SRI International

CANADIAN HIGH COMMISSION

ACCESSING OPPORTUNITIES IN ADVANCED INDUSTRIAL TECHNOLOGIES AND MATERIALS IN SINGAPORE

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ACCESSING OPPORTUNITIES IN ADVANCED INDUSTRIAL TECHNOLOGIES AND MATERIALS IN SINGAPORE

CONTENTS

This report covers the following topics :

The Canadian High Commission in Singapore, Commercial Section, commissioned SRI International to prepare this analytical overview of investment and business opportunities in Singapore. This report is designed to help Canadian organizations meet their initial information needs regarding participation in these business areas in Singapore. The information presented is believed to be accurate and from sources that SRI believes to be reliable. Readers are urged to verify upon pertinent information before committing resources.

INDUSTRY OVERVIEW

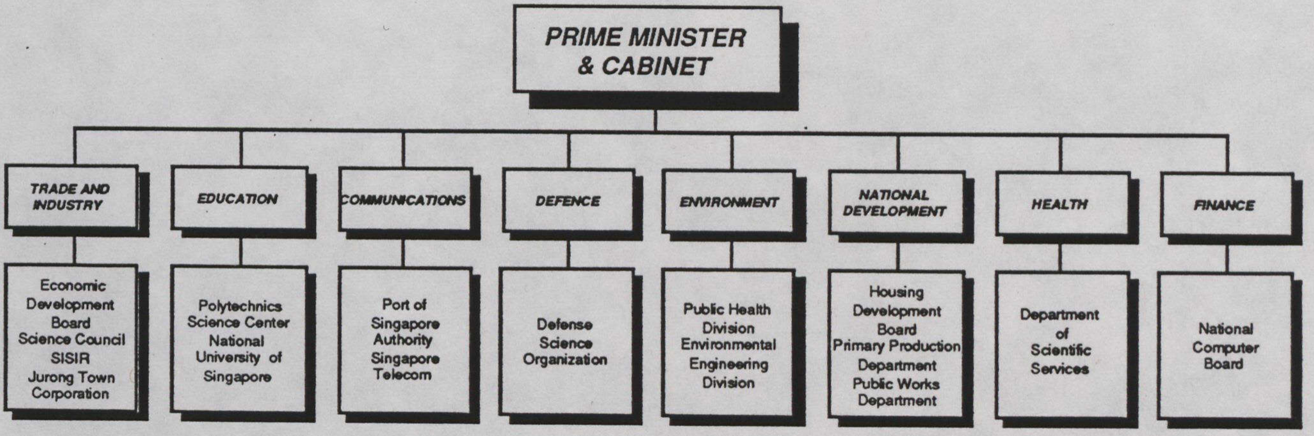
BACKGROUND

One of Singapore's key strategic thrusts is to promote foreign and local companies' R&D efforts in Singapore and advanced technological investments in order to upgrade the local manufacturing and services base. Singapore has stimulated R&D growth and developed R&D facilities through:

- Incentives and subsidies for local companies which assists them to automate and innovate
- Investment incentives for foreign MNCs to establish regional technical centers and accelerate technical transfers to local firms.

Singapore's modern R&D plan effectively began in 1979. The government evaluated R&D activity and its effects on Singapore industry. The directives issued concern upgrading the design and development capability in established industries such as electronics and plastics and developing competence in new technologies, specifically those that are expected to contribute to economic growth.

Governmental organization and structure pertaining to technology is as follows:



Foreign participation has played a vital role in Singapore's technology developments. Technology transfers from abroad have been facilitated by a world class infrastructure, relatively inexpensive and well-trained manpower and a host of tax incentives.

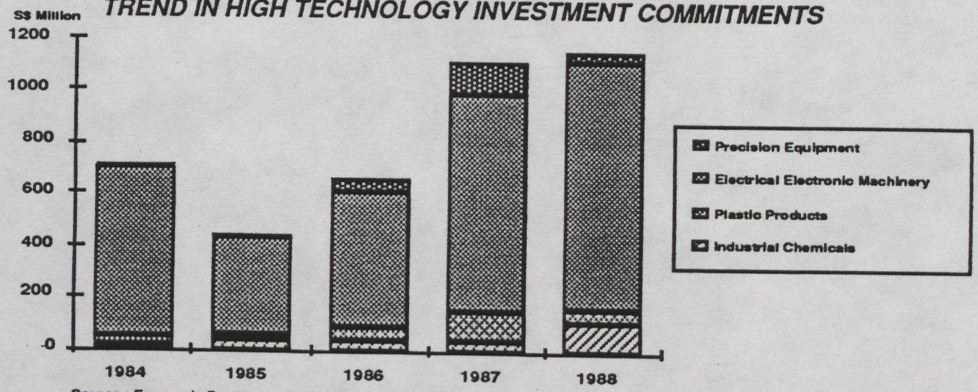
CURRENT SITUATION

Industry Specifics

Over the last decade, Singapore has witnessed major growth in several high technology industries. The most significant growth was in the Industrial Chemicals, Plastics, Machinery, Electrical and Electronics, and Precision Equipment.

SINGAPORE

TREND IN HIGH TECHNOLOGY INVESTMENT COMMITMENTS



Source : Economic Development Board

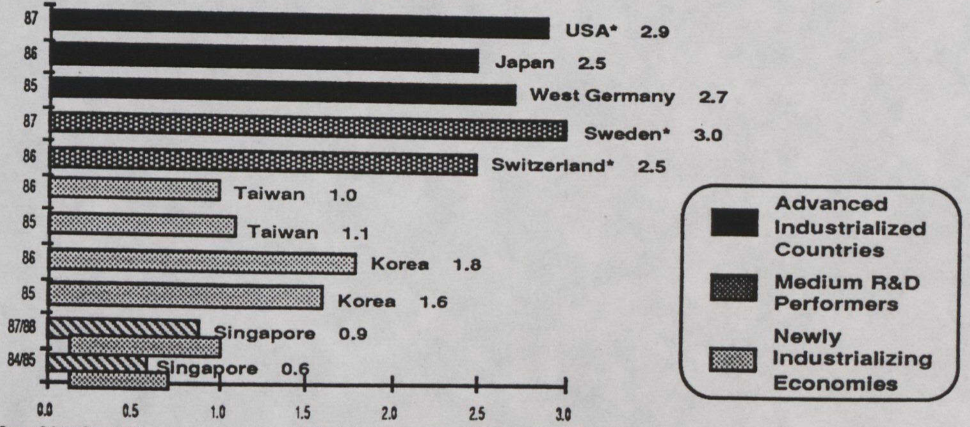
The electronics industry has been growing the fastest. In 1988, it posted a 28% increase due to demand for integrated circuits, semi-conductor devices, computer, audio-visual and telecommunications equipment.

The electrical industry grew by 20%, reflecting growth in precision motors, compressors and power systems. Growth in investment commitments is occurring in aerospace, machinery, plastic product and fabricated metal product sectors.

Research and Development

Comparatively speaking, Singapore is striving to be a major player in the R&D arena. Gross expenditure for R&D in 1987-1988 was $374.7 million, equivalent to 0.9% of GNP.

GROSS NATIONAL EXPENDITURE FOR R&D/GNP BY COUNTRY



Source: Science Council of Singapore

*GERD expressed as a percentage of GDP, rather than GNP

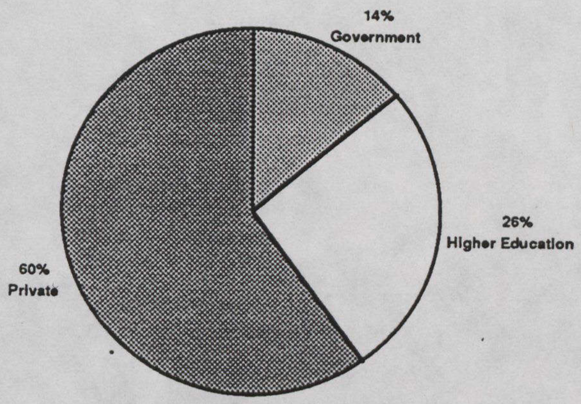
INDUSTRY OVERVIEW ...

CURRENT SITUATION ...

Research and Development...

The private sector constituted the largest share of R&D expenditure in 1988. Of the private sector, the electrical and electronics industry was the largest player, accounting for 65% of total expenditure.

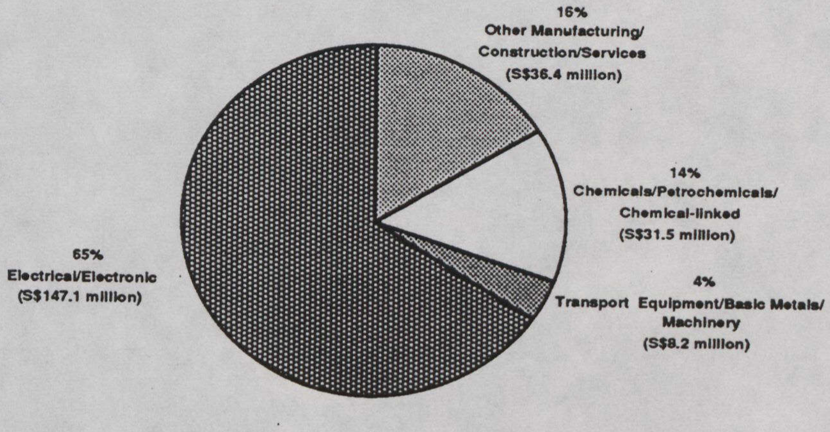
SINGAPORE
GROSS R&D EXPENDITURE BY SECTOR
1987/88



Source : Science Council of Singapore

TOTAL : S$225.6 million

SINGAPORE
R&D EXPENDITURE BY INDUSTRY GROUP
1987/88



Source : Singapore Science Council

INDUSTRY OVERVIEW ...

CURRENT SITUATION ...

Research and Development...

Although much of the R&D activity is still concentrated amongst several of the largest companies, it is now spreading across a wider spectrum as evidenced by the rapid growth of the venture capital industry. The first venture capital fund in Singapore was established in 1983 and today the level of investment is appoximately S$1050 million. The venture capital industry invests in many start-up and small and medium sized enterprises developing high technologies, especially electronics.

FUTURE THRUST

In line with Singapore's strategic thrust to upgrade its R&D and technical capabilities, the government has targeted six key areas for growth for the 1990s:

- Biotechnology and biomedical science,
- Automation, robotics and artificial intelligence,
- Information technology,
- Microelectronics,
- Communications technology,
- Laser and optics technology.

COMPETITIVE ANALYSIS

THE PUBLIC SECTOR

Singapore Institute of Standards and Industrial Research (SISIR)
SISIR is the government agency which promotes and upgrades quality and technology in the manufacturing sector. SISIR employs experts in electronic, mechanical, civil and industrial engineering.

Novo Technology Development (SISIR's commercial investment subsidiary) specializes in promoting and developing joint ventures with foreign firms to encourage technological innovation and applications for commercial use. SISIR has targeted the following high technology fields with commercial potential:

- Materials Technology
  - Metals technology
  - Plastics technology
  - Chemical technology
  - Surface technology

- Microprocessor Applications
  - Factory floor communications
  - Equipment control
  - Machine vision
  - Imaging technology and testing

- Product and Process Technology
  - Electrotechnology
  - Electronics testing
  - Mechanical technology
  - Food technology

SISIR actively pursues technology transfer for Singapore. The International Development Research Center (IDRC) of Canada is cooperating with SISIR in a project studying the needs of four priority manufacturing sectors: plastics, metal stamping, electrical and electronics, and food. As of 1988, 70 businesses have received this consulting service. Three specific programs were born from this exchange:

- Quick die change technology for the metal stamping industry
- Electro discharge machining technology for the precision-engineering industry
- Quick mould change technology for the plastic manufacturing industry

COMPETITIVE ANALYSIS ...

THE PUBLIC SECTOR ...

National University of Singapore (NUS)
NUS gives research a top priority. Funding comes from the school's operating budget, government and industry grants. Specific fields of concentration are:

- Applied Optics
- Polymers
- Image Processing
- Surface Science
- Geotechnical and Environmental Studies
- Biomedical Engineering
- Robotics
- Artificial Intelligence
- Biotechnology
- Microelectronics

NUS seeks collaboration opportunities with companies, concentrating on areas with potential for commercial applications. Together with the premier engineering school, the Nanyang Technological Institute (NTI), NUS forms joint research projects with industrial and public sector firms concerning:

- CAD/CAM, Computer Control, Microprocessor Applications
- Hybrid IC Processing Technology
- Semiconductor and Silicon Devices

Science Council of Singapore (SCS)
SCS facilitates the innovation of existing technologies for market opportunities. It manages the Singapore Science Park, an area made amenable for locating regional research efforts. 50 companies have been admitted to the park, with increased demand resulting in more construction. Participants include the AT&T IC (Integrated Circuit) Design Center, the Sony Precision Engineering Center Software R&D Laboratory, McDonnell Douglas Information Systems, and Cadam Pacific. Biotechnology firms in the Science Park include Rhone Merieux Asia Pacific and Singapore Biotech.

THE PRIVATE SECTOR

In Singapore, foreign private sector participation in high technology industries is actively used to improve manufacturing efficiency and productivity, to develop in-house R&D expertise, to fashion unique solutions for the local environment, to target Pacific Basin markets, and boost the corporate image of the firm. Private sector business in advanced technologies occurs on a wide scale. The Science Council of Singapore categorizes them into six major groups.

INDUSTRIAL PRIVATE SECTOR R&D CATEGORIES

Type I ***MNC Product & Process Development***	***Type II*** ***MNC Sales Support***	***Type III*** ***MNC R&D Cost Center***
• Hewlett Packard • Seagate • Philips • ESE • SGS • Texas Instruments • Polysar	• Mentor Graphics • Alfa-Laval • Data General	• Det Norske Veritas • Eastraco • Goodyear
Type IV ***Established Local Firms***	***Type V*** ***New Tech Venture (with Foreign Partner)***	***Type VI*** ***New Tech Venture (Local Start-up)***
• Chartered Industries • Singatronics • Lam Soon	• Plantek International • Pacific Biomedical • Diagnostic Biotechnology • Tata-Elxsi	• DART • Creative Technology • IC Equipment • Everbloom

Source : Science Council of Singapore

MNC Product/Process Development (Type I) companies have set up full scale subsidiaries involved with R&D, manufacturing, marketing and sales. Typical research concerns :

- optimization of the current manufacturing process with labor input and processing time reduction
- product quality improvement through quality assurance/control
- highly complex manufacturing task automation

The MNC Sales Support (Type II) group specializes in customizing company products for the region. These are typically referred to as "value-added" R&D centers, since the products were developed elsewhere. A common trait is that they are Western companies looking to tailor their products to the Asian consumer market.

COMPETITIVE ANALYSIS ...

THE PRIVATE SECTOR ...

MNC R&D Cost Centers (Type III) are subsidiaries that locate in the ASEAN region to take advantage of regional factors. These factors usually have to do with the tropical climate and the excellent infrastructure and trained labor. Participants include Goodyear, which established its Natural Rubber Laboratory to study rubber coagulation and Det norske Veritas, which set up a facility to study tropical marine corrosion.

The New Technology Venture with a foreign partner (Type V) is considered a newcomer to the business front in Singapore. Such partnerships take advantage of foreign technology and/or capital with local capital and human resource support. This combination has been successful in delivering a short time lag between R&D and manufacturing and sales.

KEY PARTICIPANTS

The following section gives a synopsis of high technology industries in Singapore, naming major players and their products. Canadian companies can gauge the climate for investment for their particular industry by contacting the EDB.

Within the *chemicals industry,* the government is promoting a shift to high value-added, technology-intensive specialty chemicals. There is growth in regional demand, especially with industrial chemicals. Companies such as Union Carbide and Mitsui Toatsu Chemicals have established overseas headquarters in Singapore.

The *plastics industry* is considered particularly lucrative in Singapore. In plastics fabrication, cross industry demand occurs in fields such as injection mouldings for electronic products, films and bags for the pharmaceutical and medical industries. New development opportunities exist in bi-axially-oriented polypropylene film and elastic polyurethane film production.

Biotechnology is new to Singapore, but since it is targeted by the government for growth, it shows much potential. Areas of focus are cell regulation, infectious and genetic diseases, and plant genetic engineering.

Healthcare and pharmaceuticals production is dominated by foreign MNCs. Industry growth has averaged 25% for the past five years with companies such as Bayer, Beecham, Glaxo and Kaneka being the major investors. Products range from Zantac, an anti-ulcer drug, to catheters and heart valves.

Electronics has been the largest industry in the manufacturing sector in Singapore and is well positioned to remain an ideal center for electronic production as demand for consumer and industrial electronic goods grows in the Asia Pacific region. Over 200 foreign companies have manufacturing facilities in Singapore, and the world's largest concerns are represented, such as Philips, Sony, Aiwa, and Matsushita. Their plants are the most advanced in the world, featuring just-in-time inventory systems, automated material handling, value engineering and product and process redesign and surface mount technology.

Singapore's role as a manufacturing center for the *computers* is strong and increasing. Apple Computer, Compaq Computer and Hewlett Packard each have their Asian manufacturing and distribution plants in Singapore.

The *communications industry* is relatively young; however, AT&T and Motorola manufacture telephones, radio phones, pagers and fax machines in Singapore.

With *aerospace and aviation related industries*, Singapore has focused primarily on the manufacture of parts. Because Asia-Pacific regional air traffic is expected to grow at an annual rate of 11% between 1990 and 1995, companies such as GE, Honeywell Aerospace, Pratt & Whitney and Aerospatiale have set up shop for market visibility and cost effective manufacturing.

Singapore is a regional leader in the field of *industrial automation.* Major players are the Matsushita Technical Center, Hirata, Technistar, and the Robot Leasing Company. Business involves selling robotics and automation hardware as well as automation consultancy services.

COMPETITIVE ANALYSIS ...

KEY PARTICIPANTS ...

Opportunities for Advanced Technological Products and Services

The following section deals with the specific advanced material and industrial technologies opportunities in Singapore. Canadian businesses interested in particular fields should contact SISIR.

In the field of *materials technology*, the government has four target categories to group the industrial activity in Singapore: plastics, metals, chemical and surface technologies.

Developments related to metals involve: failure diagnosis, material characterization and selections, metallurgical investigation and testing. This includes stress corrosion, inclusion counts, failure diagnosis of high temperature alloy and in-place metallography.

The evaluation and characterization of plastics involves :

- infrared spectroscopy,
- curing kinetics, and
- oxidative inductive time for polymers.

Chemical technology materials evaluation seeks to determine the purity or contamination of chemical raw materials and products. Representative fields are in pharmaceuticals, petroleum products, construction materials, additives, vitamins, pesticides and industrial chemicals.

Surface technology material evaluation analyses coating, plating and finished products. The technology covers evaluating paints and metallic finishings.

Singapore's strength lies in secondary R&D; it has reached the highest levels in *product and process technology*. As a result, there is increasing demand for sophisticated technical services in engineering product evaluation concerning mechanical and structural evaluation, computer aided analysis, and electrical and electronic product evaluation.

With *electronics and computer applications*, current demand exists for vision and imaging technology, intelligent systems, sensors and instruments development, and electronic communications and monitoring systems.

Singapore Technologies Industrial Corporation is a partially privatised national conglomerate involved in *high technology goods manufacturing*, primarily weapons. It has four divisions: Industry, Aerospace, Ordance, and Marine. The company is seeking investment, transfer of technology, and licensing opportunitites in:

- Shape Charge Technology
- Millimeter Wave Sensing
- Explosive and Pyrotechnics Technology
- Tank Fire Control Systems

Companies are welcome to bring prospective ideas to Singapore Technologies.

INDUSTRY INCENTIVES AND REGULATIONS

INDUSTRY INCENTIVES

The government allows free repatriation of profits. There are no import or export duties. The corporate tax rate is 32% and can be reduced or waived in special circumstances such as when companies locate overseas headquarters in Singapore.

New policies from the EDB to upgrade local operations with these measures are:

- Coverage of 70% of total costs for computerization of local companies.
- Coverage of 50% of consultancy costs incurred by local companies.
- Provision of loans for computerization at special interest rates.
- Coverage of linkage costs between government departments and private sector companies.
- Investment allowance of up to 50% for R&D and equipment and tax exemptions of up to 5 years.
- Financial assistance covering 75% of product design costs by local firms.

INDUSTRY REGULATIONS

The Singapore government exercises a laissez-faire policy for incoming businesses. Full or partial ownership of local firms is legal and licensing agreements flourish as well. The Singapore government is generally permissive in allowing persons to conduct business. Provided that there is no environmental damage, companies are free to start subsidiaries and build plants in Singapore with minimal regulation.

APPENDIX I

KEY INDUSTRY AND GOVERNMENT CONTACTS

GOVERNMENT AGENCIES IN SINGAPORE

Economic Development Board
250 North Bridge Road
#24-00 Raffles City Tower
Singapore 0617
Telephone : (65) 336 2288
Telex : RS 26233
Facsimile : (65) 339 6077
Contact : Mr Tan Chin Nam
Managing Director

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71 Science Park Drive
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Singapore 0511
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Facsimile : (65) 778 9611
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Divisional Director, Industry

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Facsimile : (65) 777 1711
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Executive Director

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Telex : RS 55876
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Group President

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Telex : RS 28617 / 28170 TRADEV
Facsimile : (65) 274 0770 / 278 2518
Contact : Mr Wong Meng Tuang
Director

KEY INDUSTRY AND GOVERNMENT CONTACTS ...

GENERAL BUSINESS ASSOCIATIONS

Canada - Singapore Business Association
Asia-Pacific
Foundation of Canada
2529 Kings Avenue
West Vancouver, BC
Canada, V7V 2C7
Telephone : (1-604) 684 5986

Singapore Manufacturers' Association
20 Orchard Road
SMA House
Singapore 0923
Telephone : (65) 338 8787

Canadian Business Association
c/o Private Secretarial Services
20 Bideford Road
#11-05 Wellington Building
Singapore 0922
Telephone : (65) 734 2608

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Canada
3T9
Telephone : (1-416) 363 8227
Telex : 06-218004 OUBSC TOR
Facsimile : (1-416) 363 1671

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235 Queen Street
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Department of External Affairs
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