Ministère d'État
hnology Sciences et Technologie Canada

RESEARCH, DEVELOPMENT AND ECONOMIC GROWTH

Canada

RESEARCH, DEVELOPMENT AND ECONOMIC GROWTH

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Introduction

A nation's technological development determines how it applies its human, capital and natural resources — the variety and quantity of goods produced and their method of production. Once a nation becomes industrialised and achieves a strong economic foundation, further economic growth depends largely on the successful development and application of new technologies through the innovation process.

Investments in industrial research and development lead to opportunities for new or improved products and processes. Such improvements are crucial to maintain and expand our share of markets in an increasingly competitive world. The strength of our national economy depends on how well we meet the competition.

Investments in academic research and development enable the creative endeavours that are an integral part of a truly dynamic, innovative society. These investments are also imperative to the training of highly qualified people upon whom such a society depends.

The combined strength of Canada's academic and industrial research and development also defines our ability to absorb and adapt new technologies that will inevitably be produced beyond our borders.

This presentation highlights the vital relationship between research and development, innovation and economic growth. It indicates some grounds for concern about Canadian technological advancement and international competitiveness and outlines some challenges for the future.

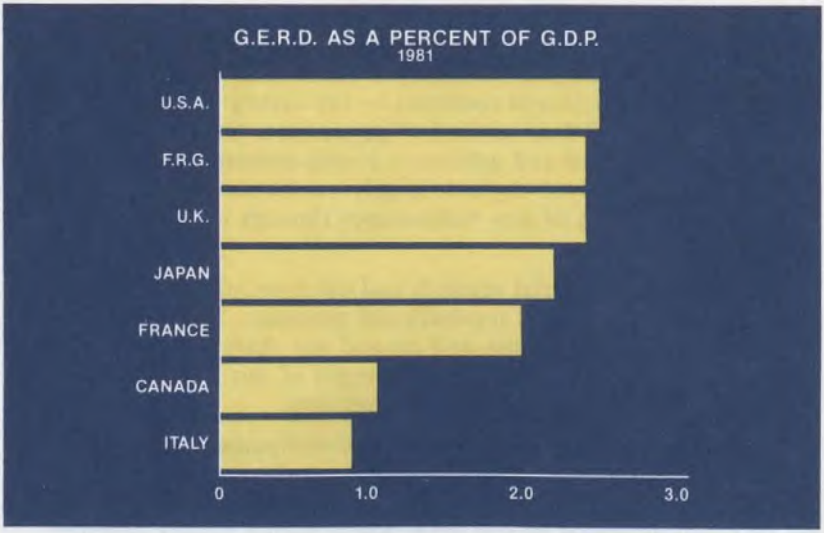

Figure 1:

A country's commitment to research and development can be measured by the ratio of gross expenditures on R&D (G.E.R.D.) to gross domestic product (G.D.P.). Historically, this indicator has been low for Canada in comparison to our major competitors. Although this indicator rose in 1982, it fell slightly in the following years, so we still remain significantly behind other major economies.

In 1984, a related indicator, the ratio of G.E.R.D. to Gross National Product, was estimated to be 1.2% for Canada whereas the German, American and Japanese values were 2.8, 2.7 and 2.6% respectively.

While international comparisons are informative, they do not indicate the future plans of the various countries. Nor do they address the differences in economic infrastructures and national goals. These factors must be taken into account when establishing economic goals and investment priorities.

The concept of a minimum G.E.R.D. investment may be valid to the extent that it allows a country to participate with the international group of scientifically and technically advancing nations. Without at least a threshold G.E.R.D., Canada would not be able to identify and evaluate the foreign technological developments upon which we so heavily depend.

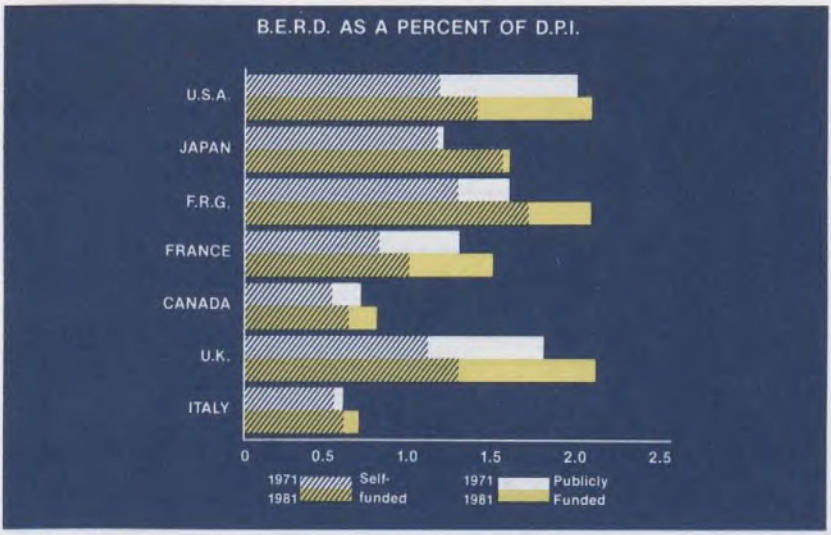

Figure 2:

The commonly used measure of a nation's industrial research effort is the ratio of business enterprise R&D investment (B.E.R.D.) to the domestic product of industry (D.P.I.). This indicator shows that Canadian industry invests significantly less in R&D than that of other major economies. Probable reasons may include a strong reliance on abundant natural resources and a significant proportion of foreign-owned enterprises. The large publicly funded share of B.E.R.D. in the U.S.A., France and the U.K. is a reflection of their significant defence expenditures.

Industrially performed research and development represents about 52% of Canada's total G.E.R.D.; a share that is low by international standards. The Canadian business sector funds about 82% of this research and development. This investment increased at an average annual rate of 21% between 1975 and 1981. More recently, the average rate of increase has dropped to 7% annually.

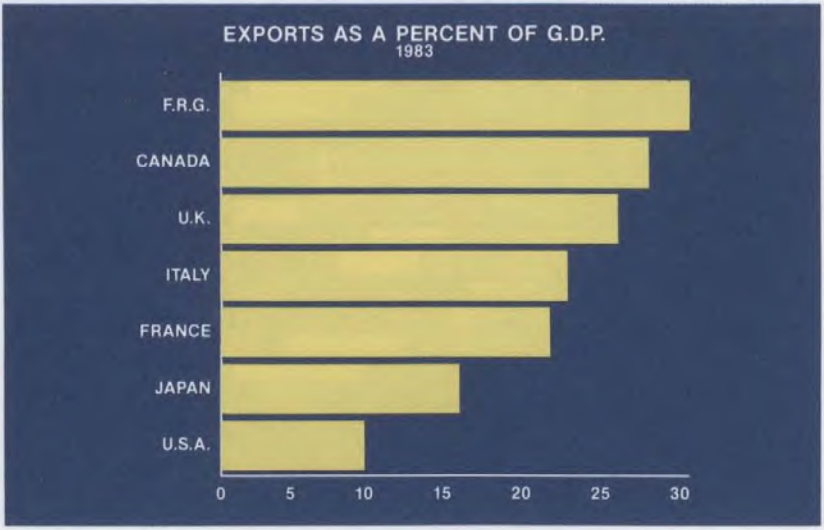

Figure 3:

Exports account for a growing share of Canada's production of goods and services. With exports representing about 28% of Gross Domestic Production, Canada is more dependent on external markets than all other major industrial nations with the exception of the Federal Republic of Germany. Since their domestic markets are much larger, Japan and the U.S.A. are considerably less dependent on exports.

Canadian exports can be roughly described as 85% merchandise (goods) and 15% services. Raw materials account for almost one-quarter of the value of Canadian exports. Manufactured products accounted for 67% of Canadian merchandise exports in 1983. Roughly one-third of the production of Canada's manufacturing sector is exported. This sector provides employment for some 1.7 million Canadians whose salary and wages represent 21% of the national total. It has been estimated that if Canada's share of world merchandise exports were to revert from its current level of 4.0% (1983) to the 1970 level of 4.5%, 160,000 more Canadians would be employed.

An accelerated rate of industrial innovation would provide opportunities for increased exports and import substitutions through diversification of the industrial base and improved competitiveness of existing goods and services.

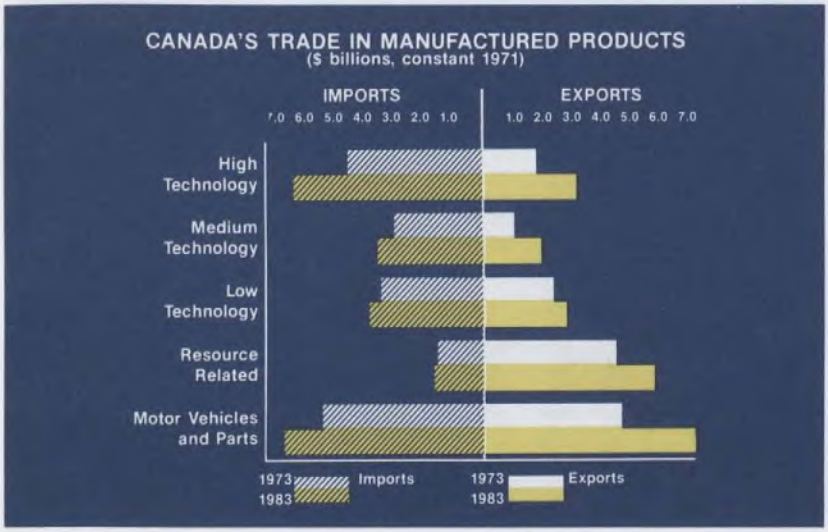

Figure 4:

Canada had a negative trade balance in manufactured products throughout most of the 1973–83 period. Since at least 1968, Canada has incurred a positive trade balance only once; that being in 1982.

The largest components of this deficit are trade in high and medium technology commodities. However, the large trade surplus in resource related products has moderated the overall deficit.

Since the late sixties exports of high and medium technology products have grown faster than those of the other categories.

Canadian high technology firms, like their counterparts in other countries, are very export oriented. Their participation in the growing international market is reflected in the rapid growth of exports in this sector. Yet, as a whole, they have not met the rapidly growing domestic market for these products. Imports in this sector have grown more rapidly than in any other sector and, overall, the deficit in high technology products continues to widen.

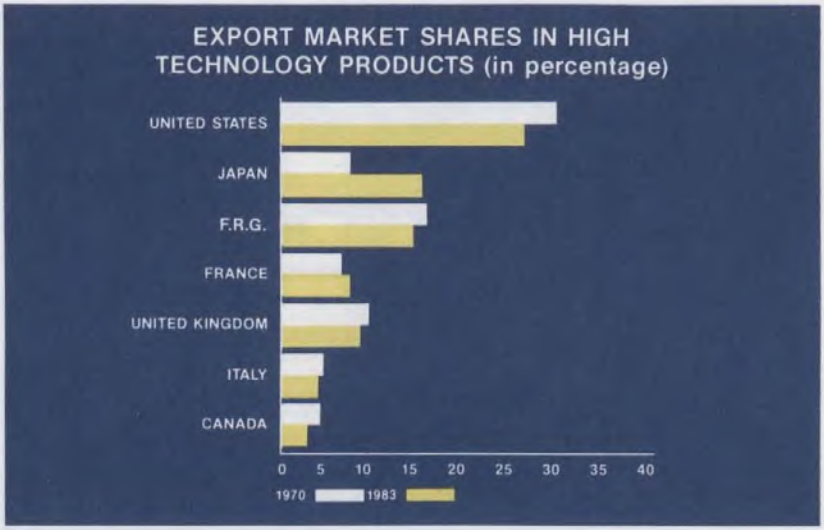

Figure 5:

Worldwide exports of high technology products have grown more rapidly than those of low and medium technology. From 1970 to 1982 the value of high technology exports increased by a factor of 6.3 compared to a factor of 4.9 for other manufactured products. Significantly, exports of high technology products continued to grow through the recession of 1980–82 while exports of low and medium technology products declined. This may suggest that high technology products encounter fewer obstacles to trade than other, more traditional commodities.

While all exporting countries can benefit from this growing market some seem better poised to take advantage of it. As illustrated above, Japan and France were the only two nations to gain market share in the high technology sector. Proportionally, Canada has lost the greatest market share. In fact, Canada was the only nation to incur a negative trade balance for both 1970 and 1983.

AVERAGE ANNUAL PERCENTAGE RATES OF INDUSTRIAL GROWTH
1961–1974

	Employ-ment	Real Output	Produc-tivity	Prices
High Research-Intensive Industries	2.42	6.41	4.49	1.39
Medium Research-Intensive Industries	2.75	6.60	3.95	1.64
Low Research-Intensive Industries	1.61	5.19	3.47	3.13
No Research Industries	0.73	3.85	3.14	3.25
Total Manufacturing	1.87	5.79	3.82	2.37

Figure 6:

High and medium research-intensive industries account respectively for about 61% and 27% of the R&D performed by the Canadian manufacturing sector, and together employ about 87% of the industrial R&D personnel. Over the period 1961 to 1974, high and medium research-intensive industries outperformed low research and no research industries in the growth of employment, real output, and productivity. In addition, their products had a greater price stability.

Employment growth has been fastest in the high and medium research-intensive industries. There were approximately 100,000 jobs created in the research-intensive industries, a gain of over 45%. Employment in medium research industries increased by over 107,000 or 48%. The greatest employment increase was in the low research industries (162,000), but the growth was only 28%.

The real output growth of the high and medium research-intensive industries surpassed that of the total economy. By 1974, these industries accounted for approximately 49% of total output from the manufacturing sector.

These Canadian patterns are repeated throughout the world. High and medium research-intensive industries are a major force in employment and economic growth.

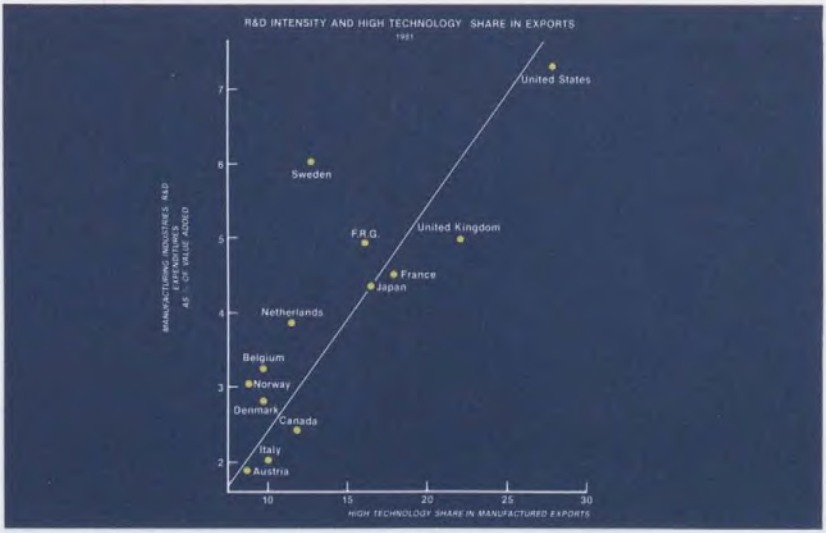

Figure 7:

As a general rule, nations with greater research and development intensities have a larger share of high technology products in their manufacturing exports. Trade balances also indicate that the surplus generated by high technology industries is related not only to the national R&D intensity but also to the size of the domestic markets.

Canada's trade deficit may be attributable to the low level of industrial investment in research and development.

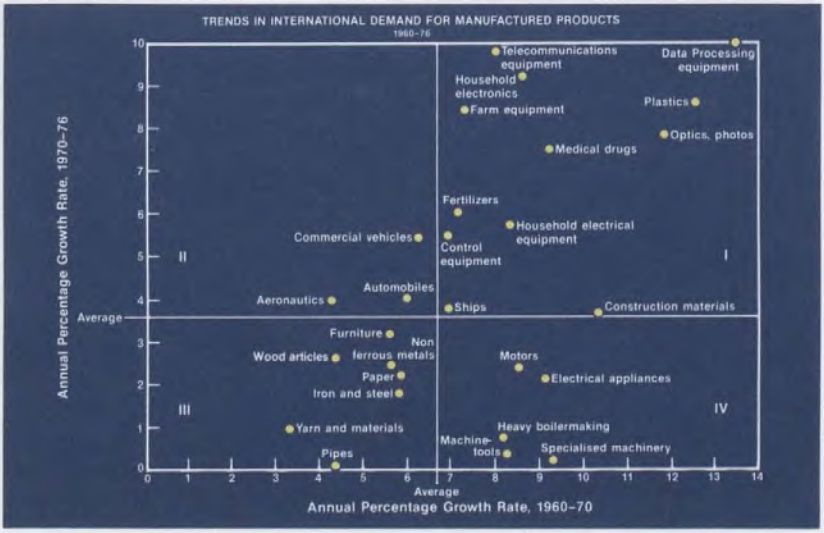

Figure 8:

The structure of world demand for manufactured goods has shifted significantly during the last two decades. As illustrated above, this changing structure is the result of very different rates of growth in the demand for certain products.

Products in Quadrant I had a faster than average growth in demand through the sixties and maintained this growth into the seventies. They are mainly high technology products.

Quadrant III contains products whose demand grew slower than the average in the two periods. They are mainly low technology products.

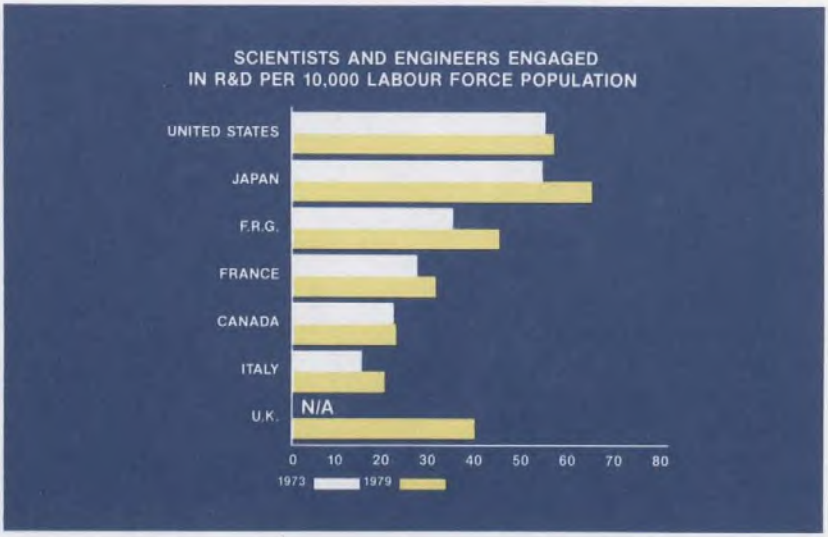

Figure 9:

In Canada, the number of research scientists and engineers per 10,000 labour force is significantly smaller than in most other major countries. Other countries, in particular Japan and the Federal Republic of Germany, have shown increases, while the Canadian level has remained constant. In 1981, two of every 1,000 persons in Canada's labour force were research scientists or engineers as compared to six in the United States.

Highly qualified people supply specialized knowledge essential to scientific advancement and industrial innovation. Canada's future hinges not only on investment in industrial research and development, but also on the quantity and quality of human resources available today and in the future. Tomorrow's human resources depend primarily on the priority assigned to education today.

In the long run, emphasizing the importance of science in primary and secondary school curricula may be more important for the future of Canadian technology-intensive industries than any other corrective measure we may take today.

Conclusion

Canada is a richly endowed nation. We have a well-educated population, abundant natural resources and an established industrial base. To remain successful in the international marketplace, Canadians will have to increase both the level and effectiveness of investments in research and development. Increased research, development and innovation will stimulate employment by means of greater export and import substitution activity.

Technological innovation is a primary thrust of science and technology policy in all industrialised countries. A primary aim is the development and exploitation of the rapidly emerging new technologies, especially informatics/microelectronics, biotechnology, new materials and advanced manufacturing technologies. Their potential applications extend throughout the economy.

New technologies depend on continuing scientific research. Their development and application require long-term investments including funding for education and academic research to meet our future needs for highly qualified people.

Exploitation of our rich store of natural resources has brought about today's wealth and will continue to be a dominant activity in Canada. Diversification of our industrial base may be a key to increasing Canada's economic activity. Such diversification would require a realistic appraisal of national capabilities — scientific, industrial and economic — in relation to our international competitors.

Policies for science and technology should reflect indigeneous strengths and comparative advantages and avoid unimaginative imitation of the actions of other countries. An appropriate mixture of tax incentives, research and development grants, and policies emphasizing procurement and venture capital initiatives is required. Responsibilities must be shared between the private and public sectors.

In this way, research and development will play a vital role in securing expanded markets for our goods and services; thereby increasing the number of jobs for Canadians.

RESEARCH, DEVELOPMENT AND ECONOMIC GROWTH

Sources and Methods

Figure 1

Sources: — Science and Technology Indicators Unit, OECD, Paris

— Japanese Government survey as quoted in the Globe and Mail, January 11, 1985 — REPORT ON BUSINESS

Figure 2

Source: — DSTI 4732 S 26142, OECD, Paris, December 1984

Figure 3

Sources: — Quarterly National Accounts, OECD, Paris Canadian Statistical Review, Catalogue number 11-003E, Statistics Canada, December 1984

— Government of Canada publication, "Canada and The World: Competing for International Markets" Prepared for the First Ministers' Conference on the Economy 1985

— Note: Raw materials include live animals, food, feed, beverages, and tobacco, and crude materials inedible

Figure 4

Source: — Science and Technology Indicators, 1984, Catalogue number 88-201, Statistics Canada, 1985

Figure 5

Source: — M.K. Ranga Chand, The Canadian Business Review, Summer 1978

Figures 6 and 7

Source: — DSTI/SPR/84.66, OECD, Paris, November 1984

Figure 8

Source: — DSTI/IWD/FIS/80.22, OECD, Paris, 1980

Figure 9

Source: — DSTI/SPR/82.59, OECD, Paris, November 1982

NOTE: Definitions and assignments to the various technology classes are provided in the sources referred to above. Because of Canada's particular economic interests, Statistics Canada has subdivided the OECD classification of Medium Technology into Medium Technology and Motor Vehicles and Parts, and Low Technology into Low Technology and Resource-related.

National Economic Conference
March 22 and 23, 1985
Agenda

Friday, March 22

Session 1 (Morning)	The imperative of economic renewal.
Plenary	An opening speech by the Minister of Finance will be followed by discussion from the floor.
Session 2 (Afternoon)	***Employment in an era of fundamental change.***
Plenary	Subjects to be discussed in the plenary session include: ***generating new jobs (entrepreneurship, new businesses, and innovation)***; a flexible labour market (training, re-training, mobility, and patterns of job allocation); ***technology, R&D, and productivity; Canada's competitiveness in domestic and foreign markets; and basic education (keeping up with change).***
Session 3 (Evening)	Social issues resulting from economic change.
Concurrent Workshops	1. Effective use of unemployment insurance and social support programs. 2. Options for dealing with declining industries. 3. Alternative responses to regional unemployment. 4. Labour standards, occupational health and safety, and environmental protection. 5. Changing patterns and concepts of work: shorter work week, job sharing, part-time work, the voluntary sector.

Saturday, March 23

Session 4 (Morning) — Enhancing the environment for equitable job creation.

Concurrent Workshops

1. Access to financing and capital markets for conventional and non-conventional businesses.
2. Regulation and de-regulation.
3. Improving access to employment for groups facing special difficulties, including women, youth, natives, the disabled, visible minorities, and ethnic peoples.
4. Incentives: the tax system, subsidies, and grants.
5. Labour-management relations, job creation, and job security.

Session 5 (Afternoon)

Plenary

I. ***International trade and employment.***

Subjects to be discussed include: enhancing access to markets; trade liberalization vs protectionism; future trade relations with the United States; export financing and other government support of trade; and interest and exchange rates.

II. The Canadian economy and the potential for consensus.

What consensus exists about goals for Canada's economy and the means of achieving them?

What ways and means should be pursued for drawing Canadians into the process of developing economic policy?

Notes