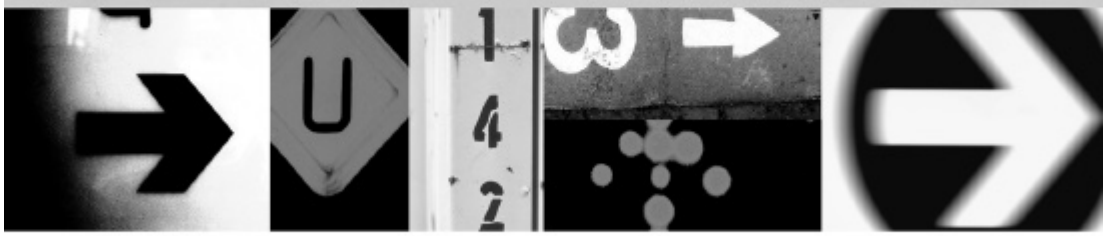
The Medical and Scientific Equipment Industry In Victoria

Audit Report

MAY 2002

strategic audit of victorian industry



State Government Victoria

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Finally, I am grateful for the active interest and support that The Honourable Rob Hulls, Minister for Manufacturing Industry and his staff have given to the Audit Team throughout the Audit process.

Tony John
Project Coordinator
Strategic Audit Team

1. Executive Summary

The medical and scientific equipment industry is a specialised part of the manufacturing industry. Governments everywhere have a direct influence on demand as major users of equipment in health care, education and research and development.

The Victorian industry sector is highly innovative and very export orientated. Medical and scientific equipment produce ranges from simple moulded sample bottles to complex devices such as mass spectrometers and laser surgical instruments.

In Victoria the market is valued at $1.2 billion, production is at $470 million - 30 % of the Australian total. Almost 90 % of production is exported. The industry has 2,700 employees in the State, mostly professionals or highly skilled technicians. The industry's research and development spending rate is eight times that of all manufacturing and its rate of exports is five times that of all manufacturing.

The industry sector globally, in Australia and in Victoria is broadly comprised of two sub-segments, medical equipment and scientific equipment. There is some degree of overlap in markets and many firms manufacture for both segments. However there are some significant differences. The medical equipment market is highly concentrated in the health care, medical, surgical, hospital, first aid and special and aged care marketplace. Scientific equipment is sold into that market as well but also covers many other areas such as the education, research, biotechnology, mining, defence and petrochemical sectors, and most of the rest of manufacturing industries.

This report considers the present status and circumstances of the medical and scientific equipment industry in the State of Victoria. The report analyses the characteristics, trends and performance of each of the two segments and addresses the key issues and challenges they each have. Many of the issues are common but there are some discrete differences.

Manufacture of Medical and Scientific equipment in Victoria and Australia has grown significantly over the last five years, at 18% and 14% respectively. Growth in local manufacture has outstripped growth in the domestic market, as a whole, when imports are included.

Victoria is a national leader in the Scientific segment and is also growing strongly in medical equipment.

Similar to the rest of the world the industry sector is comprised of a large number of small and medium sized firms with a few large multi-national enterprises. In Victoria in the medical segment the larger firms are nearly all overseas owned. However in the scientific segment in Victoria there are some locally owned firms operating globally.

The future prospects for medical equipment in the domestic market primarily depend on government purchasing practices within the health industry. Major issues are lack of global scale manufacturing and the need for increased Government strategies and support to improve domestic market access.

With one of the chief characteristics of the global medical equipment market being the large and increasingly wide range of products needed, there are opportunities to develop specialised products and exploit market niches in the global marketplace. Rising prosperity and ageing populations provide increased opportunities for sales growth for medical equipment manufacturers.

For the scientific equipment segment the export and import replacement challenges are the keys to further development in the segment. Global market growth prospects continue to appear excellent. This is almost entirely due to the combined factors of the continuing search for quality, faster and more productive manufacturing and improvements in analysis, verification and diagnostic processes in all fields of industry, science, medicine and research.

For scientific equipment there are several market areas that appear to have the strongest opportunities. The global biomedical research and development sectors, the environmental control and research and the commercial and personal security and surveillance industries are continuing strong growth. The food and beverage industries require increasingly capable equipment to ensure compliance with increasingly stringent regulations and for development of improved products.

Other areas that have strong long-term prospects are the fields of micro-fluidics and biosensors, array-based diagnostics, photonic devices, surface science, pathology detection and monitoring equipment, image processing, genomic detection instruments, and bio-informatics. Victoria's recent decision to invest in a synchrotron facility could provide a tremendous advantage in developing new leading edge products provided the linkages, clustering and coordination by all stakeholders is carefully developed.

The industry would benefit from combined overseas marketing of Victoria's complementary strengths of medical research, health and education and associated manufacturing capabilities in key overseas markets

The comprehensive consultation and investigation processes carried out during this audit has revealed a number of key issues. The team has found that there is a lack of a shared vision and effective communication between the sector stakeholders as a whole and within each segment and between the segments. This has been a main contributor to the problems in the industry. The other issues relate to product commercialisation, regulations, exports and import replacement, education and training and industry image.

The recommendations of this report concentrate on the issues of improving stakeholder cooperation and communication and on creating forums to develop solutions to the problems inhibiting the rate of growth in the industry. Most of these recommendations require a combination of industry and Government action.

2. Summary of Key Issues and Recommendations

There are six key issues that are of prime importance to the MSEI.

- Co-ordination and cooperation within the industry
- Product commercialisation and access to finance
- Market regulations and standards
- The challenge of imports and access to overseas markets
- Industry dissatisfaction with the quality and direction of education and training
- The poor image of the manufacturing sector and science as a career

The following summaries of recommendations to Government are grouped under the sub-headings of the relevant issues. Support for these recommendations in context are contained in *Section 7 - Key Issues and Challenges.*

Industry Coordination

R1. Establish and/or enhance appropriate industry associations to coordinate and represent the interests of the sectors of the MSEI and to work with the Government to implement the recommendations of this strategic audit.

R2. Assess the benefits of extending the government's overseas agencies in key global centres to facilitate technology and market intelligence acquisition for new areas of biomedical and bioscience equipment development.

R3. Government and the MSEI to promote market and technology awareness and improve time to market performance.

R4. Government and the MSEI to improve linkages between research agencies and the industry to develop and enhance coordination. This could include the development of an interactive WEB site listing manufacturer capabilities, suppliers and the research programs being undertaken by research institutions.

R5. The MSEI to work with industry associations to improve supply chain performance.

Commercialisation and Finance

R6. Government and the MSEI to promote existing commercialisation assistance programs.

R7. Government to review its programs to reduce compliance costs to the MSEI.

R8. Government to assess availability of seed capital supply relative to the current and prospective needs of industry and the need for a more seamless provision of funding through each of the commercialisation stages.

R9. Government and the MSEI to investigate with the venture capital industry the need and the availability of retired executives of successful high technology firms to mentor venture capital providers.

Regulation and Standards

R10. The Government and the MSEI should work together to improve the equity of regulations and standards pertaining to local manufacturers supplying the Australian medical equipment market to:
- improve their effectiveness
- maximise harmonisation
- minimise burdens.

Exports and Import Replacement

R11. The MSEI and Government to ensure that short term marketing courses relevant to the MSEI are available.

R12. The Government to assist in identifying international opportunities using the resources of the international Victorian Government bases, especially in the United States and EU markets.

R13. The Government and the MSEI to jointly develop an export strategy including consideration of the most appropriate form of export assistance.

R14. The MSEI should work with the ISO to develop an import replacement strategy.

R15. Industry, with Government, to:
- Promote to hospitals the economic benefits of buying local product
- Improve hospital awareness of products and capabilities

Education, Training and Emerging Technologies

R16. The Government, the MSEI and the research institutions to jointly develop strategies to improve technology awareness and diffusion throughout the MSEI.

R17. Consideration should be given by the MSEI for a comprehensive skills audit of the industry.

R18. The Government to determine how Diploma of Education course work should be extended to incorporate key aspects of commercial and entrepreneurial training.

R19. The Government to investigate how under-graduate and post graduate engineering and science courses need to be supplemented with a commercial component that provides students with a basic understanding of entrepreneurship and important aspects of establishing and operating small “high tech” businesses.

R20. The MSEI and Government to assess and prepare the case for the benefits of living and working in Victoria and then investigate recruitment of expatriates to fill emerging new positions in the MSEI.

Image of Manufacturing and Science as a Career

R21. The MSEI and Government to improve and promote the image of manufacturing industry in Victoria in general and the MSEI in particular.

R22. The MSEI and Government to establish formal "school to industry" links where MSEI executives undertake regular campus visits to promote career prospects within the industry.

3. Objective of the Strategic Audit and the Process

The Victorian Government is in the process of developing a long-term strategic approach to industry development in the State. This began with the stated recognition of the importance of the manufacturing industry to Victoria's economic wellbeing.

The Government committed to a strategic audit of Victorian industry to identify current business needs and to determine long term strategies needed to realise the growth potential, job creation and future focus of Victorian industry.

The Department of Industry, Innovation and Regional Development is implementing the commitment in respect of a number of key industries in the State. The medical and scientific equipment industry is one such key industry and was selected because of its outstanding export performance and its significant growth potential. The industry has clearly been entrepreneurial and competitive and has strong links to the demands of the health care industry and the research and development requirements of industries as diverse as minerals, biotechnology, agriculture, education and food production.

The focus of this audit has been on determining the status of the industry sector and assessing what strategies may be enhanced, adopted or renewed to create stronger growth.

A prime objective of the medical and scientific equipment industry strategic audit has been to elaborate a clear vision, together with the industry, of what actions are required to support further growth within the industry sector.

Each stage of the audit process was conducted in close consultation with industry stakeholders. This included designers, manufacturers, consultants, technical service providers, industry bodies, education and training providers and government industry specialists. The major stages of the audit process included:

- an initial assessment of the key issues currently facing the medical and scientific equipment industry;
- industry stakeholder feedback on these issues and industry stakeholder assessment of the challenges and opportunities the industry faces;
- workshops to identify and substantiate industry data;
- in-depth interviews with industry stakeholders;
- identification of future opportunities for industry growth; and
- the preparation of the final audit report, overseen by an industry working group, which provides the basis for the development of an industry development plan. The Industry Working Group members were as follows: Mr Charles Wurf (Science Industry Australia), Mr Chris Thompson (Australian Medical Solutions), Mr Mark Verschuur (Fairmont Medical), Mr Jim Grindlay (Surgi Supplies International), Mr Andrew Tame (Varian Australia), Mr Richard Tantau (Athlegen), Mr Roger James (DIIRD).

The audit team has distilled the key issues from the considerable input provided from the industry stakeholders.

4. Industry Sector Overview

4.1. Industry Definition

The Medical and Scientific Equipment Industry (MSEI), for the purpose of this Audit is defined as the designers and manufacturers of products or components within Victoria for use in medical and scientific processes in any marketplace.

Much of the MSEI is defined by two groups of Australian and New Zealand Specialised Industry Codes (ANZSIC). ANZSIC 2832 is Medical and Surgical Equipment Manufacturing consisting of units mainly engaged in manufacturing medical, surgical or dental equipment, including dentures. ANZSIC 2839 is Professional and Scientific Equipment Manufacturing consisting of units mainly engaged in manufacturing measuring, drafting, meteorological, surveying or other professional or scientific instruments or equipment or watches, clocks or other timing instruments. The ABS statistics for these two groups are used to broadly characterise and quantify the size and scope of the MSEI.

ANZSIC 2839 and 2832 codes include non-manufacturing activities such as importing or distributing activities. The Productivity Commission report (1996) suggests that few companies in the industry rely solely on manufacturing of medical and scientific equipment.[1] The majority of companies in the industry are involved in more than one product activity.

The ANZIC codes do not necessarily encompass all products produced that are specifically designed for medical and scientific uses so the ABS data has been interpreted by the audit team as indicative information.

For the purposes of the audit Medical Equipment includes:

Equipment

Surgical instruments and appliances, implants, infection control products, hospital supplies, equipment for sterilisation, anaesthesia, critical care, resuscitation, diagnostics, first aid, electro-medical, x-ray procedures, radiotherapy, nuclear medicine, dental and orthodontic, syringes, respirators, veterinary instruments, operating theatre, ward, obstetric, physiotherapy and orthotic, patient aids, special rehabilitation, and also wheelchairs, baths, trolleys, beds and hygiene equipment.

Consumables

Hospital supplies, bandages, dressings, surgical tapes, wipes, gases, catheters, first aid items, gloves, syringes, dental moulds, and incontinence products.

For Scientific Equipment the list includes:

Instruments and equipment

Analysers, autoclaves, balances, baths, bio-separation equipment, sample collection equipment, cabinets, centrifuges, chromatography, data loggers, detectors, filtration equipment, fume cupboards, hoods, extractors, furnaces, gauges, generators, incubators, liquid handling equipment, microscopes, ovens,

[1] Industry Commission, *Medical and Scientific Equipment Industries*, 1996, Report No. 56, p. 21.

pumps, spectrometers, vacuum equipment, measuring instruments, clinical diagnostics, laboratory equipment.

Consumables

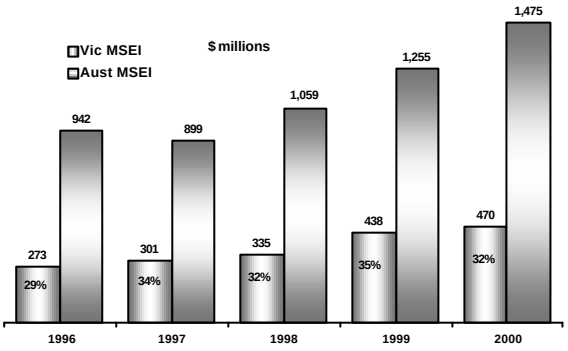
Acids, chemicals, gas, laboratory glass, paper, safety, plastic and other consumable supplies, markers, reagents

4.2. Industry Outline

The Australian medical and scientific equipment industry sector is highly innovative and also very export orientated. The sector has a highly skilled workforce. Its research and development spending rate is eight times that of all manufacturing. The rate of exports is five times that of all manufacturing.[2]

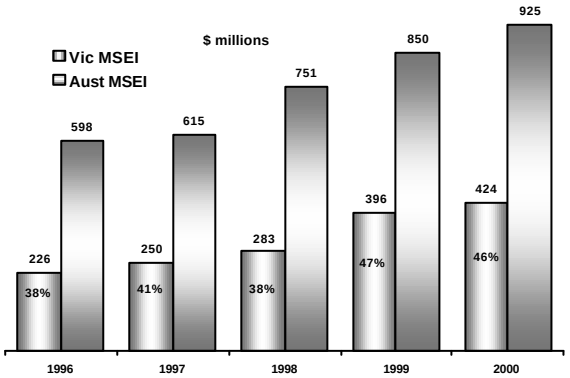
The total Victorian production of medical and scientific equipment contributed $470 million to GDP in 2000 and was 32% of total Australian production of almost $1.5 billion for the same period. *(See Chart 1).*

Chart 1 – Industry Production - Victoria and Total Australia [3]



The exports of Victorian production in the same period reached $424 million. This was 46% of all exports of domestic production from Australia. *(See Chart 2).*

Chart 2 – Exports – Victoria and Total Australia [4]



[2] Commonwealth Government Industry Commission Report No. 56, 1996, p. XVI

[3] ABS Statistics Ref. Table 1 Appendix A

[4] Statistics source ABS and Industry

The MSEI directly employs 2,700 people in Victoria and over the past three years has achieved an average annual employment growth of over 8%, one of the highest of any individual manufacturing industry sector in the Sate.

The two sub-segments of the industry, medical equipment and scientific equipment have many issues in common. Although the segments differ in character and complexity, it is common to find companies in the industry that manufacture and supply to both segments. The MSEI sees the two segments as very different for several reasons. The audit team has accordingly addressed the segments separately regarding characteristics, trends and performance in Sections 5 and 6 of this report.

The impact of product regulatory requirements is much greater on the medical equipment segment. The medical equipment market is more easily defined under the broad headings of medical, surgical, hospital, first aid and health care equipment. The scientific equipment market is much more diverse. It includes almost every field of research, manufacture, testing, measurement, calibration and recording. So there is some degree of market overlap of the segments. Medical research equipment and diagnostic apparatus are two examples of scientific equipment that are sold into the same marketplace as medical equipment. What is more common to both segments is the high level of education of the workforce and the large extent of high value added manufacture performed.

There are many stakeholders with a vital role in the future development of the MSEI. These include manufacturers, suppliers, service providers, researchers, financiers, educators, consumers and governments. The audit identifies the important issues of all the stakeholders.

4.3. Industry Size and Economic Importance

The total Australian medical and scientific equipment market is just over $4.0 billion.

The Victorian market is almost $1.2 billion, 30% of the Australian market.

At $470 million the total production of the Victorian MSEI, although tiny globally, has a value of almost 40% of the value of the Victorian market. The Australian and Victorian markets are characterised by the high reliance on imports. Annual growth of Australian production is estimated at an average rate of 8.1%.[5] The industry is clearly focussed on continuing dynamic growth in production for exports for which there is great potential. The Victorian MSEI is also keen to improve its local sales performance.

4.3.1. The Global Industry

The total annual global market for medical and scientific equipment is estimated at about $420 billion[6].

[5] Source IBIS Business Information (April 2000)

[6] Based on data from AdvaMed (Advanced Medical Technology Association) USA and SIA (Science Industry Australia).

Overall, the world's production and consumption is dominated by the major economies of the USA, the EU and Japan.

Of the total global market of US$170 billion for medical equipment in 2000, the United States accounts for approximately 40%, the EU 20% and Japan 15%.[7]

The estimated global market for scientific equipment is around US$50 billion.[8] The United States accounts for over 50%, the EU and Japan together account for over 30% of global production and consumption of scientific equipment.

A few very large multinational companies dominate the global market. The industry's top thirty global companies account for around 80% of sales worldwide. The balance of the industry is made up a large number of SME's in developed countries.

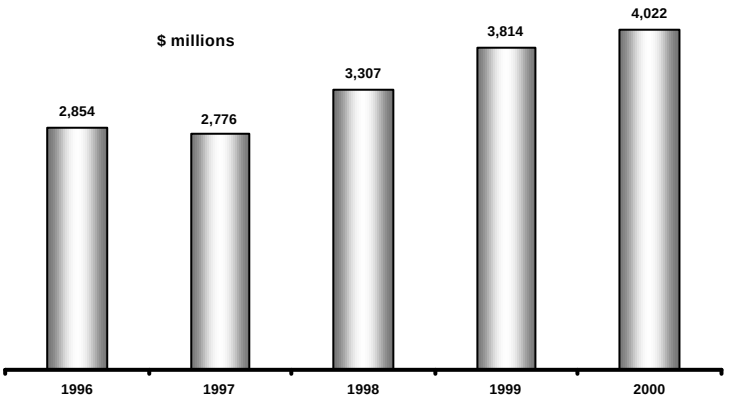
4.3.2. The Australian Industry

The main market drivers in the medical and scientific equipment segments are government and private spending on health services, medical and scientific research and the development of new technologies. The biotechnology sector is now a key and emerging source of demand.

In Australia the majority of producers are small companies. Most of the local demand is supplied by imports and the great bulk of local production is exported.

The value of the total Australian medical and scientific equipment market in the year ending June 30, 2000 was estimated to be approximately $4 billion.[9]

Chart 3 – Value of Australian Market for whole of MSEI



The MSEI has several international companies operating in Victoria with most of the major players being fully owned by overseas parents. The high level of import penetration in the domestic market has been influenced partially by external factors like exchange rates - but mostly by the comparatively small-scale size of the domestic

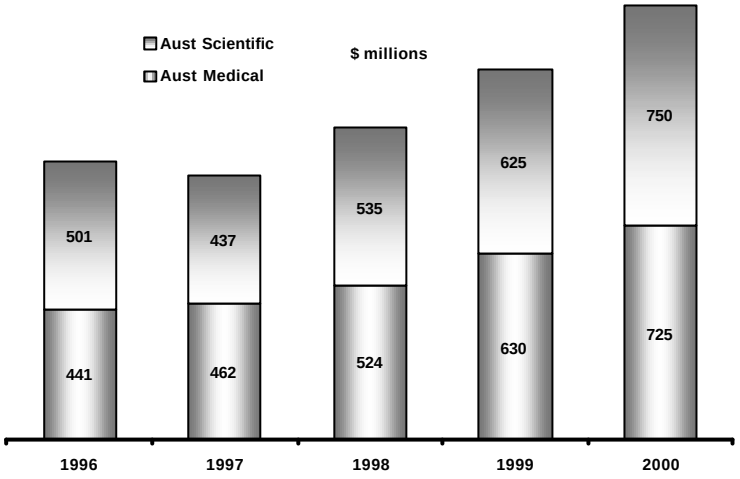
[7] Based on data from AdvaMed (Advanced Medical Technology Association) USA 9/5/2001

[8] Data on the total global scientific equipment and instrument industry is lacking except for analytical instruments. The estimated global market of US$50bn is based on estimates from the Science Industry Australia.

[9] This estimate is based on ABS data and import statistics for ANZSIC class 2832 & 2839.

market. This makes it difficult to justify the capital investment costs of start–up in product areas already catered for by imports from global suppliers. A crucial factor for the competitiveness of the MSEI is access to funds and incentives for research and development to generate new niche products for import replacement and export sales.

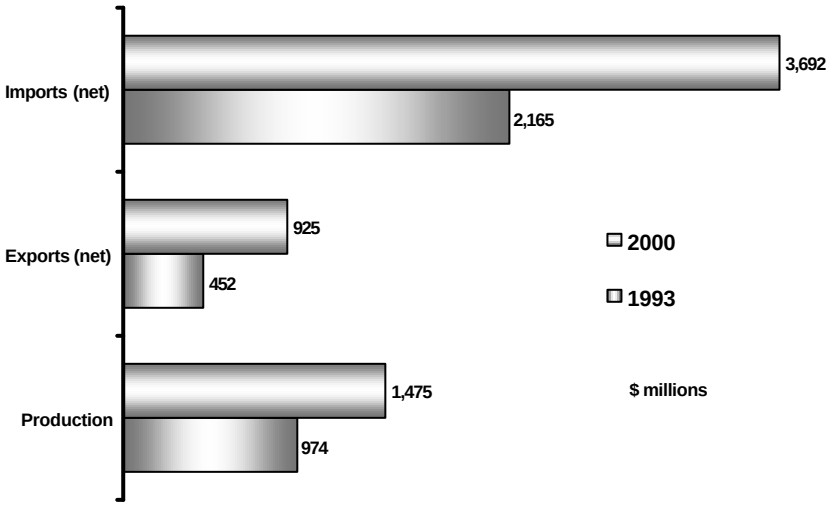
Chart 4 – Production – All Australia per Segment – Medical/Scientific Equipment



Total imports of medical and scientific equipment were almost $3.7 billion in 2000 of which over $500 million was re-exported. Imports represent the majority of the Australian market with about $550 million supplied from local production.[10]

Chart 5 below shows the changes in imports, exports and local production from 1992/93 to 1999/00 for the whole of Australia.

Chart 5 - Total Australian MSE Industry – Change from 1993 to 2000 [11]
(Note: Import and Export figures are net and do not include imports re-exported)



The MSEI employs almost 9,000 people nationally[12] and almost all employees are full-time and about half of the workforce has tertiary qualifications. Employment levels

[10] Based on estimates made by the Industry Commission in Report No 56 " Medical and Scientific Equipment Industries" December 1996, updated with information from industry sector company interviews.

[11] Source of statistics from ABS and industry sector estimates.

have been variable across the nation during the early 1990's. There have been almost static levels of employment nationally since 1996, but in Victoria there have been increases of more than 5% per annum. This contrasts against slower growth in several of the other states.

Industry information and statistical data indicate that the Australian market for scientific equipment is significantly larger than it is for medical equipment. This differs from the global scene that indicates the reverse situation. Details of each segment's performance and other issues are dealt with in more detail in the following pages. However some of the national figures showing differences in the segments are worth noting here.

In 2000, imports of scientific equipment consumed domestically were estimated at $2.27 billion. This compares with around $1.7 billion in 1995, an increase of 33% over five years. In the same period imports of medical equipment totalled just over $1.4 billion compared with $780 million in 1995, an increase of 82%.[13]

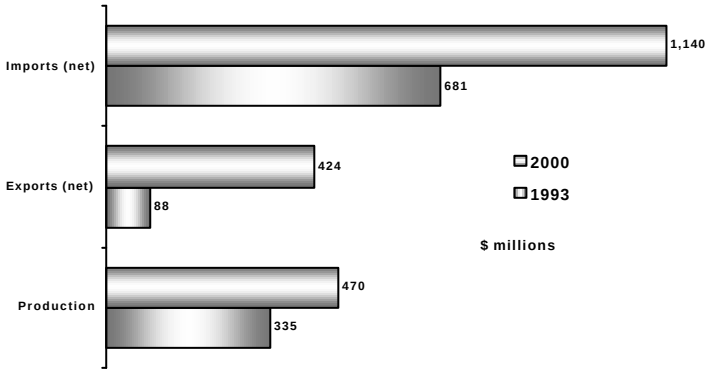
Exports of Australian produced scientific equipment have increased from $286 million in 1995 to $540 million in 2000, an increase of 89% over the period. In the same period exports of medical equipment totalled just over $385 million compared with $225 million in 1995, an increase of 71%.[14]

4.3.3. The Victorian Industry

The MSEI in Victoria is vigorous, particularly in the performance of the scientific equipment segment. Both segments have shown remarkable enterprise over the 90's by significantly increasing exports despite the enormous advantages of scale in some products of the major producers in North America, Europe and Japan.

Chart 6 depicts the changes in imports, exports and local production for the fiscal years 1993 and 2000. The figures are not conclusive in showing the size of the State's market as the actual consumption may take place elsewhere in Australia.

Chart 6 – Victorian MSEI – Comparisons of 1993 to 2000 [15]



[12] Source of statistics from ABS.
[13] Source of statistics from ABS and industry sector estimates.
[14] Source of statistics from ABS and industry sector estimates.
[15] Source ABS Statistics – Ref Table Appendix A

There has been a remarkable growth in exports from 1993 to 2000. This growth has been offset by decline in the proportion of domestic sales. There has been a switch from local supply to exports.

Exports of medical and scientific equipment produced from Victoria in 2000 were at $424 million compared with $88 million in 1993 and $226 million in 1996. This was made up of the medical equipment sector exporting $21 million in 1993 and $90 million in 2000, and the scientific equipment sector exporting $67 million in 1993 and $334 million in 2000.

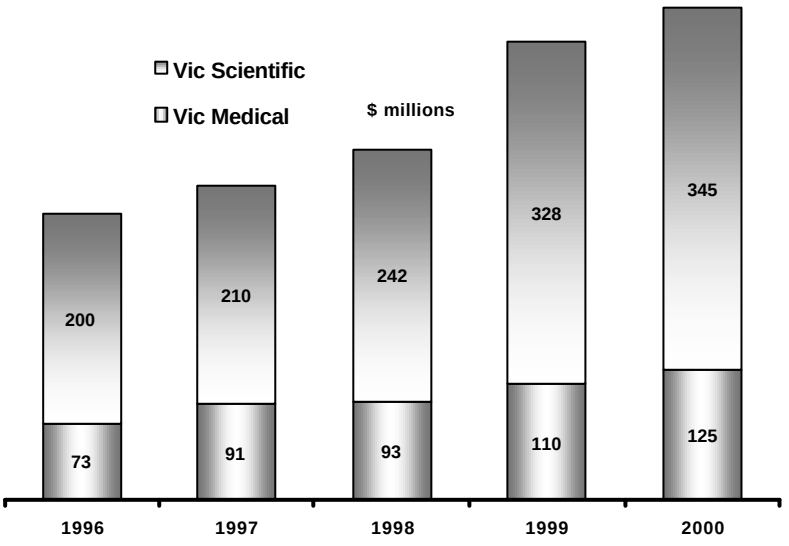
Changes in State preference in local purchasing practices by major customers have been the major effect on the decline in domestic sales levels.

Contrasting strongly with local market demand drivers the prime driver of the growth of the Victorian medical and scientific equipment industry over the past seven years has been global demand for niche products.

Chart 7 shows Victorian MSEI production per segment from 1996 to 2000. Each segment has increased production output value over the period by more than 70%.

The proportion of each segment has remained basically the same over the period with the larger scientific equipment production at 74% and medical equipment production at about 26% of the total.

Chart 7 – Production - Victorian MSEI - by Segment 1996 to 2000



The Victorian MSEI in 1999 employed approximately 2,700 people, 30% of the total Australian industry employment. Chart 1 (see page 10) showed the Victorian proportion of the total Australian industry production value in 1999 at 35%.

Note that the employment figures shown in the following charts indicate a considerable improvement in productivity over the period when compared with the changes in production value (refer to Chart 7) over the same period.

Chart 8 –Employment Totals - Victoria/Australia

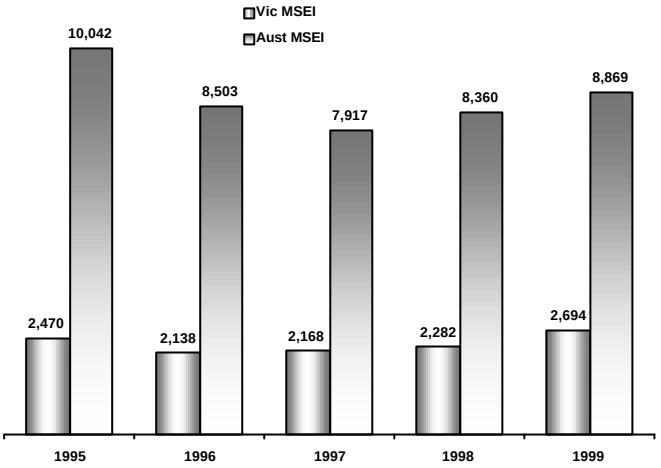
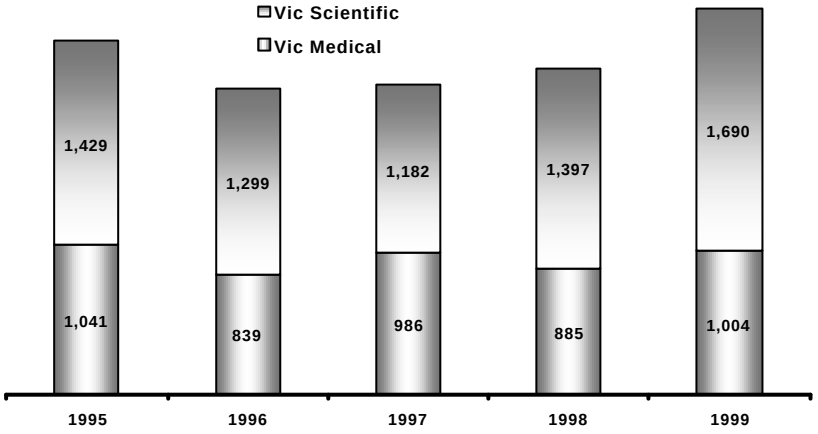


Chart 9 – Employment per Segment - Victoria



Brief Summary

The Victorian MSEI sector:

- is a high growth industry
- supplies a low proportion of the Victorian and Australian markets
- is a successful overseas market niche supplier
- is very competitive internationally
- could be a larger domestic supplier

The following sections outline the characteristics, market trends, performance analysis and prospects for each of the segments of medical equipment and scientific equipment.

5. Medical Equipment Segment

5.1. Medical Equipment Segment Characteristics

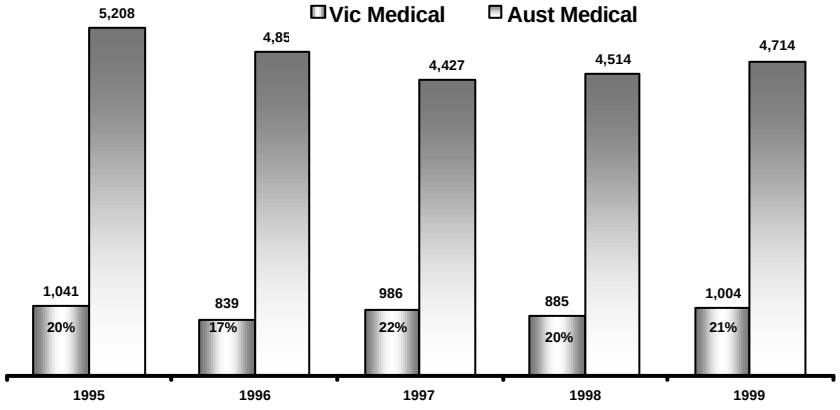
Worldwide the ME segment spends a greater proportion of its sales revenue on research and development than does the rest of the manufacturing sectors overall and commonly represents about 7% of sales revenue. Research and development is extremely important to the medical equipment industry as the main means of taking advantage of new technology and reducing the risk of being overtaken by technology changes. In the United States, not only do medical equipment manufacturers outlay a higher proportion of their turnover on research and development than other manufacturing sectors generally but also a higher proportion of their turnover is devoted to research and development than other designated high technology industries. Global trade remains constrained by non-tariff barriers. This is more evident in Japan and some other Asian countries but also in the United States.

One of the important characteristics of the global medical equipment market is the wide range of products needed with clearly differentiated capabilities and capacities. There are unpredictable and continuous changes required in technology. There is also the risk that changes in new technology can render an existing product obsolete in a very short space of time.

Another important common feature of the medical and scientific equipment and instrument industry, both in Australia and globally, is the characteristic that many companies produce for both the medical equipment market and the scientific equipment market. The Australian medical equipment market is well developed and has a similar wide range of products to those that exist in other developed economies. More than 80% of imports into Victoria originate from the three major producing areas, the United States, the European Union and Japan.

Victoria is not maintaining its share of national employment and production in the industry despite the State's highly respected medical research base. Production has fallen from 16% in 1993 to 13% in 1999 and employment has hovered at much the same level for the past five years.

Chart 10 - Employment - Medical Equipment segment – Victoria & Australia



A strongly held industry view of Victoria's declining share of medical equipment output is that the commercialisation process which should be exploiting the State's undoubtedly strong medical research base needs to become more effective than it has been in the past decade. The recent formation of the Technology Commercialisation Program Network should be further publicised and encouraged to provide the much needed coalescing of the diverse range of commercialisation services that are available in Victoria.

5.2. Market Trends – Medical Equipment Segment

Increasing and ageing population together with increasing prosperity indicate that the medical equipment markets in developing countries, although small by comparison with the West, will grow more rapidly relative to the developed economy markets. The markets for the majority of medical equipment in developed economies is more mature and may tend in the future to be constrained by their governments' fiscal curbs particularly in the important area of health spending. However the ageing population will continue to further propel growth.

Over the 1990's Australian consumption of medical equipment and instruments and consumables rose at an average annual rate of 12% and the scope to further sustain strong growth remains viable. As with much of the industry globally, this appears to be due mainly to an ageing population and more sophisticated demand for products and services being continuously evolved.

The investment in medical research continues to increase, as does the growth of the biotechnology industry.

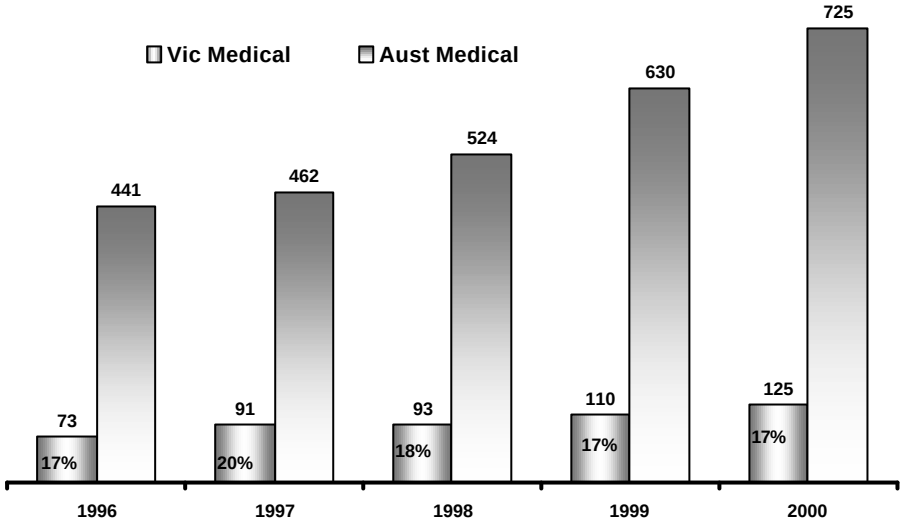
Public and private hospital medical equipment and consumable needs are a prime driver of industry sales and represent the majority of company turnover. In these circumstances, hospital purchasing practices and public sector budgets for health spending will continue to have important effects on the development of the industry in Victoria and Australia.

The data shown in Chart 6 clearly indicates that import growth trends have been faster than domestic production and exports in the medical equipment segment, especially in Victoria.

5.3. Performance Analysis – Medical Equipment Segment

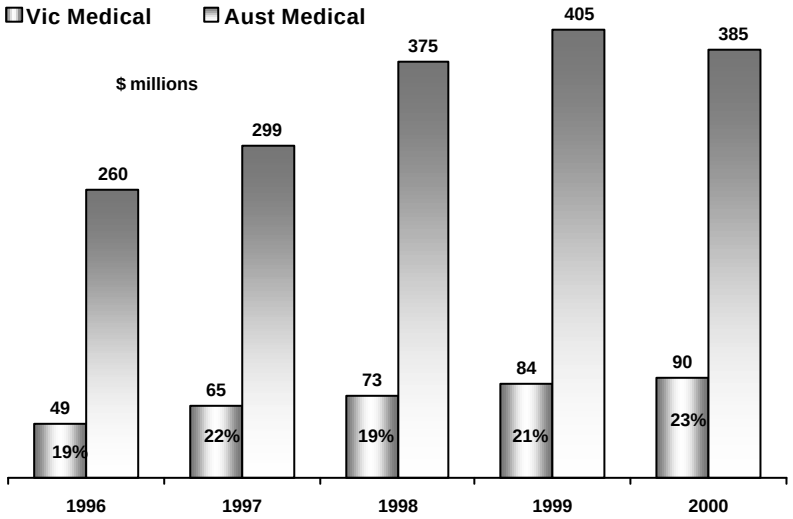
Between 1993 and 2000 national imports increased by 90%. Over the same period, local production rose approximately 70%, an average of 10% per annum.

Chart 11 – Production - Medical Equipment segment – Victoria and Australia



The value of Victorian medical equipment production grew by 47% over the past seven years compared with 68% growth in the national output. The value of medical equipment manufacture in Victoria, the sum of local production for the local market and exports, was $99 million in 2000 compared with $73 million in 1993. This is an increase of 36%. This compares with an increase of 70% for the national market. Although this is equivalent to an average annual growth of around 8.5% per annum, it is from a low base and could be encouraged to grow at a much faster rate. Victoria's share of national turnover since 1993 has also declined from 17 % to 13.5% in 2000.

Chart 12 – Exports - Medical Equipment segment – Victoria and Australia



National exports of medical equipment in 2000 were $385 million, a very high proportion of the value of local production. Over 60% of exports are directed to the Asian region.

5.4. Prospects - Medical Equipment Segment

The prospects for medical equipment segment in the domestic market primarily depend on government purchasing practices within the health industry.[16] Most of the domestic market is supplied from imports. The opportunity for import replacement has significant scope. However the prospects of being able to enter the competitive arena on a broad front to win work currently supplied by importers depends on surmounting a number of quite arduous hurdles. The major stumbling block is a lack of global scale manufacturing and there is a need for further development of adequate business and Government strategies to enable improved access to the marketplace. The VIPP and new hospital purchasing incentives for local supplied equipment are key strategies available to Victoria to assist in import replacement.

With one of the chief characteristics of the global medical equipment market being the large and increasingly wide range of products needed, there is significant opportunity for small firms to develop specialised products and exploit market niches in the global marketplace. There are hundreds of products, many with their own differentiated markets often in the annual value range of anything up to $5 billion globally.

The industry requires being agile in the marketplace and must operate to meet short product life cycles. The unpredictable but continuous changes in technology keep offering further opportunities to develop new products. However, there is the risk that changes in new technology can render an existing product obsolete in a short space of time. The industry must therefore be prepared for such events by having a reasonable range of products being developed in the pipeline. This also means utilising state-of-the-art design technologies, rapid prototyping, rapid tooling and trialing technologies, data management and efficient usage and control of intellectual property.

More prosperous and ageing populations provide increased opportunities for sales growth for medical equipment manufacturers.

The equipping and maintaining of hospitals, special care and age care facilities provides opportunities in particular market sectors where customers demand groups, packages or systems of products servicing specific medical requirements. These are products that are more than just components or specific instruments but may be complete systems for specific applications that can be marketed as a system or group and serviced as such.

Brief Summary

The Victorian Medical Equipment Segment has:

- many SMEs
- low share of national production
- all Australian Governments as its major purchasers
- good opportunities in the fast growing global marketplace
- significant niche market export success
- strong future import replacement prospects in local markets
- high levels of R & D
- excellent biotechnology prospects

[16] IBIS, Business Information, *C2832Medical and Surgical Equipment manufacturing*, Vol 7, April 2000.

6. Scientific Equipment Segment

6.1. Industry Characteristics – Scientific Equipment segment

The global market for scientific equipment also covers a very wide range of products. There are strong similarities between the global market for scientific equipment and medical equipment, with rapidly growing demand for more capability and specific high reliability equipment.

Substantial research and development expenditure is imperative to companies remaining viable in the long run for both the medical and scientific equipment segments and there is a strong dependence on R&D assistance programs for most companies in the industry, both globally and in Australia. Access to start-up funding is of critical importance.

The ever-present threat of sudden changes in technology force companies to be highly innovative and R&D expenditure as a percent of Victorian industry turnover is very high – in the order of 7 up to 15% of production turnover. This compares very favourably with manufacturing overall. Globally the research and development expenditure is around 9 % of turnover. Indeed, the proportion of sales spent on research and development for the scientific equipment segment is even higher than it is for the medical equipment segment.

The competitive stance taken by companies can vary. Some produce a wide range of products, others are more focused while some firms are very specialised manufacturers.

Most scientific equipment is substantial in value, is produced in relatively low volume and is readily airfreighted throughout the world. Access to the highest quality international airport infrastructure is a necessity for the industry. Currently Melbourne's facilities are sufficient but must continuously be improved to sustain a competitive supply chain.

Despite moves to freer trade in the past five years, various forms of tariff and non-tariff barriers still exist in the United States, China, Thailand and Korea. Almost 50% of global production is traded globally and the industry, both internationally and in Australia, is very integrated into and dependent on international trade. Australia's barriers are basically only the Customs duties of 3.0% on a minor proportion of the equipment variety with all other equipment at zero tariffs.

Within Australia at present the most important drivers of the scientific equipment segment is government policy toward research and development in particular, and government purchases. The Scientific Industry Association estimates that about 60% of demand for scientific equipment in Australia emanate from Australian and State Government funded agencies and research institutes.

The Australian scientific equipment segment appears well integrated into the global economy and is almost entirely reliant on exports for growth.

The structure of the scientific equipment segment in Australia is similar to the structure of the industry globally, where most firms employ less than ten people. In Australia, over 75% of firms have less than 10 employees.

There are three important employment characteristics in the scientific equipment segment:

- 50% are professionally qualified, high-income earning employees.
- The majority of employment is full time.
- The segment produces high value-added products and employs a direct workforce represented by semi-skilled employees in manufacturing operations.

6.2. Market Trends – Scientific Equipment segment

Globally, the segment experienced a slower growth phase in the first half of the 1990's owing to reduced economic growth in the major world economies. However, a recovery has occurred during the past three years reflecting a number of factors including stronger global economic activity, the opening up of the China market and increased allocations of public funds towards research & development initiatives.

The fastest global growth is expected from the non-traditional markets in Asia and South America.

The growth in Australian imports of scientific equipment and instruments, although larger in aggregate value than for medical equipment, has not increased at the same rate of growth as the medical equipment segment over the 1990's.

It would appear that over the past fifteen years there has been a progressive increase in long term growth trends in the Australian scientific equipment segment of the MSEI. In the period 1987 to 1995 for example, average annual growth in production was 5%, while in the period 1995 to 2000 average annual production growth has increased to 6%, and this includes a severe short term slump between 1995 and 1997. Also assisting growth has been a stronger level of economic activity both in Australia and overseas from 1997 to 2000 compared with the first half of the decade.

Since 1993, imports have increased by 70%. Close to 75% of all imports come from the United States, EU and Japan.

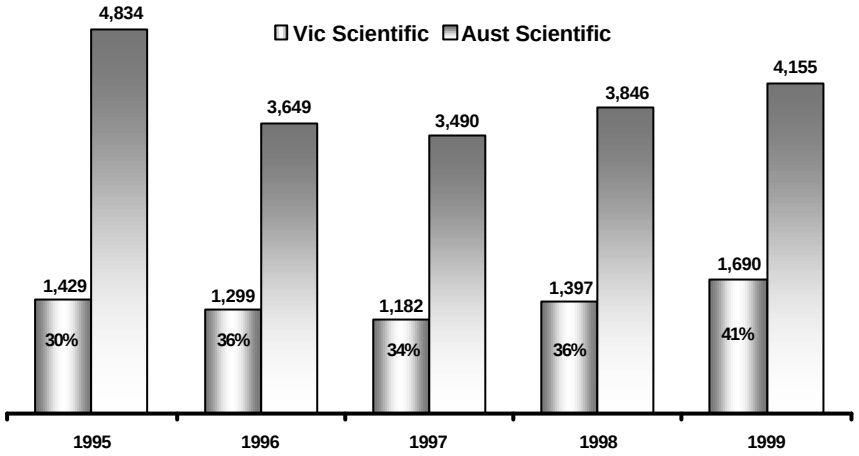
6.3. Performance Analysis – Scientific Equipment segment

While the Australian industry growth has not be spectacular over the past ten years overall, there has been a more decisive recovery since 1997 that in part reflects the increased policy emphasis and expenditure by all governments in Australia on research and development and on health.

Nationally the industry growth has been concentrated in Victoria in the past four years. The value of domestic production has increased by over 110%. This has largely been directed towards exports.

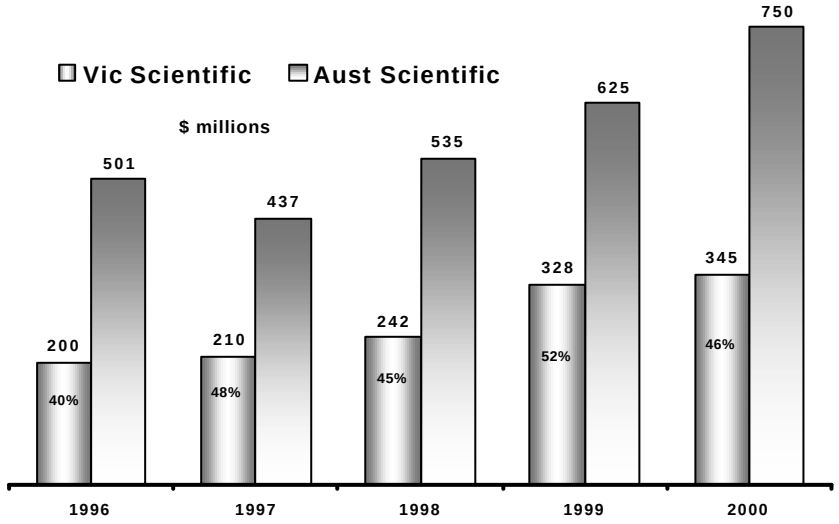
This longer-term trend masks two different sub-periods in employment trends. Between the years 1993 and 1997 employment in the industry fell 28% from 1,652 to 1,192. Since then employment has increased quite firmly.

Chart 13 - Employment - Scientific Equipment segment – Victoria & Australia



This pattern in Victorian employment growth is consistent with national trends for the scientific equipment segment. It reflects similar factors such as the recovery in economic activity, both nationally and globally, in the second half of the 1990's and an increased government commitment to research and development which has such a direct impact on knowledge intensive industries such as the MSE. Victoria has increased its share of national employment in the scientific equipment segment of the MSE Industry from 30% in 1995 to 41% in 1999.

Chart 14 – Production - Scientific Equipment segment — Victoria & Australia

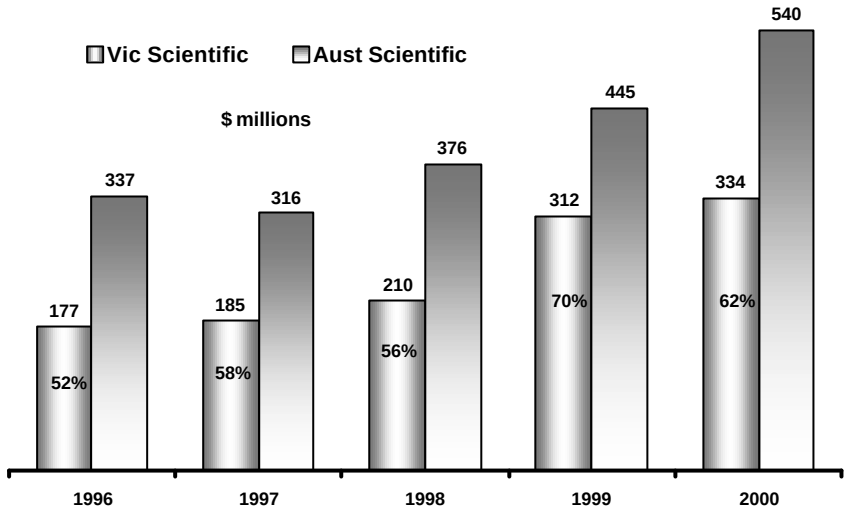


The value of output from the Victorian industry segment was $200 million in 1996 with an increase to $345 million in 2000. Victoria's share of national output having risen from 40% in 1996 to 46% in 2000 indicates that scientific equipment manufacture in Australia is definitely becoming more highly concentrated in Victoria.

The export success of the Victorian segment is very evident when the figures for Victoria are seen in the national context. The State has increased its export sales for

each of the past nine years from $67 million to $334 million. In doing so it has also steadily increased its national share from 22% in 1993 to 62% in 2000.

Chart 15 – Exports - Scientific Equipment Segment - Victoria & Australia



6.4. Prospects - Scientific Equipment segment

The export and import replacement challenges are the keys to further development in the segment. Global market growth prospects continue to appear excellent. This is almost entirely due to the combined factors of the continuing search for quality, faster and more productive manufacturing and improvements in analysis, verification and diagnostic processes in all fields of industry, science, medicine and research.

Significantly, those factors that influence the prospects for the medical equipment segment also prevail to a large extent for the scientific equipment segment as well. Influencing factors such as ageing population, advancing education, and improving economies and prosperity and the low Australian dollar. For the segment though a significant factor has to be the increasing expenditures in research and development.

For scientific equipment there are several market areas that appear to have the strongest opportunities. The rapidly growing global Biomedical Research and Development sectors constantly seek new developments in scientific equipment. Community attitudes and situations have seen the rise of the Environmental Control and Research and the Commercial and Personal Security Industries and have spawned a whole range of needs that are continuing strong growth. The Product and Process Quality Control sector, especially in the Food and Beverage Industries requires increasingly capable equipment to ensure compliance with increasingly complex regulations and for development of improved products. Other areas with growing needs include the Education sector, the Agricultural sector, the Defence Supply sector and the Oil and Mining sectors. All are gaining in further sophistication and have continuing strong need for scientific equipment. Both domestic and global markets can provide local firms with new opportunities.

Other areas of development that are even stronger prospects in the longer term are the newer fields of micro and nano technologies, micro-fluidics and biosensors.

Microtechnology is seen to be a new way of designing and manufacturing cost-effective instruments and equipment for the biotechnology industry. Products already produced include biochips, microchemical reactors and environmental sensors.

There are also the fields such as array-based diagnostics, photonic devices, surface science, pathology detection and monitoring equipment, image processing, genomic detection instruments, and bio-informatics.

Victoria's investment in the proposed new synchrotron could provide the scientific equipment segment with a tremendous advantage in developing new leading edge products provided the linkages, clustering and coordination by all stakeholders is carefully developed.

Several factors are at work in favour of finding and developing greater market opportunities. Global buyers rely heavily on the Internet for purchasing and Australian and Victorian manufacturers must ensure they are well placed to use e-commerce as an imperative to selling high-value products capable of being airfreighted globally. The industry can also receive promotion in key offshore markets from combined overseas marketing of Victoria's complementary strengths of medical research, health and education and associated manufacturing capabilities.

Brief Summary

The Victorian Scientific Equipment Segment has:

- 46% of national production
- a strong niche export market focus
- several large, well established firms
- high levels of research and development
- a highly skilled workforce
- an increasing need for more professionals and skilled people
- excellent opportunities in many fields including biotechnology

7. Key Issues And Challenges

The total MSEI has much inherent strength and many successful firms exporting. However there is the need for much more coordination within the industry's infrastructure and supply chain for the industry to develop into a significant global supplier and to be capable of retaining in Australia the intellectual property so often lost to overseas manufacturers.

The industry concerns raised and developed during the workshops and particularly during the many interviews with stakeholders carried out by the audit team have been listed under six basic key issues:

- Co-ordination and cooperation within the industry
- Product commercialisation and access to finance
- Market regulations and standards
- The challenge of imports and access to overseas markets
- Industry dissatisfaction with the quality and direction of education and training
- The poor image of the manufacturing sector and science as a career

The challenges put forward at this time are to find the best strategies and actions required assisting in the resolution of the issues. The recommendations and suggested actions relevant to each sub-section of the issues are stated in *italic* inside text boxes.

7.1. Industry Coordination

The MSEI has a large number of stakeholders - manufacturers, design and testing services, research institutes, investors, distributors, suppliers, unions, education and training providers and governments. As a sector it is perceived to be lacking an overall industry vision, a strategic industry policy and an effective means of coordination of its activities. There are two existing national associations that represent many of the companies in the MSEI, the Medical Industry Association of Australia (MIAA) and Science Industry Australia (SIA). These two bodies represent suppliers of imported equipment and local manufacturers and have memberships also covering servicing firms and consultants, etc. The majority of membership is made up of vendors importing and servicing, and a much smaller contingent of local manufacturers designing, manufacturing and servicing. Both associations appear to lack the resources to fully tackle the issues and information needs of the manufacturers in each segment and both would have difficulty representing the whole of MSEI manufacturers due to the significant differences in the segment activities. Neither receives much support funding from governments, relying on industry subscriptions and being sustained mainly by the larger member firms.

During the January 2001 MSEI Forum several industry representatives commented that there was a strong need for a unifying support function which coordinates the activities of the industry's stakeholders in addressing key industry issues. There is a need to improve the interface between manufacturing companies in the MSEI and the State Government on many issues and effective industry representative bodies would assist in this regard.

The MSEI is very keen to have regular formal discussions with Government on issues of strategic importance to the industry and industry associations would be well placed to facilitate this important process. Many of the SME's in the medical equipment segment in Victoria feel they need an industry association that will represent the manufacturing segment. One alternative is the creation of a regional section of the existing national body that is more directly representing the manufacturing sector in Victoria.

The future direction of the MSEI will increasingly require a strategic and multi disciplinary approach with more attention given to coordinating the development of mutual understanding and cooperation between engineering, science, marketing, financial accommodation and government.

R1.	*Establish and/or enhance appropriate industry associations to coordinate and represent the interests of the sectors of the MSEI and to work with the Government to implement the recommendations of this strategic industry audit.*

The identification and adoption of new technology in the MSEI requires the use of first class market intelligence. As referred to previously, there are a number of firms in the Victorian scientific equipment industry that are now basically dependent on a technology focus that is in the slow end of the market. These firms will need to diversify their product and market ranges and will benefit from a well- connected global marketing network. An alternative way of delivering needed market intelligence to firms in the MSEI and other strategic industries involved in bio medical and science technologies would be for the Victorian Government to establish overseas offices in key global centres of excellence for these technologies.

R2.	*Assess the benefits of extending the government's overseas agencies in key global centres to facilitate technology and market intelligence acquisition for new areas of biomedical and bioscience equipment development.*
R3.	*Government and MSEI to promote market and technology awareness and improve time to market performance*

All manufacturers interviewed by the Audit Team expressed a strong desire to forge closer links with research institutes. At present there are no formal links between researchers and manufacturers in the MSEI sector. Equipment manufacturers are concerned that opportunities to develop new products emanating from research are being lost. In all major global MSEI clusters, such as Boston and San Diego in the United States, there are close bonds between major medical and scientific research bodies and equipment manufacturers.

There are many advantages from improving the interface between the researcher community in Victoria and local MSEI manufacturers. A more developed and mutual understanding between research institutes and local manufacturers of their respective research and manufacturing capabilities will facilitate both the research and manufacturing capabilities of the MSEI overall. In many instances joint research would

enhance the prospects for commercialisation by accessing the experience, greater financial resources and global networks of local manufacturers. Closer links between research institutes and industry will improve the mobility between researchers and industry. This is a common practice in the United States. Increased mobility will also enhance the career image of science and provide greater job security and improved promotion prospects for scientists and redress the loss of talented researchers leaving Australia attracted by the perception of superior career paths overseas.

Increased cooperation and participation on research between institutes and manufacturers is therefore extremely important. It will focus further the development of the industry by increasing the prospects of commercialising research and improving career paths for researchers. Manufacturers need to strengthen and maintain their understanding of the capabilities of research institutes and institutes need greater awareness of both the research and manufacturing capabilities of local MSE manufacturers. In particular, institutes need to know how manufacturers are able to assist in the commercialisation of their research.

R4.	*Government and MSEI to improve linkages between research agencies and the industry to develop and enhance coordination. This could include the development of an interactive industry WEB site that lists manufacturer capabilities, suppliers and the research programs being undertaken by research institutions.*

Many leading medical and scientific equipment manufacturers expressed concerns during interviews by the audit team regarding experiences of inadequate quality of supplies from the packaging, fabrication and precision engineering industries. The difficulty in obtaining quality inputs has required a number of MSEI manufacturers to integrate into their own workplace the operations of fabrication, machining, painting and packaging.

Successful marketing of scientific and medical equipment relies heavily on the quality of packaging for medical, scientific and testing equipment. The quality or appearance of packaging can greatly influence the user's impression about the quality of the equipment or components enclosed.

The industry also relies on the materials fabrication and precision engineering industries in the development phase to produce models, prototypes, engineering samples and tooling. The abilities and timing of these supplier resources can be critical factors in the success of the product development process.

In many cases the problem appears to be either one of scale (there are few suppliers who can meet the requirements of the industry) or one of inadequate communication regarding the problems. In respect to the precision engineering industry, the problems appear mainly to relate to the intermittent load and small scale of work orders placed by the equipment manufacturers. The result is that precision engineering shops have difficulty in meeting urgent lead-time requirements without prejudicing larger and more consistent work from their regular clients. Often the only available resource is then the less precise operators who may provide a less than satisfactory result. There is a need to encourage some supplier enterprises to develop specific capabilities for the requirements of the MSEI

R5.	*The MSEI to work with supplier industry associations to improve supply chain performance.*

7.2. Commercialisation and Finance

A great deal of confusion continues to exist within the MSEI as to where to obtain comprehensive advice, direction and finance for product commercialisation processes.

Many manufacturers and research institutions expressed concern to the Audit Team regarding the resources they have to devote to compliance on applications for government programs, especially the Commonwealth R & D assistance programs and STI grants. Smaller firms in the MSEI need to improve their understanding of both Commonwealth and State government assistance programs.

R6.	*Government and MSEI to promote existing commercialisation assistance programs.*
R7.	*Government to review its programs to reduce compliance costs to industry.*

The availability of seed capital early in the product development process is critical to the establishment of new enterprises with new product ideas. Virtually all companies interviewed expressed concern about the availability of early stage funding while a number were also concerned about an adequate supply of proof of concept funding.

According to the MSEI there are signs that the provision of early stage funding may not be growing adequately as the formal venture capital firms focus on later stage and lower risk investments. There is a common perception in the MSEI that the availability of seed capital is in short supply. Larger funds managers are under increasing pressure to invest in comparatively low risk businesses and to minimise funds management overheads. The formal venture capital market is increasingly looking to invest in established businesses with a proven track record. As a result, there has been a shift away from investing in early stage entrepreneurial companies. A number of companies and financiers interviewed suggested that Victoria could establish its own seed capital fund modelled along the Small Business Innovation Research (SBIR) program in the United States.

However, it should be noted that there is data available that suggests movement of venture capital from NSW to Victoria and from the Information Technology sector to manufacturing.

R8.	*Government to assess availability of seed capital supply relative to the current and prospective needs of industry and the need for a more seamless provision of funding through each of the commercialisation stages.*

The MSEI perceives that Victoria needs to improve its supply of venture capital. Most venture capitalists in Melbourne also need to find more experienced managers for executive positions to manage their business investments.

R9.	*Government and the MSEI to investigate with the venture capital market the need and the availability of retired executives of successful high technology firms to mentor venture capital providers.*

7.3. Regulation and Standards

The Victorian Government has stated that it is continually seeking to eliminate unnecessary industry regulations. Therefore industry regulatory issues are of concern especially in respect to the re-certification of imported medical devices that have already received certification from accredited EU testing authorities and the Federal Drug Administration in the United States.

The industry is concerned that standards are not uniform across Victoria as the Therapeutic Goods Administration (TGA) applies to private equipment manufacturing firms in respect to sterilising equipment. Equipment manufacturers consider they are subject to more rigorous regulation for all consumables made and assembled and subsequently sold to hospitals.

R10.	*The Government and the MSEI should work together to improve the equity of regulations and standards pertaining to local manufacturers supplying the Australian medical equipment market to:* ▪ *improve their effectiveness* ▪ *maximise harmonisation* ▪ *minimise burdens.*

7.4. Exports and Import Replacement

The Victorian MSEI has many good features including that of strong export growth. The audit team has however observed that continued development of new exports is critical for sustained growth and viability in the Industry. The growth to date has only been in a few product areas and only significant from a few firms who have gained some marketing knowledge.

One clear and major issue for the industry is the relatively small Australian and Victorian markets for their products and services. This restricts the ability of local firms to expand and improve their financial returns. Despite the small Victorian market opportunities for manufacturers in this segment imports are significant and growing. Import replacement by the local industry is an obvious way to increase volume. Unfortunately much of the product imported into this segment is highly specialised or made on larger manufacturing bases overseas and is therefore highly competitive.

The Audit Team perceived the industry had some difficulties regarding access to some markets. One of the more common concerns was the risk of litigation and apparent non-tariff barriers in the United States market. Some firms are hesitant to seek sales in the

United States market mainly for these reasons. This is rather ironic since the United States market represents over 40% of the global market for both medical and scientific equipment. There are few marketing professionals employed in the industry. Lack of marketing expertise is common throughout the industry extending through from research institutes to newly formed firms to even those companies with an established market presence and to financiers.

Smaller firms in the industry have expressed concern that the relative costs of both attending trade exhibitions and exhibiting trade booths is markedly lower for larger firms. Small firms also regard the cost of attending trade shows as prohibitive. (The existing and proposed sector industry associations should address the expense of attending and exhibiting in trade fairs. Industry associations can combine entrants and can more effectively take advantage of existing assistance provided by governments for trade promotion).

The Victorian scientific equipment industry sector has expanded largely from the field of spectrometry. This is now a mature technology. Competition in global markets in the field has intensified and the price of spectrometers has been falling over the past two years. To continue to sustain growth in the Victorian scientific equipment industry sector in particular, manufacturers will need to focus more on the creation of specialised ranges of products directed at global niche markets. The opportunity for replacement of imports is quite extensive but firms should still focus their developments and not make too many different products unless they can market them globally.

R11.	*The MSEI and Government to ensure that short term marketing courses relevant to MSEI are available.*
R12.	*The Government to assist in identifying international opportunities using the resources of the international Victorian Government bases, especially in the United States and EU markets.*
R13.	*The Government and the MSEI to jointly develop an export strategy including consideration of the most appropriate form of export assistance.*

Given the very high import propensities for the MSEI, there appear to be extensive opportunities for import replacement. It is however important to consider the scale of the current types of imports and assess the potential to also export particularly high value added products. Industry representatives at the January MSEI forum stated that over the past five years the Industrial Supplies Office (ISO) assistance to the industry has not been as effective as for other industry sectors. The ISO has a key role in assisting the industry replace imports and can support the industry with information, assistance with bench-marking, and in identifying potential product areas.

R14.	*The MSEI should work with the ISO to develop an import replacement strategy*

The medical consumables segment of the MSEI has a number of “heart felt” specific concerns in respect to import replacement.

The industry segment has the perception that hospitals in Victoria should make more attempt to consider the importance of buying from local suppliers. Governments in Australia account for the majority of domestic demand for medical equipment. The 700 or so public hospitals in the states and territories account for most of this demand. Some manufacturers think that there is scope for a scheme operating in Victoria that provides better price preferences for local manufacturers that could operate in conjunction with other policies to boost import replacement such as the VIPP.

R15. Industry and Government to

- *promote to hospitals the economic benefits of buying local product*
- *improve hospital awareness of products and capabilities.*

7.5. Education, Training and Emerging Technologies

The industry is a vital outlet for the development and use of new and emerging technologies. The industry is also a user of technologies in its manufacturing and business processes. Therefore fostering of this industry using strong industry policy plans is crucial to provide opportunities and practical uses for outcomes transformed from the Victorian research and development communities.

Publicly funded world-class research facilities such as CSIRO, Swinburne University of Technology's Industrial Research Institute, Co-Operative Research Centres and the excellent research hospitals and institutions that exist in Victoria and provide the industry with substantial exposure to new technology and opportunities for product innovation. For Victoria this is a particularly strong case in the field of medical and biotechnology research and development.

Despite the positive outcomes of extensive research and development programs, the process of spreading the benefits of many technologies throughout the industry by means of some type of technology diffusion process needs to boosted.

R16. The Government, the MSEI and the research institutions to jointly develop strategies to improve technology awareness and diffusion throughout the MSEI.

Recent studies found that not only are the number of students studying the key enabling disciplines relevant to effective employment in the MSEI declining, the drop in enrolments in these subjects is greater than for VCE enrolments overall.

There are also an increasing number of students studying science and maths to enhance their opportunity for admittance into university and the course of their first choice which may have no relevance to engineering or science. There are industries in addition to the MSEI that have well documented skills shortages such as the ITC industry, where prerequisite qualifications needed for gainful employment are quite similar to those required by the MSEI. The two subjects of psychology and business management that combined received a 200% increase in VCE enrolments between 1992 and 2000. More students need to be encouraged to consider subjects that are consistent with the strategic industry thrust of the State Government as it relates to biotechnology and medical and

scientific research and nor are the preferred options taken at VCE level consistent with the needs of the MSEI.

This significant drop in the number of students enrolled at VCE level in the key enabling disciplines of physics, chemistry, maths and biology, are essential prerequisites for gainful employment, is a major cause for concern given the employment growth expectations in the MSEI.

R17. Consideration should be given by the MSEI for a comprehensive skills audit of the industry.

Shortages of secondary school teachers with training in physics, maths and chemistry have the potential to impact the future development of the MSEI. Further, teachers need to improve their understanding and appreciation of the importance of innovation and commercial principles.

R18. The Government to investigate how the Diploma of Education course works could be extended to incorporate key aspects of commercial and entrepreneurial training.

Skill shortages are a problem in most segments of the industry extending from research institutes through to manufacturers. For research institutes, the most urgent deficiency is an inability, at a very early stage, to prepare a detailed business case and place a market value on the research idea. Universities and other research institutions require a greater understanding of basic commercial principles and marketing expertise. There are skill shortages in the number of managers capable of establishing and operating small firms engaged in technology intensive activities

R19. The Government to investigate how under graduate and post graduate engineering and science courses can be supplemented with a commercial component that provides students with a basic understanding of entrepreneurship and important aspects of establishing and operating small "high tech" businesses.

The industry faces difficulties in retaining highly talented scientists and engineers. A common problem for both research institutes and manufacturers is the loss of senior staff to overseas where the main attractions are higher remuneration and career prospects. It's been estimated that there are over 5,000 highly skilled expatriate Australians in California alone.

R20. The MSEI and Government to assess and prepare the case for the benefits of living and working in Victoria and then investigate recruitment of expatriates to fill emerging new positions in the MSEI.

7.6. Image of the Manufacturing Sector and Science as a Career

There is a perception among students that career prospects associated with the study of science based subjects is limited. This is, however, disputed by the MSEI. A major concern expressed at both the MSEI forum convened by the audit team and in subsequent interviews by the Audit Team was the poor image of manufacturing as a career option held by young people and its overall poor image generally in the community. Addressing image issues is a priority of OOM.

R21.	*Improve and promote the image of manufacturing industry in Victoria in general and the MSEI in particular.*
R22.	*The MSEI and Government to establish formal "school to industry" links where MSEI executives undertake regular campus visits to promote career prospects within the industry.*

8. Government Policy

Federal and State Government policies have a major impact upon the performance of the Australian medical and scientific equipment industry. Primary areas of Government policy affecting the industry include microeconomic reform - at both Federal and State levels - professional design standards and export promotion activities.

Government Initiatives and Assistance Programs

The State Government views the manufacturing industry as a cornerstone of the future economic prosperity of Victoria. Accordingly, the Government has shown keenness to support the growth of manufacturing with a range of efficient and appropriate industry programs.

- The Victorian Government has in the past, for example, assisted the medical equipment manufacturing industry by raising awareness regarding the European CE marking related issues. Among the other initiatives of the Government has been an establishment of an "Australian Medical Solutions Network" involving thirteen medical equipment manufacturers and service companies that have joined forces to explore the overseas markets.[17]
- Governments both Federal and State provide a wide range of assistance programs that could be relevant to the medical and scientific equipment industry. Support is provided to Co-operative Research Centres (CRCs), which provide an important research base to the medical and scientific equipment industry. Grants and fellowships are also provided for academic excellence, service technology and innovations.
- The State Government is a very active participant in trade missions and fairs and in providing export assistance through the Export Assistance Program. A wide range of assistance is available to facilitate the take up of E-Commerce.
- Special assistance is available to assist SMEs to expand their activities through the Business Growth program. Mentoring and innovation programs are also available with assistance available for technology diffusion and the commercialisation of research and development.

[17] IBIS Business Information Service.

Appendices

Appendix 1

MSEI Reference Group

Name	Position	Company
Charles Wurf	Executive Director	Science Industry Australia (SIA)
Chris Thomson	Network Manager	Australian Medical Solutions Pty Ltd
Mark Verschuur	Managing Director	Fairmont Medical Pty Ltd
Jim Grindlay	Managing Director	Surgi Supplies International Pty Ltd
Ron Grey	Managing Director	GBC Scientific Pty Ltd
Andrew Tame	Product Manager	Varian Australia Pty Ltd
Peter Dawes	Managing Director	SGE Group of Companies
Richard Tantau	Managing Director	Athlegen Pty Ltd
Roger James	Industry Specialist, Advanced Manufacturing	Office of Manufacturing DIIRD

Appendix 2

List of MSEI Public Forum Attendees

Held 29th January 2001

Name	Position	Company
Mr Andrew Langdon	General Manager	Air-Met Scientific Pty Ltd
Mr Mark Clarke	President	Australian Commercial Dental Laboratories Association
Mr Peter Lazarus	Director, Sales & Marketing	Austramedex (Vic) Pty. Ltd.
Mr Denham Dickson	Manager, Victoria	Crown Scientific Pty Ltd
Dr Willem Lindemans	Director, R&D	CryoLogic
Mr Greg Davis	Managing Director – Optical Spectroscopy	Varian Australia Pty Ltd
Mr Robert Dalsasso	Managing Director	Ecotech Pty Ltd
Mr Jose Cotta	Plant Manager	Gambro Pty Ltd
Dr Jeff Gorman	Leader, Protein Mass Spectrometry	Health Service & Nutrition, CSIRO
Mr Milan Brandt	Associate Professor	Industrial Research Institute Swinburne
Ms Jane Campbell	Operations Manager	Lovell Surgical Supplies Pty Ltd
Dr David Komesaroff	Director	Medical Developments Australia Pty Ltd
Mr Otto Ash	General Manager	Medical Developments Australia Pty Ltd
Mr Fabian Petronio	Director	Neomedics Pty. Ltd.
Mr Roger James	Industry Specialist, Advanced Manufacturing	Office of Manufacturing DIIRD
Mr Steven Damiani	Director, Finance	Peter MacCallum Cancer Institute
Ms Judy Smith	Financial Controller	Shimadzu Australia Manufacturing Pty. Ltd.
Dr Matthew Gillespie	Associate Director	St Vincents Institute of Medical Research
Ms Nola Gray	Director	Surgicare Pty. Ltd.
Mr Peter Gray	Managing Director	Surgicare Pty. Ltd.
Mr Phil Bone	State Business Manager	Tyco Healthcare
Mr Duncan Jones	Manager, Business Development	Vision Instruments Limited
Dr Elsmaree Baxter	Manager, Laboratory Services	Walter and Eliza Hall Institute
Mr John McQuay		Wickman Machine Tools and Service Pty Ltd

Appendix 3

Abbreviations

ABS	Australian Bureau of Statistics
ACS	Australian Customs Service
AdvaMed	Advanced Medical Technology Association (USA)
ANTA	Australian National Training Authority
ANZSIC	Australia and New Zealand Specialised Industry Codes
ARTG	Australian Register of Therapeutic Goods
Austrade	Australian Trade Commission
COMET	Commercialising Emerging Technologies
CRC	Cooperative Research Centres
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DETYA	Department of Education, Training and Youth Affairs
DHAC	Department of Health and Aged Care
DISR	Department of Industry, Science and Resources
DIIRD	Department of Industry, Innovation and Regional Development (Victoria0
EFIC	Export Finance and Insurance Corporation
EMDG	Export Market Development Grants scheme
EU	European Union
FDA	Food and Drug Administration (US)
IP	Intellectual Property
IR&D	Industrial Research and Development
ISO	Industrial Supplies Office
ITB	Industrial Training Boards
MSEI	Medical and Scientific Equipment Industry
MIAA	Medical Industry Association of Australia
NHMRC	National Health and Medical Research Council
OECD	Organisation for Economic Cooperation and Development
PEI	Precision Engineering Industry
PPSE	Photographic, Professional and Scientific Equipment
R&D	Research and Development
RYTO	Registered Training Organisation
SIA	Science Industry Australia (was SSAA)
SME	Small and Medium-sized Enterprise
TGA	Therapeutic Goods Administration
VCE	Victorian Certificate of Examination
VET	Vocational Education and Training
WTO	World Trade Organisation

Appendix 4

Glossary of terms

B2B
Business to Business (on-line commerce).

Biosensors
Biosensors are analytical devices that are capable of providing either qualitative or quantitative results. Biosensors combine the exquisite selectivity of biology with the processing power of modern microelectronics and optoelectronics to offer powerful new analytical tools with major applications in medicine, environmental diagnostics and the food and processing industries.

Biotechnology
Any technique that uses living organisms or their products to make or modify a product, to improve plants or animals, or to develop micro organisms for specific uses.

Commercialisation
The procedure to move a product or service into the marketplace. The processes will normally involve planning, market research and development of marketing methods and tools, after-market servicing, optimisation of pricing, guarantees, indemnities and terms, materials management, capital purchasing, production, warehousing, logistical and inventory analysis, budgeting, finance, etc.

Import replacement
The replacement in the marketplace of imported products by locally produced products.

Microfluidics
Microfluidics is the science of designing, manufacturing, and formulating devices and processes that deal with volumes of fluid on the order of nanolitres (symbolised nl and representing units of 10^{-9} litre) or picolitres (symbolised pl and representing units of 10^{-12} litre). The devices themselves have dimensions ranging from millimetres (mm) down to microns (μm), where 1 μm = 0.001 mm. Microfluidics hardware requires construction and design that differs from macroscale hardware. It is not generally possible to scale conventional devices down and then expect them to work in microfluidics applications. When the dimensions of a device or system reach a certain size, as the scale becomes smaller, the particles of fluid, or particles suspended in the fluid, become comparable in size with the apparatus itself. This dramatically alters system behaviour. Capillary action changes the way in which fluids pass through microscale-diameter tubes, as compared with macroscale channels. In addition, there are unknown factors involved, especially concerning microscale heat transfer and mass transfer, the nature of which only further research can reveal.

Non-tariff barriers
Barriers to trade in forms other than import tariff or customs duty. The various types of non-tariff barriers that impede the flow of international trade include: import quotas, exchange controls, customs delays, (“France, *once required* Japanese video players be cleared through a tiny Customs office in the town of Poitiers with *horrendous delays"),* government purchasing policies, subsidies, customs calculation procedures, boycotts, technical barriers, bribes and voluntary restraints

Production value
The value of equipment produced and sold. In this audit it specifically means the equipment manufactured within Victoria or Australia.

Professionally qualified employees
Employees with at least university degree level qualifications recognised in Australia.

Seed capital
Start-up capital required by entrepreneurs with a new product in the development phase to get the product through development and tool-up to testing and verification.

Semi-skilled employees
Employees with specific on-the-job training relative to their employment but with no recognised qualification beyond secondary school.

Skilled employees
Employees with a recognised trade training certificate or higher qualification such as a technical certificate or a diploma.

Supply chain
A supply chain encompasses all the facilities, functions and activities involved in producing and delivering a product or service, from suppliers to customers. It includes planning and managing supply and demand; acquiring materials; producing and scheduling the product or service; warehousing, inventory control and distribution; and delivery and customer service.

Synchrotron
A synchrotron is essentially a doughnut-shaped accelerator that boosts the velocity of electrons nearly to the speed of light. When an electron is accelerated, it radiates electromagnetic energy. A synchrotron is a device for accelerating electrons and using the emitted radiation for a variety of purposes. Basically a synchrotron is a source of electromagnetic radiation. Synchrotrons produce a wide range of electromagnetic radiation, and are often constructed so that the predominant emission consists of x-rays. The Canadian Light Source (CLS) will produce photons (light quanta) from below 0.5 eV to 20 keV in energy. This corresponds to wavelengths of 2.5 micrometres to 0.7 Ängstrom. Synchrotron x-rays are an ideal tool for research and industrial applications. The most significant advantages of the synchrotron x-ray beam are:

- short wavelength photons that penetrate matter and interact with atoms such as carbon and oxygen
- high concentration, tenability and polarisation that ensure focusing accuracy even on atom-size targets
- stability and hours of duration

Appendix 5

Interview List

Name	Position	Corporation
Andrew Langdon	General Manager	Air-met Scientific Pty Ltd
Attilio Demicheli	Managing Director	Anztek Pty Ltd
Chris Thomson	Network Manager	Australian Medical Solutions
Peter Lazarus	Director – Sales & Marketing	Austramedex (Vic) Pty Ltd
John McDavitt	Regional Manager	Baxter Healthcare Pty Ltd
Tony McLynskey	Manager Business Bank	Bendigo Bank
Fernando Salazar	Manager Business Banking	Bendigo Bank
Trevor Andrews	Marketing Director	Bio Electronics Pty Ltd
Andy Gearing	Chief Executive Officer	Biocomm International
Hugh Niall	Chief Executive Officer	Biota Holdings Ltd
Noel Ryan	Executive Director	Centre for Manufacturing
Anna Kilgour	Project Coordinator	Committee for Melbourne
Sophia Spimelli	Senior Project Coordinator	Committee for Melbourne
David Burton	Managing Director	Compumedics Sleep Pty Ltd
Willem Lindemans	Research Director	Cryologic Pty Ltd
Ian Sare	Chief of Division	CSIRO Manufacturing Science & Technology Division
Robert Lee	Manager R & D Photonics & Micromanufacturing	CSIRO Manufacturing Science & Technology Division
Alison Coutts	Client Director	Deloitte Touche Tohmatsu
Danica Sekulovska	Project Manager	Deloitte Touche Tohmatsu
Jose Cotta	QA & RA Manager	Gambro Pty Ltd
Ron Grey	Managing Director	GBC Scientific Equipment Pty Ltd
Dr Fred Davis	Director	Invetech Operations Pty Ltd
Ed Hilliard	Manager	La Trobe R & D Park
Vic Lovell	Managing Director	Lovell Surgical Supplies Pty Ltd
Hugh Ibbotson	Managing Director	Medical Concepts Aust
Ian Midgley	Investment Manager	Melbourne Business Enterprises Int'l
Peter Tippett	Managing Director	Neomedics Pty Ltd

Name	Position	Corporation
Peter Acton	Managing Director	Parncutt Acton Pty Ltd
Brigitte Smith	Manager	N M Rothschild & Sons (Aust) Ltd
Peter Dawes	Managing Director	SGE Group of Companies
Brian Godden	Manufacturing Manager	Shimadzu Australia Manufacturing Pty Ltd
Shuji Miyake	Managing Director	Shimadzu Australia Manufacturing Pty Ltd
Matthew Gillespie	Associate Director	St Vincent's Institute
Nola Grey	Director	Surgicare Pty Ltd
Dr Elsmaree Baxter	Head of Technical Services	The Walter & Eliza Hall Institute of Medical Research
Tony Bigum	Chief Executive Officer	Trace Scientific Ltd
Phil Bone	Small Business Manager	Tyco Healthcare
Gregory Davis	Managing Director	Varian Australia
Michael Ohanessian	Managing Director	Vision Instruments Ltd
Margaret Brumby	Chief Executive Officer	Walter & Eliza Hall Institute of Medical Research

Appendix 6

Submissions Received

Submission (or Comments)	Name	Corporation
Comments on Draft Report	Charles Wurf	Science Industry Australia
Industry issues Table	Chris Thomson	Imarq Pty Ltd
Venture Capital Framework	Carol Halsall	DIIRD
Platform for Health & Medical Research in Australia	Dr Mathew Gillespie	St Vincent's Institute of Medical Research
Comments on Draft Report	Alan Finkel	
Venture Capital in Ireland	Pat Frain	University College, Dublin
BioMelbourne Network	Anna Kilgour	Committee for Melbourne
Comments on Draft Report	Chris Thomson	Imarq Pty Ltd
Venture Capital	Dr Fred Davis	Invetech Pty Ltd
Foreign Trade Mission Criteria	Mark Pratt	Dolphin Products Pty Ltd
Comments on Draft Report	Ed Hilliard	Latrobe University R & D Park
Comments on Draft Report	Dr David Komesaroff	Medical Developments Australia Pty Ltd
Comments on Draft Report	Dr Ian Macfarlane	Invetech Operations Pty Ltd

Appendix 7

ABS Statistics Table
(with adjustments from the industry)

Year ending 30th June:			1993	1994	1995	1996	1997	1998	1999	2000
Employment (nos.)	Australia	Aust Medical	4,093	4,345	5,208	4,854	4,427	4,514	4,714	n.a.
		Aust Scientific	5,010	5,079	4,834	3,649	3,490	3,846	4,155	n.a.
		Aust MSEI	9,103	9,424	10,042	8,503	7,917	8,360	8,869	n.a.
	Victoria	Vic Medical	983	1,006	1,041	839	986	885	1,004	n.a.
		Vic Scientific	1,742	1,615	1,429	1,299	1,182	1,397	1,690	n.a.
		Vic MSEI	2,725	2,621	2,470	2,138	2,168	2,282	2,694	n.a.
Production ($m)	Australia	Aust Medical	321	342	468	441	462	524	630	725
		Aust Scientific	653	607	598	501	437	535	625	750
		Aust MSEI	974	949	1,066	942	899	1,059	1,255	1,475
	Victoria	Vic Medical	70	77	79	73	91	93	110	125
		Vic Scientific	265	196	191	200	210	242	328	345
		Vic MSEI	335	273	270	273	301	335	438	470
Net Exports ($m) (Australia only - Total Exports less Re-exports)	Australia	Aust Medical	153	188	225	260	299	375	405	385
		Aust Scientific	299	301	286	337	316	376	445	540
		Aust MSEI	452	490	512	598	615	751	850	925
	Victoria	Vic Medical	21	33	32	49	65	73	84	90
		Vic Scientific	67	121	167	177	185	210	312	334
		Vic MSEI	88	154	199	226	250	283	396	424
Imports ($m)	Australia	Aust Medical	671	816	781	940	983	1,202	1,418	1,426
		Aust Scientific	1,494	1,584	1,705	1,725	1,680	1,984	2,196	2,266
		Aust MSEI	2,165	2,400	2,486	2,665	2,662	3,186	3,614	3,692
	Victoria	Vic Medical	163	202	181	223	209	266	317	311
		Vic Scientific	518	606	680	670	637	756	811	829
		Vic MSEI	681	809	861	893	846	1,022	1,128	1,140
Market size ($m) (Production + Imports - Gross Exports) **Calc.**	Australia	Aust Medical	804	930	978	1,070	1,091	1,291	1,578	1,695
		Aust Scientific	1,773	1,805	1,922	1,783	1,685	2,016	2,236	2,326
		Aust MSEI	2,576	2,734	2,900	2,854	2,776	3,307	3,814	4,022
	Victoria	Vic Medical	212	246	228	248	235	286	343	346
		Vic Scientific	716	682	704	693	662	788	827	840
		Vic MSEI	928	928	932	941	897	1,074	1,170	1,186