for managing quality in the outsourced environment of a supply chain require the OEM to have strong and effective business partnerships with its suppliers, best practice quality management that is diffused throughout the supply chain and into the operations of the partners. This should enable faster and more accurate information flows and improved coordination between the supply chain partners.

Quality improvement is a commercial decision for individual companies. The implementation group has a role to increase the industry's awareness of quality and ways that companies can improve their products and services. This will enable science companies to improve their compliance with global standards.

Working with education and training providers to ensure that students receive sufficient training in quality management will be a priority of the implementation group.

The industry has developed and commenced delivering a quality awareness program aimed at providing specific information on quality issues, and how companies can develop their quality management systems. It is using various means of delivery that include a website, newsletter, industry periodic magazines, seminars and competitions. SIA conducted its 'Better Lab Design 2005 Conference' that incorporated the 'Laboratory of the Year' competition in collaboration with an industry periodical magazine. The implementation group will investigate leverage on the quality programs of other industry bodies such as the Australian Organisation of Quality.

The success of the science industry companies is testimony to the wealth of experience in the industry for improving product and service quality. Many of the people who have succeeded in improving their company's quality are willing to help companies with this need by being a mentor. As part of the implementation of the action agenda, the implementation group will develop a mentoring program that includes quality improvement.

Networking has been successful in Victoria as a means of sharing experience and the implementation group will encourage quality management to be part of a wider networking program.

Recommendation 3

Improve the quality of science industry products and services.

GETTING THE REGULATION FRAMEWORK RIGHT

"The nicest thing about standards is that there are so many of them to choose from."

Ken Olsen - founder of Digital Equipment Corporation

The science industry relies heavily on international trade. It recognises that a strong regulatory framework that can operate seamlessly with the relevant international regulations and standards is essential to preserving public trust and for trade in the industry's products and services. However, Australian science companies operate in a competitive business environment. Australia's regulatory framework, as it is currently configured, is a significant impediment to the efficient operation of the market, reducing the industry's competitiveness by imposing costs on the industry that are ultimately borne by the community.

The 2004 survey of the science industry by the Department of Industry, Tourism and Resources found that of all the issues impacting on industry, the efficiency of Australia's regulatory and certification processes and international regulatory issues were of most concern to the industry. The acceptability of Australian standards in world markets was seen as a small advantage.

Australia has a complex regulatory regime with nine jurisdictions (eight states and territories and the Commonwealth), each with its own regulations and standards that are administered by many different regulatory bodies. The Commonwealth alone has around 60 Government departments and agencies, and 40 national standard-setting bodies and Ministerial Councils that have powers to prepare or administer regulations. Another layer of complexity is added by international markets having regulations and standards different from domestic ones. These compliance costs are exacerbated by companies having to remain current with the continuously changing regulatory environment.

Much is already underway within Australia and internationally to address this impediment to the industry's growth. Government reviews regulation and assesses its impact before changes are introduced. One such measure is the Regulation Impact Statement (RIS) process. The Productivity Commission reports annually on the compliance of Australian Government bodies with RIS requirements. Work has commenced internationally under the auspices of the Globally Harmonised System for the Classification and Labelling of Chemicals.

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 Commonwealth's regulations and standards and then modified them for their own purposes. Merck must remain current with the frequent changes to the regulations and standards and have to 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.

The science industry is seeking improvements in the coordination of regulation development and administration from Government. It is also seeking the alignment of Australian regulations and standards with relevant international ones such as CE Mark, UL certification[2], US Food and Drug Administration (US FDA) and the quality standards ISO and American Standard Test Method. Of particular interest to the industry is the introduction of a harmonised national code of practice that Commonwealth, State and Territory Governments use for packaging and labelling of hazardous substances - poisons, drug precursors and therapeutic substances.

To improve the regulatory environment in Australia for the industry, the implementation group will work with government, other industry bodies and international regulatory reform initiatives. It will add the industry's weight to the shaping of regulatory reform proposals aimed at improving the coordination of regulation development and administration and alignment with international standards.

The science industry's particular concerns about domestic regulations and standards are:

- Variations in the restrictions and the way certain regulations are administered by Commonwealth, State and Territory jurisdictions. The areas of primary interest to the science industry are scheduled poisons on schedules 4 and 7, drug and explosives precursors, *in vitro* diagnostics, weights and measures uniform trade legislation, and electrical safety.
- Lack of a consistent process for formulating and implementing regulations and national codes of practice.

The industry is a significant exporter. To access export markets manufacturers must comply with product certification regulations and standards. Quality standards are embodied in these. Internationally, the significant standards are those of the European CE Mark and UL certification and the US FDA. There are indications that the European CE standard is being adopted as a global standard. The industry considered that Australia's regulations and standards should be aligned with those of Australia's major export markets. This suggests that CE should be considered to be Australia's standard.

Better coordination between jurisdictions and the harmonisation of regulations and standards with relevant international ones would improve the efficiency of regulation. This would improve the international competitiveness of the industry by reducing business input costs and improving market access.

The industry is concerned that its interests are not being canvassed in the formulation of regulations and codes of practice by the various regulatory bodies in the different jurisdictions in Australia. The process is different for different substances in each jurisdiction and this imposes costs on industry. The science industry is seeking a common and more inclusive process for the development of

[2] CE means Consultants Europe, Europe's trusted source of product compliance information.
UL means Underwriters Laboratories Inc., a trusted global source of product compliance information.

the reporting and monitoring requirements of governments on hazardous substances. Having a common process would reduce the cost to industry.

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 with 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.

Regarding the industry's involvement in regulation formulation and review processes, the industry recognises that it has a role to express its views to governments. Essential to engaging governments in this task is to have a strong case. The science industry will identify and prioritise the regulations and standards of most concern. It will also identify where Australia's regulations and standards could be aligned with relevant globally accepted standards such as the EU's CE Mark and UL certification, US Food and Drug Administration, and pharmaceutical standards.

The Chemicals and Plastics Action Agenda has some elements in common with the Science Industry Action Agenda. However, the main difference is that the science industry deals with much smaller quantities of chemicals for its laboratory-related activities as opposed to the industrial and agricultural applications of the chemicals and plastics industry. However, while the pack sizes are small, the industry sells a larger number of packs. The science industry is developing a strategic alliance with Chemical and Plastics Leadership Group which has responsibility for implementing that action agenda.

The Medical Industry Association of Australia (MIAA) has been involved in the science industry's considerations of regulation and standards issues, and it has recently commenced its action agenda on medical devices. MIAA is keen to collaborate with SIA on regulation reform and other issues of common interest.

The science industry is investigating ways to collaborate with other industry bodies that have similar interests to develop joint regulation reform proposals for intergovernmental endorsement.

While the larger companies are aware of the standards their markets require, smaller companies are less aware. The industry considered that access to accurate domestic and international information on product certification regulations and standards is essential to overcoming this information impediment to the industry's growth. SIA will investigate the feasibility of establishing links on its website that provide current information on technical standards and compliance requirements.

Recommendation 4

Progress the harmonisation of regulations and standards relevant to the science industry across Commonwealth, State and Territory Governments and align them with relevant international standards.

ADDRESSING SKILLS SHORTFALLS

The science industry is a knowledge-intensive industry that is heavily reliant on its human capital for its competitive advantages in developing and delivering high value-added world-class products and services.

Anecdotal evidence and surveys of the science industry indicate that it is experiencing skills shortfalls in two areas. It has a shortage of trained and qualified people, particularly laboratory technicians, technical trades, chemists, mechanical and software engineers, sales and management staff. The industry emphasised that its sales and management staff should have a high level of knowledge and understanding of science and the equipment that the science industry and its clients use. It also has a shortage of staff with an adequate knowledge and understanding of how to manage quality, particularly in manufacturing operations.

These shortages have the potential to adversely affect the industry's competitive advantages and ability to respond to emerging opportunities.

Factors contributing to the skills shortages

Contributing to the skills shortages are the growth in demand for skilled staff, the relatively low profile of the industry as a career, and the limited number of industry specific training courses for prospective staff.

The industry expected that the demand for skilled staff in general would grow in line with economic growth over the next three years. It expected even stronger growth in demand over the next three years for mechanical engineers, software engineers and technical trades. Driving this demand is the strong growth in domestic and export sales which the industry expects to exceed 10 percent per annum over the period.

The industry considered that it had a low profile as a potential employer and that graduates considered other careers in preference to the science industry. This could be influenced by those factors affecting the labour supply in manufacturing industry generally, namely, the trend for employees to move away from manufacturing to service industries. Exacerbating this situation is the ageing workforce and consequent loss of skilled staff.

More broadly, the manufacturers of scientific instruments found that trades and management staff do not have a well developed understanding of quality and how to achieve it in manufacturing operations. This was attributed to the lack of a 'quality culture' in Australian industry. It was also attributed to undergraduate and vocational training courses not placing sufficient emphasis on quality management in their curricula.

Increasing the supply of skills

During the course of its development, the action agenda advised the Government's National Skills Shortage Strategy (NSSS) steering committee, the board of the former National Industry Skills Initiative and the Audit of Science, Engineering and Technology Skills of the industry's specific skills shortages issues. The action agenda's implementation group will continue to monitor the skills shortfall situation and advise Government accordingly.

Improving the industry's low profile as potential employer

The industry's low profile as a potential employer contributes to the lack of skilled entrants to the industry. There are a number of aspects to this issue. The industry has a perception that students consider salary and conditions ahead of other factors in choosing a career and that the science industry is not competitive with other careers. The industry also considered that students and graduates lack an awareness of the science industry and the opportunities that it offers.

To address this impediment to graduates joining the industry, the implementation group will investigate options to raise the profile of the science industry as a career. Options include participating in initiatives such as the NSSS science careers project, Questacon, Careers Network, Local Community Partnerships and university career and open days.

Building stronger linkages between educational institutions and the industry would enable the industry to promote itself better. The implementation group will investigate options and initiate those considered appropriate. Options could include offering students placements with companies during their training possibly with a science industry-related project; the industry co-supervising post-graduate students; encouraging successful industry leaders to visit their former university faculties and schools to promote science careers; industry practitioners familiarising science teachers with their operations to raise teacher awareness and confidence in advocating the science industry; encouraging exchanges between staff in universities, research organisations and industry; and sponsoring science-related design competitions.

Improving the content of course curricula

The science industry, particularly its manufacturers of scientific goods, considers that its workforce would benefit from a greater understanding of quality management and how to achieve it in manufacturing operations. This was attributed to the lack of a quality culture in Australian industry and to its lack of emphasis in undergraduate and vocational training.

Progress has been achieved in incorporating quality management into the curricula of vocational education and training institutions. For example, the newly endorsed laboratory operators training package incorporates quality issues. The science

industry is keen to have this spread more widely including incorporation into formal engineering courses.

Commonwealth, State and Territory governments play a key role in the development and improvement of national training. The system has changed recently and now comprises training boards and skills councils. Bodies such as the NSSS Steering Committee and the Manufacturing Industry Skills Council support the development, implementation and continuous improvement of nationally recognised training products and services of interest to the science industry.

To enable the industry to have its specific curricula content needs addressed, the implementation group will establish effective linkages with the new national training system and relevant academic bodies and learned societies such as the Australian Council of Deans of Science, the Australian Council of Engineering Deans and the Australian Academy of Technological Sciences and Engineering.

Recommendation 5

Ensure that the science industry can access the necessary skilled workforce it requires for continued growth.

SUSTAINING WORKPLACE FLEXIBILITY IN THE SCIENCE INDUSTRY

The science industry comprises mainly SMEs and relatively fewer large enterprises. Its workforce is highly educated, skilled and mobile. It receives above-award wages. In many circumstances, the working conditions of science industry companies are superior to those of many in manufacturing industry. Employment security is also good. The knowledge-based industry values its staff and recognises that they are integral to the industry's long term competitiveness. The industry has high levels of investment in training and skill development, spending on average five percent of its sales on staff training. Manufacturers and product maintenance and service companies had the highest expenditure on staff training at eight percent of sales.

The science industry is globally competitive and recognises emerging domestic and international challenges.

Many employers in the industry consider that the existing workplace arrangements provide them with sufficient flexibility to manage their companies effectively and harmoniously. They are keen for this situation to continue. They also recognise that as enterprises grow this situation could change.

A diversity of workplace practices

The science industry has diverse workplace arrangements from award-based employment and informal common law contract arrangements, to workplaces where wages and conditions are determined by federal collective agreements.

This variability in arrangements suggested that employers in the science industry, especially new entrants to the industry, could benefit from a specific focus on workplace relations to both free up any existing impediments to productivity and competitiveness and to protect existing flexibilities.

Creating and preserving high performance workplaces

Research and experience suggests that the adoption of a high performance workplace employment model can contribute significantly to companies establishing and maintaining workplace arrangements that enhance their future competitiveness.

The high performance workplace employment model is productivity-centred, and can be used for collaborative and participative work systems. It favours a long-term view of business strategy and is based on the strategic integration of enterprise objectives and employee commitment and participation. It is not prescriptive in terms of a workplace relations instrument, and is suited to the science industry workplace. The adoption of this approach complements the strategic approach to

improving and maintaining the quality of enterprise products and services proposed by the action agenda.

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 also has offices in Sydney, Melbourne, Auckland, Pittsburgh (USA) 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 percent 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. Focus research and development efforts on niche markets. Ai Scientific is one of six global manufacturers of auto-samplers for inorganic analysis, and one of 14 companies that provide 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 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.

Simple strategies can be introduced to align a workplace with this workplace employment model and enhance the value of the employee's contribution to the business. These include:

- Management with clear workplace improvement objectives;
- Alignment of employer and employee objectives;

- A comprehensive workplace relations communication strategy; and
- Empowerment of employees.

Resources available to the science industry

Resources are available through industry bodies and employer organisations to assist employers to choose the workplace relations arrangement most appropriate to their stage of development and situation. Organisations like Australian Industry Group provide dedicated industrial relations services with qualified professionals. SIA has a role to monitor workplace relations developments of most significance for science industry employers, to inform its constituents and to assist them in avoiding pitfalls.

The Department of Employment and Workplace Relations' Office of Workplace Services in all states and territories provides free, personalised assistance to employees and employers about opportunities and choices in the federal workplace relations system. Further information is available on the Department's website.

State governments also offer a range of programs supporting excellence in the workplace. The Victorian Government for example offers a range of programs including the Partners at Work program and the Workplace Excellence Awards.

Successful company executives are also a valuable resource from which others can draw.

The implementation group, in collaboration with the Department of Employment and Workplace Relations, other government agencies and industry groups, will facilitate the promulgation of the high performance workplace employment model across the science industry to ensure that flexible workplace practices continue to enhance the industry's competitiveness. In doing so, the implementation group will encourage the science industry to adopt the workplace model.

Recommendation 6

Sustain flexibility in science industry workplaces.

INFORMATION AND EDUCATION

Commonwealth, State and Territory governments and industry bodies offer a wide variety of policy and program measures aimed at improving the business environment and building the capacity of companies to compete effectively in the marketplace. However, the industry's lack of awareness of these is an issue.

The action agenda process identified that a number of the impediments to the industry's growth could be reduced by encouraging companies to make better use of the information and other assistance measures that are already available from governments and industry.

During the development of the action agenda the science industry was made aware of the suite of relevant Government programs to assist the industry to improve its performance. SIA initiated action on a number of information and education measures by drawing on these resources. For example, with Austrade's assistance, SIA facilitated the participation of its members at two export development workshops. SIA developed and delivered a conference series on technology diffusion and the transfer intellectual property from research organisations to industry, and showcasing of Australian science industry capability at a series of Australian conference exhibitions and at the international exhibition Pittcon 2005 in US. SIA routinely uses its newsletter and its website to promote events and resources of assistance to the industry.

The implementation group will expand on SIA's information and education program by leveraging off existing information and education resources from industry bodies and government. It will also encourage companies in the science industry to make greater use of government programs.

The case study on NIR Technology Australia below demonstrates how an SME in the science industry used government programs to successfully build its business.

The industry has members with a highly successful track record and who have a strong desire to share their experience with others as a mentor. Mentoring is a very effective means of transferring expertise from those who have it to those who would benefit from it. It can provide one-on-one support aligned with the needs of individual company executives. Mentoring complements packaged courses and information already available. Government support is available for mentoring through, for example, the Commercialising Emerging Technologies program. Some larger industry associations can assist smaller industry associations with activities like mentoring.

Networking is an alternative to mentoring. It provides companies with opportunities to share best-practice, market intelligence and other useful information. It can also involve linking companies with research organisations. Informal networking is already occurring in Victoria amongst some science companies.

The implementation group will develop a mentoring and networking program.

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 NIR 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 that 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 had just returned from four years experience working with the US company Pacific Scientific, and was well placed to develop an analyser in Australia to meet AWB's requirements.

In 1996 Phillip 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, UK, 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.

Recommendation 7

Increase the science industry's use of assistance measures available from government and industry.

INDUSTRY STATISTICS

Comprehensive, reliable and current statistics and information on the industry's structure and economic performance are essential to progress the action agenda and monitor its progress.

Research showed that Australian Bureau of Statistics recorded statistics on the industry in its Australian and New Zealand Standard Industry Classification (ANZSIC) system. This was complemented by statistics and information available through IBISWorld. IBISWorld uses ABS statistics complemented by other information sources.

The five principal ANZSIC classes that record the activities of science companies are:

- C2839 Professional and scientific equipment manufacturing n.e.c.;
- F4612 Professional equipment wholesaling;
- L7829 Technical services n.e.c.;
- O8631 Pathology services; and
- L7810 Scientific research.

While the activities of some enterprises do not fit the definition of the science industry, it was possible to identify the largest of these and remove them from the aggregate figure. For example, Australian Bureau of Meteorology in the class L7829 Technical services n.e.c. was not considered to be in the science industry.

The aggregate statistics and information provided by IBISWorld was checked against the knowledge of industry leaders.

The Strategic Industry Leaders Group required more detailed information on the industry's structure, sales, exports, imports, products and services, markets, customers, business confidence, business environment issues, workforce, and research and development that was not available from publicly available statistics and information on the industry. To obtain this information, the Department of Industry, Tourism and Resources conducted a survey in July/August 2004 with the necessary approval of the Government's Statistical Clearing House. The results of the survey are summarised in this report and described in more detail in a separate report. This work forms the basis for future surveys of the industry.

The implementation group will continue this work to maintain a current set of statistics and information on the industry.

Recommendation 8

Maintain a set of key economic statistics on the science industry.

IMPLEMENTING THE ACTION AGENDA AND IMPROVING INDUSTRY LINKAGES

"Things don't change; we change."

Henry David Thoreau

The Science Industry Action Agenda requires the formation of a body that will be responsible for implementing the recommendations in this report and achieving the industry's 10 year vision. Strengthening the industry's internal and external linkages will be essential to this. The implementation group will be led by Science Industry Australia Inc. (SIA), the industry association sponsoring this action agenda. SIA will draw on the industry's stakeholders, such as those that have been involved in the development of the action agenda. These stakeholders could form the new industry peak body. SIA will also provide the secretariat services to the implementation group.

The implementation group requires support from a number of committees and an industry-led secretariat. The committee structure could reflect the action agenda's priorities, namely R&D commercialisation; regulatory reform; export market development; and improving the industry's workforce, though this will need to be settled by the implementation group. The secretariat will need to be adequately resourced for its task.

The science industry, as defined by the action agenda, comprises manufacturers of scientific equipment, importer/distributors of scientific equipment, laboratory and technical service companies and researchers. Scientific equipment and laboratory-related goods are the common element that links these groupings.

There are over 5 000 companies and other enterprises in the industry. These include manufacturers, importer/distributors, laboratory and technical services providers and researchers involved with laboratory technologies. Around two hundred of these are manufacturing companies and 250 are importer/distributors. There are more than 3 000 laboratory and technical services companies. Researchers are mainly those involved in public sector research and education. The industry has many small and medium-sized enterprises (SMEs) and fewer larger enterprises. The small enterprises employ less than 10 employees and have a turnover of less than $50 million. The larger enterprises are either multinational companies (MNCs) or subsidiaries of MNCs.

Individually, these four industry segments are performing very well, though they have operated essentially independently of one another. This fragmentation places limits on the coordination of activities in the science industry supply and value chains and it is an impediment to the industry's growth. For the industry to throw off this constraint and grow as an entity it should develop its own identity and a unity of purpose. A more united industry will be better able to represent the interests of its members, coordinate its activities, influence its business environment, develop the capacity of its members, seize opportunities and create its own future.

In so doing, the industry will be better able to satisfy consumer demand along its supply chain in a timely, flexible and comprehensive way.

While the manufacturers and importer/distributors are well represented by SIA, there is no industry representative body for laboratory and technical services companies. SIA's constitution embraces laboratory and technical services companies. The action agenda is aiming to increase the number of laboratory and technical services providers and researchers that identify themselves with the industry and increase their participation in the SIA.

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.

Representing the science industry's interests to government, industry and other relevant parties are essential to progress the action agenda. As well as the more routine representation activities, the science industry could seek to have representation on relevant Commonwealth, State and Territory government boards and committees e.g. the R&D Board and relevant Major National Research Facilities committees.

A critical activity of the action agenda will be to collaborate with like-minded industry bodies and other groups to coordinate those activities that share common outcomes such as improving the commercialisation of Australian public research and regulatory reform.

The action agenda has already built a number of strategic alliances and partnerships during its development. AiGroup, Medical Industry Association of Australia, Royal

Australian Chemical Institute, National Measurement Institute and the Victorian Government were represented on the action agenda's leadership and working groups.

SIA is collaborating with Knowledge Commercialisation Australasia on science industry commercialisation initiatives. SIA has also opened dialog with the Australian Institute of Commercialisation, the Plastics and Chemicals Institute of Australia, and the New South Wales and Queensland Governments with a view to developing strategic alliances to progress the implementation of the action agenda.

The other industry associations and bodies with common interests include AusBiotech, Australasian Institute for Mining and Metallurgy, Australian Electrical and Electronics Manufacturers Association, Therapeutic Goods Administration (to become Trans-Tasman Therapeutic Products Agency), Medicines Australia, National Association of Testing Authorities, Joint Accreditation Australia and New Zealand, Standards Australia, Australian Institute of Export, Australian Venture Capital Association, environmental protection authorities.

An annual science industry conference would provide a forum for bringing together the industry's stakeholders and other relevant groups. It would enable the industry to network, reaffirm its values, build cohesion, and identify emerging issues and strategies for addressing them. Recognising significant achievements would be an important part of this event.

Recommendation 9

Implement the Science Industry Action Agenda and improve the industry's internal and external linkages.

Achievements during action agenda development

Industry and government have been proactive in addressing issues as they have arisen during the action agenda's development.

To address the shortage of current economic statistics and information on Australia's science industry, the SILG asked the Department of Industry, Tourism and Resources (DITR) to conduct an industry survey in July/August 2004. The Education, Training and Work Practices Working Group also conducted a small survey to scope the workforce issues.

Austrade and the Victorian Government are represented on the Market Development Working Group. Science industry companies attended Austrade's *Trade Start* workshops in June 2004. Victoria provides funding to the science industry for SIA's market development manager. SIA has opened dialog with all state and territory governments and the indications by these governments are that they are supportive of the industry.

The SIAA has advised Government of the appropriateness of its new policy proposals and policy settings. It put submissions to Parliamentary inquiries on innovation and the harmonisation of legal systems on trade and commerce. It put submissions to DITR on the Commercial Ready Program, the Industry Cooperative Innovation Program, the Joint China-Australia Free Trade Agreement Feasibility Study, and the experimental use of patented inventions. It put a submission to the National Health and Medical Research Council on the new code for conducting research. It put submissions to DEST on the International Science Linkages Program; and to Austrade's review of the Export Market Development Grants Scheme.

The involvement of CSIRO in the action agenda enhanced communication between industry and the researcher, which assisted with promulgating CSIRO's new streamlined contracting processes. This will improve SME access to CSIRO and reduced the administrative costs of doing business with CSIRO.

The SIAA advised the National Industry Skills Initiative Board in May 2004, the National Skills Shortages Steering Committee and the Audit of Science, Engineering and Technology Skills in November 2004 on skills and training issues. Skill shortfalls are in laboratory technicians, technical trades, chemists, mechanical and software engineers, sales and management.

To address potential information gaps in industry's knowledge of government assistance, particularly the assistance for R&D and its commercialisation and for exporting, the action agenda provided the industry with a summary of all relevant Commonwealth, State and Territory government industry programs. The leaders group and the working groups acclaimed the usefulness of this resource.

SIA, under its 'Laboratory Week 2005' branding, promoted a five event series in Melbourne in April 2005. The events were 'Science 2005 Exhibition and Seminar

Series', 'Better Lab Design 2005 Conference', 'Future Materials for Life Sciences 2005 Conference', 'Accelerating Biomedical Discovery Mini Symposium', and 'Lab Technology Diffusion and Commercialisation Symposium'. The latter event was the first of six similar symposia being held in six capital cities around Australia concluding in Perth in early October 2005. SIA and "What's New" magazine's 'Laboratory of the Year' competition was concluded during Laboratory Week 2005.

SIA also facilitated the marketing of the industry's products at Australian conferences and exhibitions in 2004-05 and at the international conference/exhibition Pittcon 2005 in US. SIA managed the Australian exhibit and enabled 22 Australian science companies and research organisations to exhibit products, technologies and processes.

DITR, DEST, Austrade and the Victorian Government supported different aspects of these activities through their programs.

As it is intended, the action agenda process provided the players in the industry and government with an excellent vehicle to collaborate with one another to identify and agree on the initiatives that would overcome the impediments to the industry's future growth. This has created a firm foundation on which to unite the industry and strengthen its internal and external linkages. In so doing it enables the industry to be more effective in realising its future growth potential.

Evaluating the action agenda's progress

The implementation of the recommendations, strategies and actions agreed between the industry and the Government is the critical phase of the action agenda. Typically, the implementation phase will take three years from the time of the action agenda's launch. However, this can vary depending on the industry and the nature of the recommendations proposed.

To ensure that implementation proceeds to plan and the action agenda has the greatest opportunity of success, the Government requires the implementation group to provide the Minister with an annual report. This offers the industry an opportunity to meet with the Minister to discuss achievements, outcomes and impediments. It also provides the Minister the opportunity to announce major achievements of the action agenda. Furthermore, the Government evaluates each action agenda as it approaches the conclusion of its implementation.

To assess progress against all the action agenda's vision statement, recommendations, strategies and actions a set of performance indicators is required. Performance indicators should be relevant to the action agenda; indicative of the whole value chain; easily collected; accurate; timely; and easy to assess and interpret.

Three key issues to be considered in measuring the performance of the action agenda are appropriateness, effectiveness and efficiency.

Appropriateness refers to a need identified by the Strategic Industry Leadership Group to achieve the action agenda's desired outcomes, and for which there is a strong causal link between the recommendations, strategies and actions and the outcomes.

Effectiveness is the extent to which the action agenda's outputs make positive contributions to achieving particular outcomes.

Efficiency is the extent to which inputs are minimised for a given level of outputs, or outputs are maximised for the given level of inputs.

Action agendas are industry-led and the Government is primarily concerned with the outcomes achieved by the action agenda in developing the industry and overcoming impediments to its growth. Consequently, performance indicators for appropriateness and effectiveness are more relevant to evaluating the action agenda than efficiency.

Performance indicators can be quantitative or qualitative. Quantitative performance indicators being numerical are generally easier to measure. Qualitative performance indicators being descriptive in nature are generally more difficult to measure. However, they are valuable in assessing the 'ambience' of the industry.

The implementation group will develop a set of performance indicators to assist it to manage the implementation process and with the preparation of the annual report for the Minister.

Appendix 1: Members of the working groups

R&D commercialisation working group

Mr Peter Dawes (Chair)
Managing Director
SGE International Pty Ltd

Professor Mark Baker (Vice-Chair)
Chief Executive Officer
Australian Proteome Analysis Facility

Mr Paul Field
Director, Biobusiness
ATP Innovations Pty Ltd
(February 2004 - September 2004)

Mr Phillip Clancy
Managing Director
NIR Technology Australia

Ms Vicki Tutungi
Deputy Chief Commercial
CSIRO Manufacturing & Infrastructure Technology

Mr John Pulsford
R&D Director
Varian Australia Pty Ltd

Mr Simon Calder
Senior Economist
Australian Industry Group

Professor Mary O'Kane
Director
Sienna Capital Limited

Mr Rob Cook
Chief Technical Officer
DSTC Pty Ltd

Mr Tony Bigum
Chief Executive Officer
Thermo Electron Corporation

Mr Steve Irwin
General Manager
Science &Technology Policy
Department of Education, Science and Training

Market development working group

Mr Greg Davis (Chair)
Formerly Managing Director
Varian Australia Pty Ltd

Mr Tony Bigum (Vice Chair)
Chief Executive Officer
Thermo Electron Corporation

Mr Max Arbrew
Managing Director
Laboratory Systems Group

Ms Pamela Danby
Market Development Manager
Science Industry Australia Inc. (Victoria)

Mr Clive Davenport
Chief Executive Officer
Cooperative Research Centre for Microtechnology

Dr Fred Davis
Manager - Instrument Design and Development
Invetech Operations Pty Ltd

Mr Stephen Pronk
Managing Director
Ai Scientific Pty Ltd

Mr Roger James
Manager - Scientific
Office of Manufacturing
Department of Innovation, Industry and Regional Development

Dr Laurie Besley
Director
National Analytical Reference Laboratory
National Measurement Institute

Mr Lino Strangis
Manager, International Market Liaison
Government, Industry and Policy Group
Austrade

Mr Leigh Wilmott
Senior Business Development Manager
Biotechnology/Health
Austrade

Distribution and services working group

Mr Tony van Staveren (Chair)
Managing Director
Eppendorf South Pacific

Mr Alan Lawrenson (Vice Chair)
Executive Director
Science Industry Australia Inc.

Mr Sam Bastounas
General Manager
Nuplex Specialty Products
Nuplex Industries (Aust) Pty Ltd

Mr Ray Doyle
Group General Manager
Amdel Limited
(February 2004 - June 2004)

Dr Jim Gonis
Managing Director
PerkinElmer Life and Analytical Sciences

Dr Peter Harman
Managing Director
Australian Laboratory Services Pty Ltd

Mr John Hewetson
General Manager
Shimadzu Scientific Instruments
(Oceania) Pty Ltd

Mr Tony Tait
Managing Director
Crown Scientific Pty Ltd

Mr Rod Minett
National Sales Manager
Agilent Technologies Australia Pty Ltd

Mr Mark Impey
Support Delivery Manager
Agilent Technologies Australia Pty Ltd

Mr Peter Sommers
Managing Director
Merck Pty. Limited
(August 2004 - December 2004)

Ms Roswitha Gail-Eller
Division Manager
Merck Pty Limited
(April 2004 - July 2004)

Dr Terry Spencer
Australian Government Analyst
National Measurement Institute

Dr M Neil Galbraith
Former Board Chair
Royal Australian Chemical Institute

Mr Rob McKeon
General Manager
Department of Industry, Tourism and
Resources

Education, training and work practices working group

Mr Michael Ohanessian (Chair)
Managing Director
Vision BioSystems Limited

Ms Vonda Fenwick (Vice-Chair)
Manager Manufacturing Operations
GBC Scientific Equipment Pty Ltd
(February 2004 - November 2004)

Mr Tom Armstrong
Managing Director
A&D Mercury Pty Ltd

Mr Chris Thomson
Principal
HWL Consulting

Mr Graham Thurston
Manager Business Development
Science Faculty
Monash University

Mr Peter Sommers
Managing Director
Merck Pty. Limited

Ms Pamela Danby
Market Development Manager
Science Industry Australia Inc. (Victoria)

Ms Mary Johnston
General Manager
Industry Training
Department of Education, Science and Training

Mr Roger James
Manager - Scientific
Office of Manufacturing
Department of Innovation, Industry and Regional Development

Ms Karen Whittingham
Director Business Development
North Sydney Institute
TAFE NSW

Ms Diane Merryfull
General Manager
Industries
Department of Employment and Workplace Relations

Mr Stuart Weston
Manager
Industries
Department of Employment and Workplace Relations

Ms Gillie Kirk
Manager
Vocational Education & Training Group
Department of Education, Science and Training

Ms Karen Cavanagh
Manager
Training and Development
Vision BioSystems

Appendix 2: Glossary

Bio-informatics The application of computer technology to the management of biological information. Specifically, it is the science of developing computer databases and algorithms to facilitate and expedite biological research, particularly in genomics.

Biomedical research The study into the branch of medical science that applies biological and physiological principles to clinical practice

Biosensors Special glasses or bracelets containing electrodes that monitor a muscle's electrical activity.

Biotechnology A set of biological techniques developed through basic research and now applied to research and product development. In particular, biotechnology refers to the use by industry of recombinant DNA, cell fusion, and new bioprocessing techniques.

Centrifuge A device that spins a sample around a central axis at a high rate of speed that creates a centrifugal force. It is used to separate mixtures of suspended material.

Chromatograph An apparatus for analysing mixtures of compounds by separating them into individual components which can be identified by colour or other means.

Genomics The study of the sequence, structure, and function of the genome.

Incubator An incubator is a device which maintains controlled environmental conditions, especially used for providing warmth and dryness. Some incubators are specifically designed for cultivating cell cultures and bacteria in Petri dishes.

Informatics The study of the application of computer and statistical techniques to the management of information. In genome projects, informatics includes the development of methods to search databases quickly, to analyse DNA sequence information, and to predict protein sequence and structure from DNA sequence data.

Micro-fluidics Study of motion of fluids at a micro-scale. Micro-fluidic systems can be used for a variety of applications including drug dispensing, ink-jet printing and general transport of liquid, gases and their mixtures.

Nanotechnology The application of science to developing new materials and processes by manipulating molecular and atomic particles.

Pathology The study of disease processes with the aim of understanding their nature and causes. This is achieved by observing samples of blood, urine, faeces, and diseased tissue obtained from the living patient or from an autopsy, by the use of X-rays and by many other techniques.

Proteomics The study of the structure and function of proteins.

Reagents The chemical agents, dyes, indicators or titrants used in testing various aspects of water quality.

Spectrometer the instrument connected to a telescope that separates the light signals into different wavelengths, producing a spectrum.

Spectrophotometer An instrument used to measure the amount of light reflected from a specimen when illuminated by a controlled light source. This measurement generates a spectral curve (fingerprint) of a product, which can be used in the numerical identification and the calculation of colour difference between samples.

Appendix 3: Acronyms

AIC Australian Institute of Commercialisation

AVCAL Australian Venture Capital Association Limited

COMET Commercialising Emerging Technologies

CRC Cooperative Research Centre

CSIRO Commonwealth Scientific and Industrial Research Organisation

DEST Department of Education, Science and Training

DITR Department of Industry, Tourism and Resources

FDA Food and Drug Administration

GDP Gross domestic product

IP Intellectual property

KCA Knowledge Commercialisation Australasia

MNCs Multinational companies

PACIA Plastic and Chemicals Industry Association

R&D Research and development

RIS Regulation impact statement

SIA Science Industry Australia Inc.

SILG Strategic Industry Leaders Group

SMEs Small and medium-sized enterprises

SWOT Analysis Strengths, weakness, opportunities and threats analysis