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Industry Canada

A Competitive Overview of the Canadian Consulting Engineering Industry

Final Report

Industry and Science Canada | Industrie et Sciences Canada

Ottawa, Canada
K1A 0H5

March 7, 1994

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Dear Sir/Madam:

Subject: **A COMPETITIVE OVERVIEW OF THE CANADIAN CONSULTING ENGINEERING AND GEOMATICS INDUSTRIES**

Attached, for your review are competitive overviews of both the Canadian consulting engineering and geomatics industries which Ernst & Young was commissioned by Industry Canada to undertake.

The primary objective of this assignment was to gather information that would allow some comparisons to be drawn between Canada's consulting engineering and geomatics industries and their main competitors. This work must be viewed as a first attempt to document the relative competitiveness of these industries in a general sense. The size of the assignment did not allow for the probing of particular issues in detail, nor the filling of information gaps with subsequent interviews.

It should be noted the opinions contained within these two reports on government policy are those offered by the consultants and do not represent Industry Canada positions.

If you require additional information, you may contact Philip Morrison at Industry Canada (613) 941-4213.

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Yours sincerely,

Christopher G. Charette
Director, Consulting & Engineering Service Industries Directorate
Business Services Industries Branch, IC

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Recent Decline in Export Markets

The Consulting Engineering (CE) industry has traditionally been one of Canada's strongest and most internationally competitive industries. In the domestic market, the industry has played a major role in building the nation's infrastructure and resource base. Internationally, Canadian consultants have been active players in the U.S. and European market as well as in developing countries. For example, in 1988, the Canadian industry (by one measure) ranked second in the world in terms of export revenues.

Despite its historical success, in recent years the Canadian industry has experienced a decline in its international market performance. As measured in ENR Magazine's annual survey, Canada has fallen from second place in 1988 to sixth place in 1992 in terms of international billings of firms ranked in the world's Top 200. As discussed in some detail in the main text, the number of Canadian CE firms ranked among the World's Top 200 International Firms has fallen from 12 in 1990 to 8 in 1992. During years when the U.S. has shown a steady increase in its number of large international players, Canada has shown a steady decline. In terms of export revenues, the listed Canadian firms have suffered a $US 63 million (11 percent) decline during the 1989 to 1992 period from $US 594 million in 1989 to $US 531 million in 1992. All other major nations, except Italy, have seen increases during these years. For example, during the same period, American firms have seen export revenues increase by some $US 3 billion, Dutch firms by some $US 500 million and British firms by almost $US 400 million.

Examining the performance of Canadian consultants in winning World Bank funded contracts shows that Canadian firms have not suffered similar declines. Canadian consultants have generally received between $45 million and $54 million worth of contracts each year since 1987. Canadian consultants leads the Netherlands in this area, although they trail France, the U.K. and the United States by considerable margins.

What is most startling about the World Bank figures is the weak performance of Canadian goods and equipment suppliers. These Canadian firms received $128 million worth of World Bank disbursements compared to $558 million for French firms, $212 million for Dutch firms and $1.2 billion for American firms. The synergy that exists between the CE and goods industries of many nations does not appear to exist in the Canadian context.

Comparisons of Canadian and American Industry Data

The second chapter of the report presents a series of comparative U.S. and Canadian data as derived from a detailed industry survey. Some of the more interesting findings of the survey comparisons are summarized in Exhibits i and ii.

As shown, firms in the United States and Canada report similar profitability results. American firms, on average, have both higher revenues and higher costs, with the result being that profitability is comparable.

American firms are more likely to have implemented particular computer systems - the example shown here is that of marketing systems where American firms have a considerable lead. The final

column shows that Canadian firms have a sizeable advantage in total insurance costs. The main contributor to this is the fact that Canadian health insurance costs are primarily covered under government policies while American costs are largely absorbed by industry.

Exhibit i: Selected Key Findings

	Profit/ Revenues %	Total Hourly Cost $C	Percent with Marketing Systems %	Total Insurance/ Total Staff $C
Multi-Region, U.S.	2.2	64	88	5319
Multi-Region, Canada	2.0	53	45	2533
U.S. Northeast	1.7	66	66	6399
Central Canada	1.8	51	41	2720
U.S. Mountain	4.3	54	57	4698
U.S. West	.4	75	65	5911
Western Canada	2.5	54	33	2198

Exhibit 9 in the main text provides a more detailed assessment of the cost breakdown of Canadian and American firms expressed in terms of *average percent of direct labour costs*. The exhibit shows that Canadian firms in all three comparison regions have cost structures that are about 20 percent lower than the corresponding U.S. regions.

Drawing upon this detailed breakdown, it is possible to combine the revenue, direct labour and overhead expenses into one table, as presented below.

Exhibit ii: Profit Comparisons of Canadian and American CE Firms

($C Per Hour)	Multi-US	Multi-Cda	NE-US	Centr-Cda	Mount-US	West-US	West-Cda
Net Revenues	66	54	63	54	56	70	53
Direct Labour	24	22	24	22	20	25	21
Overhead Expenses	28	21	30	22	22	31	21
Profit (before tax)	14	11	9	10	14	14	11

Exhibit ii indicates that Multi-region U.S. firms and Western Region U.S. firms probably have higher profitability before taxes than their Canadian counterparts, while Northeastern U.S. firms probably have lower profitability than their Central Canadian counterparts. In order to substantiate these general findings to any serious level of detail, the federal government would have to conduct a more in-depth study of the comparisons - probably on a case-by-case individual company basis.

General Comparisons of the Canadian and European Industries

The data in the following table represent the most recently available information on the consulting engineering industries as obtained from the statistical agencies of Canada, the Netherlands, France and the United States. These comparisons should be interpreted with caution as there are important factors (particularly differing definitions) that reduce their reliability. For instance, France's statistical agency adopts a broader definition of "études techniques" for its industry than does the Canadian or Dutch agency. A much more detailed study would be required to obtain more comprehensive comparisons.

As shown in Exhibit iii, the United States has the largest consulting engineering industry among the four countries being compared. With roughly 35,600 firms and $50 billion in sales, it is respectively 2.5 and 1.8 times larger than the next largest national consulting engineering industry

in France. The CE industry of France is roughly four times larger than the Canadian industry while the Dutch industry is about three-quarters the size of Canada's.

Exhibit iii: Selected Consulting Engineering Statistics

	Canada	*Netherlands*	*France*	*United States*
Industry Gross Sales ($C billion)	5.2	4.0	19.7	49.9
Number of Firms (000)	5.6	4.2	19.2	35.6
Number of Employees (000)	71	45	132	592
Average Revenue per Establishment ($C million)	0.9	0.9	1.0	1.4
Average Revenue per Employee ($C 000)	74	88	151	84
Profit before income taxes (as % of revenue)	8.4	7.7	7.6	5.2
Exports ($C million)	499	932	2972	na
Exports as Percentage of Total Sales	9.6	23.6	15.1	na

Source: Statistics Canada, 63-234 and 63-537, 1988/89; United States Bureau of the Census, 1988; Institut National de la Statistique et des Etudes économiques, France, 1990/91; CBS - Centraal Bureau voor de Staistiek, Netherlands, 1990/91.

In terms of average revenue per establishment, the Canadian industry achieves comparable numbers to those of the Netherlands and France. The information on average revenues per employee indicates that French employees derive about double the per-employee revenue of the other countries. It appears that Canadian, Dutch and French firms have comparable profitability when expressed as a percentage of revenue.

According to the trade statistics of the respective statistical agencies, the French and Dutch industries are out-performing the Canadian industry - both in terms of absolute exports and exports as a percent of sales. (However, it should be stated that these statistics are not entirely consistent with those provided in ENR Magazine's annual international report. The federal government may wish to explore this apparent inconsistency in further detail).

While Canada and France seem to have a similar proportion of firms within the small size category, it is interesting to note that these small firms account for fully one-third of France's exports, while small firms account for only 7 percent of total Canadian CE exports. The anecdotal views that we have gathered suggests that this significant difference results from a combination of a) France's small companies working together to secure foreign contracts, b) greater efforts on the French Government's part to encourage aid recipients to purchase services from French contractors and c) the close relationship between France's financial and engineering communities.

According to ENR's annual report, there are four Dutch firms that derive over $100 million in export revenues (Nethconsult, Fugro-McClelland, NEDECO and DHV Beheer) and a total of 9 firms with over $20 million. This compares to two and six firms respectively for Canada and three and six respectively for France.

Canadian firms seem to have particular expertise in power projects and in industrial/petroleum projects (pulp and paper, steel, refineries, petrochemical plants, offshore installations and pipelines). Dutch firms indicate particular focus on water projects (dams, reservoirs, canals, tunnels, mains, treatment plants, pumping stations, etc) and on transportation projects (airports, bridges, dredging, marine facilities, railroads, subways, etc). French firms report a similar emphasis on water projects and transportation projects.

Challenges and Opportunities Facing the Canadian Industry

There are a number of pressures that impact upon the international competitiveness of the Canadian CE industry. Addressed properly, many of these represent opportunities for the Canadian industry. These include the following.

Consulting Engineers Must Enhance their Skills in Certain Areas

There is an increased emphasis in today's economy on such things as business process improvement and re-engineering. As well, there is some potential in Canada to further improve the technical processes which are so important to the competitiveness of the manufacturing sector. This includes technology implementation and improving the use of technology, among other needs. Both of these areas require those involved in delivering the expertise - such as consulting engineers - to have strengths in dealing with people.

As well, our experience in interviewing buyers of engineering services suggests that Canadian engineers are not particularly strong marketers. University curricula are highly oriented toward technical matters. Marketing, in particular, has historically been minimized by engineers as perhaps falling beyond the scope of the profession. Among other explanations, some have suggested that engineers construe "marketing" in a stereotypical form of door-to-door selling, rather than as the strategic exercise that it should be. Yet, in today's environment, the development and implementation of marketing strategies is critical for all professional service industries in Canada, including consulting engineering.

Canadian Policy Must Enhance Canada's Implementation of Technology

In comparison to the United States, the Canadian industrial community displays a deficiency in its levels of implementing advanced manufacturing technologies (AMT). According to a Statistics Canada study, Canadian firms across all size categories are about 1.5 times as likely as American firms to have ignored AMT in their manufacturing facilities. This characteristic impacts on Canadian CE firms in two ways.

- First, it reduces the potential business that can be obtained by CE firms that focus on industrial modernization and technology implementation. It also reduces the likelihood that Canadian CE firms would be hired to provide up-front advice to firms before they invest in new technology. In so doing, it sets the Canadian CE industry back relative to its international competition.

- Second, it serves to minimize the level of interaction and synergy between the CE community and the manufacturing community. As a result, Canada brings fewer turn-key options and joint bids to foreign work. Relative to European and American competition, Canadian firms are more likely to bid on international work in isolation.

Both of these impacts weaken the Canadian engineering community and thus constrain its ability to sell technology and process improvement related expertise abroad.

Accreditation and Education Bodies Must Adjust.

While individual consulting engineering firms must respond to the challenges and opportunities facing them, it is equally important that the surrounding infrastructure also adjust. In this regard, we believe that progress remains to be made in many facets of the education and accreditation

processes that affect the competitiveness of the Canadian CE community. These are discussed in detail in the main text.

Canada's Trade Support Should be More Competitive

Many Canadian engineering firms are of the view that it is time for Canada to abandon its policy of being "Boy Scout to the world while we continue to lose jobs". In their view, the Canadian government must enhance its financial and political support of Canadian interests overseas. This entails encouraging CIDA and other government agencies to place greater pressure upon international customers to buy Canadian.

Some Canadian CEs are also less than praiseworthy when discussing the emerging role of the Export Development Corporation (EDC). In their views, the EDC "is starting to act like a conservative, Canadian bank". The countries on EDC's Open-Market list have been decreasing in recent years. The EDC is felt to be lacking relative to other development agencies in terms of its unwillingness to provide concessional financing (soft credits), interest-free financing or grace periods.

Both of these complaints have been heard before from Canadian exporters, although in recent months it seems to be presented with greater frequency. The question of EDC financing and CIDA support, how it affects Canadian design firms, and how it compares internationally, may thus be worthy of a more thorough investigation.

Canadian trade efforts also require better coordination. As a trading nation, Canada relies to a very large extent on the U.S. market and on natural resource exports. With some exceptions, Canada's trade emphasis in other segments and regions is relatively weak. It has been suggested that the export orientation of Canadian CE firms is particularly weak during good economic times when domestic markets (infrastructure and resource development projects) are more appealing.

By contrast, France and Holland have a well developed international presence in many fields and regions. France is an acknowledged expert in presenting a coordinated team of government, industry and financial players. French policies also routinely tie aid to trade and will use every influence of the government to advance French interests abroad. The British are similarly adept at ensuring that there is only one British bidder for each international project. Through a combination of influence and pressure, the British government encourages the industry to present a united front on the global scene with no external rivalry. Canada, by contrast, often has 3-4 bidders competing for the same project with the result that they end up splitting Canadian support.

The United States has a very similar structure to Canada's consulting engineers and also has a history of being inward looking. However, the American approach differs from that of Canada in some key respects. The U.S. government, for instance, often uses its political and military muscle to fight for American business interests. American CE firms do very well in markets that have benefitted from U.S. military intervention or assistance. The United States also has a considerable advantage through its network of multinational companies. As stated by one interviewee, "American multinationals hire American engineers. If an engineer helped build a state-of-the-art mining facility in Utah, then you will call them to do the same project for you in Chile".

The Canadian industry could probably benefit from a more coordinated "team" approach to many foreign projects.

Canada's Weak Equipment Sector Hinders Export Efforts

A further limitation expressed by CEs, and one that we discuss in Chapter 4, is the growing importance of integration. A nation, and its design firms, should be able to meet the equipment and goods demands that may arise from particular international projects. Most large projects increasingly demand that an engineering company organize and manage all elements of the project. The customers want "one-stop" shopping and will reward the firm that can provide such comprehensive service.

The weakness and lack of export aggressiveness of the Canadian manufacturing sector, particularly in capital goods and equipment, poses a significant disadvantage for Canadian CEs pursuing export contracts. Without strong progress in Canada's capital goods expertise, the truncated nature of the Canadian economy suggests that Canadian CEs may have to increasingly link up with offshore equipment suppliers.

The Growing Private Orientation of International Work Means Greater Marketing Costs

The type of international client for CE work has changed quite significantly during the past five years. In the early-1980s, a large portion of international CE work was conducted for the development banks and/or national governments. In the late-1980s, the clientele for such services shifted to the private sector as governments and quasi-government agencies could no longer finance projects to the same degree. The international environment facing CEs today is one of an increased private sector orientation of infrastructure projects, reduced funding of CIDA, minimal funding of External Affairs, and an aversion of EDC toward providing low interest or other forms of risk financing. Yet, at the same time, the task of developing business and contacts has become more costly.

When the market was dominated by government-funded projects, companies needed only to cultivate a few contacts. In the current environment, firms may have to cultivate several dozen contacts and devote considerable time and effort establishing the necessary business relations. Such efforts cost money of a magnitude that rules most Canadian CE firms out of the game. The impact of this issue, and other questions such as the extent to which it applies in China, may be worthy of a more detailed investigation by the federal government.

1.0 Introduction

1.1 Background

This study aims to provide some insight into the relative competitive position of the Canadian consulting engineering (CE) industry. Canada has developed world-leading expertise in certain aspects of the industry - particularly in many infrastructure and resource development fields.

However, these are turbulent times in Canada as in most other nations. Downturns in the Canadian resource sector, a slowing of infrastructure building, government deficits, the recession of the early 1990s, and the intensification of international competition have all combined to constrain the revenues and profits of Canadian engineering firms. Various other pressures and challenges also face the industry and they are described in the chapters that follow.

It is within this environment of change and uncertainty that the federal government wishes to increase its insights into the positioning of the consulting engineering industry and the competitive challenges facing them. The consulting firm of Ernst & Young was engaged to assist in this process.

1.2 Objectives

The primary objective of this assignment is to gather information that would allow for a preliminary benchmarking of the Canadian consulting engineering industry. It should be noted that comprehensive benchmarking assignments generally require one year or more of research and tend to focus on one industry sector and two nations. This assignment was completed in a few months within a limited budget and required research effort on two industry sectors (a similar assessment of the geomatics industry has also been conducted) and four nations. Accordingly, this work must be viewed as a first attempt to document the relative competitiveness of the industry.

The breadth of information, geographic scope, and industrial focus desired for this assignment restricted the information gathering process to one quick passing of all pertinent sources. There was no budgetary scope to probe particular issues in detail or to fill information gaps with subsequent interviews. Despite these constraints, we have compiled a substantial amount of relevant information that should assist the engineering community in identifying areas requiring further investigation and in ultimately becoming more internationally competitive.

The specific focus of the assignment was on obtaining as much information as possible within the budget pertaining to the "balance sheets" and "income statements" of the consulting engineering industries in Canada, the United States, France and the Netherlands. Beyond this, there was also a desire to explore the question of taxes and whether firms/employees in Canada have competitive tax-related advantages or disadvantages vis-a-vis those in other nations. A further objective was to bring insight in other areas that may affect the industry's competitiveness. Captured within this final category are items such as the role of accreditation bodies, the impacts of government policy, the role of equipment firms, the industry's marketing aggressiveness, and the use of foreign aid.

1.3 Our Approach

Our efforts during this study were aimed mainly at obtaining existing material, statistics, and reports and synthesizing the relevant material from these sources. To do this, we contacted a range of organizations, as follows:

Exhibit 1: Sources of Information

Canada
Industry and Science Canada; Statistics Canada - Scientific Statistics Branch; Export Development Corporation; External Affairs and International Trade Canada ; Association of Consulting Engineers of Canada; L'Ordre des Ingenieurs du Quebec; Investment Canada; Revenue Canada and various taxation documents; Ernst & Young - previous studies; Selected Consulting Engineers.

United States
External Affairs and International Trade Canada - Canadian Embassy, D.C.; Professional Services Management Journal - Financial Statistics Survey and Fee Structure Survey; U.S. Bureau of Labour Statistics; National Science Board; Department of Commerce and its U.S. Industrial Outlook.

Netherlands
EAITC - Canadian Embassy, Den Hague; Centraal Bureau voor de Statistisk - Statistics Bureau; ONRI - Dutch Consulting Engineering Association; Ernst & Young (The Hague).

France
EAITC - Canadian Embassy, Paris; INSEE - national statistics agency; Ministere de L'industrie et du commerce exterieur; HSD Ernst & Young (Paris).

Others
EFCA; FIDIC; World Competitiveness Report; ENR Annual Survey; OECD; Canadian Embassy - Brussels; World Bank; Asian Development Bank; Inter-American Development Bank

In addition to canvassing existing information sources, we also spoke with a small selection of consulting engineers to solicit their opinions.

Once gathered, the information was then synthesized and the relevant findings were presented in the form of Interim, Draft and Final reports.

1.4 Brief Overview of Competitive Benchmarking

Competitive benchmarking exercises are demanding undertakings that ideally should be done at the level of the individual firm. The core analysis lies in the identification of major processes within an enterprise that determine its competitive capabilities. Once identified, key measures of performance related to these processes need to be developed. The ultimate measure of a firm's competitiveness is its profitability. But other measures such as growth in sales are also widely accepted as a measure of competitiveness. Certainly, from a national perspective, faster growing firms, with increasing employment requirements, are highly valued. Market share is another measure of a firm's success and competitiveness. In a county such as Canada, with a relatively small domestic market, exports and export growth are seen as key measures of success and competitiveness.

Benchmarking firms within the domestic industry, or benchmarking domestic firms relative to firms in other countries, both require ensuring that 'like' firms are being compared to 'like' firms and that a common and consistent measurement system is employed. These considerations are more likely to present challenges in international benchmarking studies than in domestic studies due to varying industrial classification systems, different industry definitions, different tax and government

support systems, different modes of doing business, different measurement systems and exchange rate variations.

Even within a domestic industry, care needs to be taken to ensure that 'like' companies are compared with 'like' companies. For example, is the business of an architectural engineering company sufficiently similar to a civil engineering company that they can be examined together in benchmarking the engineering industry? Does it make sense to benchmark small firms against large firms? Once these definitional and operational issues have been dealt with, a sample of firms can be selected. In the event that industry wide data is being used, firms may be grouped according to size, location, and specialization and the benchmarking exercise can commence.

In an international comparison, benchmarking is best accomplished by choosing a sample of firms in each country of interest and gathering information on performance measures directly from each company. This eliminates many of the problems of definition, measurement, size variation, etc. Barring this, using available industry statistics will require a considerable effort in working with the statistical agencies to correct any definition or measurement differences that may exist.

In conducting international benchmarking studies, government policies, regulations and programs become critical to competitiveness. The environment created through government fiscal and monetary policies and regulatory frameworks affect national companies, positively or negatively. A government whose taxes, for example, are significantly higher than those of its major trading partners will, all else being equal, put its companies at a competitive disadvantage when competing internationally.

The same is true of a government's regulatory framework. For example, if a government's regulations significantly increase the cost of doing business or lengthen the time to get a product to market, relative to other countries, the firm faced with those increased costs will be at a competitive disadvantage in the international market place.

1.5 Competitive Performance Indicators for Consulting Engineers

The key processes involved in the business of consulting engineers, revolve around marketing, project management, consulting skills, technical expertise, corporate management (human resource management, risk management, planning) and administration. In the case of marketing, the process is critical to the consulting engineering business. A company with a more effective marketing function will increase its chances of competing against a firm that is less effective. Once contracts have been won, competent project management is required to ensure profitability. Good project management, however, is not the only factor effecting profitability. In addition, skilled and experienced professionals are required to produce reports and/or other deliverables. Administrative support needs to be kept to a minimum while efficiently completing billings and other administrative tasks.

For longer term competitiveness, corporate management functions are extremely important. Recruiting and training professionals with the appropriate kind of experience and expertise for the market place is critical. In this respect, anticipating changes in the market place and re-positioning the company when necessary requires effort in planning and forecasting to constantly monitor and adjust to market needs. In the same vein, managing risk is an important competitive aspect in consulting engineering. Diversifying geographic markets and areas of specialization, and minimizing exposure to risky projects and markets are necessary management tasks that can impact on the competitive capabilities of these firms.

In gauging the competitiveness of consulting engineering firms, it is necessary to develop performance indicators for each of the major processes identified above. Exhibit 2 provides a listing of some indicators that could conceivably be used to position an engineering firm in an international context.

Exhibit 2: Performance Indicators That Could Be Used in Benchmarking the Consulting Engineering Industry

Key Competitive Process	*Competitive Indicators*
Marketing	• marketing costs / total costs • number of marketing personnel / number of total personnel • percent of marketing time / percent of total time • backlog of work (days of revenue)
Project Management	• professional fees / chargeable hour • estimated fees / billed fees • percent of contracts completed on schedule • unbilled work in progress (number of days) • accounts receivable outstanding (number of days) • professional fees/employee
Consulting	• total chargeable time / total time • total chargeable time / employee • senior professional staff / junior staff • technical staff / non-technical staff
Corporate Management	• net income / total revenue • net income / employee • growth in revenue • growth in net income • training costs / total costs • investment / total costs • investment / total revenue • staff turnover
Administration	• overhead costs / total costs • overhead costs / total revenues • administrative staff / total staff • space costs / total staff

The exercise of obtaining information directly from a broad base of companies to assess these various indicators in four countries would typically require 1-2 years of effort and several million dollars in professional fees. In the case of this particular study, we were fortunate to obtain an annual publication that draws comparisons based on a survey of the engineering consulting industries in Canada and the United States. The comparisons with the two European countries have been based upon data obtained from the central statistical organizations and the industry associations.

1.6 Caution to the Reader

The reader should interpret the information and comparisons contained in this report with some caution. There is a significant lack of comparable data and differences in the definition of

consulting engineering between the countries which are the focus of this study. Budgetary limitations did not allow for an investigation of these definitional differences in sufficient detail to make the data more comparable. We have therefore used the data in its existing form (with appropriate warnings) and have tried to identify general competitive characteristics that distinguish the Canadian industry from its counterparts in the United States, France and the Netherlands. We have also looked for underlying factors that might explain competitive differences.

The reader should also note that the Canadian consulting engineering industry has recently undergone a reorganization which has seen some of the largest firms merge. This makes data comparisons from one year to the next more difficult. In addition, Canada has a small domestic market relative to the United States and France and faces significantly greater geographic distances to access international markets than companies in the Netherlands. This provides a greater challenge for Canadian firms - particularly those interested in non-North American markets.

1.7 Organization of the Report

Including this introductory chapter, this report comprises six chapters. The second chapter discusses the Canadian consulting engineering industry in comparison with the U.S. industry. Chapter 3 compares the Canadian engineering industry with the French and Dutch industries. The American comparisons are made in some detail and based upon an annual survey conducted of American and Canadian design firms. The European comparisons are more limited by the different definitions followed by the various statistical agencies.

Chapter 4 examines information derived from an annual international survey of international design (engineering) firms and discusses how Canada's industry is faring in international markets. Chapter 5 provides a qualitative discussion of the policy framework that affects the engineering industry. The chapter also presents some general observations that impact upon the competitiveness of Canada's engineering community. The final chapter provides a summary of the trends and challenges that face the Canadian industry.

The Executive Summary provides an overview of the main findings and conclusions, while an appendix provides a description of the tax situation existing in the four countries.

2.0 Comparison of the Canadian and American Consulting Engineering Industries

2.1 Overview of the Canadian Industry

According to the most recent Statistics Canada information for 1989, there are 5611 consulting engineering firms (CEs) in Canada with annual billings of almost $5.2 billion and exports of $499 million. The list of areas of world-level expertise in the Canadian CE field is lengthy. As one indication of the traditional success of the industry, over the past five years there have typically been 8-12 Canadian firms ranked among the world's 200 largest CE exporters.

While the majority of Canadian firms are based in Ontario and Quebec, there are a number of important firms in all regions of Canada. Approximately 38 percent of industry revenues in 1989 accrued to Ontario firms, 29 percent to Quebec, 15 percent to B.C. firms and 13 percent to Alberta companies.

In many respects, the CE industry mirrors the Canadian nation. Origins in servicing the agriculture and mining sectors have extended to energy developments, industrial projects, transportation work, and environmental projects. Where CE firms in British Columbia, for instance, have particular expertise in forestry developments, those in Alberta have emphasized oil and gas skills and those in Saskatchewan have developed around agricultural fields. Engineers are involved in the smallest of municipal projects and in the largest of energy projects. Total revenues earned by the industry in 1989 were derived from the following fields of specialization:

Exhibit 3: Segmentation of Canadian CE Revenue, 1989

Field	*Percent of Total*
Municipal Services - Roads, Water Supply	10
Buildings - Mechanical/Electrical Aspects	9
Buildings - Structural Aspects	8
Mining and Primary Metals	8
Pulp and Paper	7
Oil and Natural Gas	7
Power Generation	7
Highways, Bridges, Railways	6
Municipal Services - Sewage Treatment, Water Disposal	6
Other Environmental Services	6
Other Industrial Services	6
Transportation Facilities	4
Other	16
Total	*100*

Source: Statistics Canada

The size range of companies extends from small firms in specialized coastal engineering fields to huge organizations covering all engineering fields and many geographic regions. In 1989, fully two-thirds of the firms generated annual revenues below $250 thousand although these firms received only 6 percent of total industry revenue. At the large company end, the 1.5 percent of the firms that have annual revenues exceeding $10 million generated 51 percent of total industry revenues.

2.2 Comparison of Data from U.S. and Canadian Statistical Agencies

The data in the following table represent the most recently available information from the statistical agencies of the two countries. The data from Statistics Canada is from a 1989 source while that from the U.S. Bureau of the Census is from 1988.

As shown, the U.S. consulting engineering sector comprises around 36 thousand firms generated revenues of $50 billion. The average American CE firm employs 17 people versus 13 for the average Canadian firm and generates approximately $84 thousand in revenue per employee versus $74 thousand for the average Canadian firm.

Exhibit 4: General U.S. and Canadian Statistics
(American dollars have been converted at 1.20 for 1988)

	Canada	United States
Establishments	5,611	35,589
Employment (000)	71	592
Revenues ($C billion)	5.2	49.9
Exports ($C million)	499	na
Revenue per Employee ($C 000)	74	84
Employees per Establishment	13	17
Revenue per Establishment ($C million)	0.9	1.4
1988 Trade of Firms in Top 200[1]		
Exports ($C million)	806	1247
Imports ($C million)	48	466

Sources: Statistics Canada 63-234, 1989 and U.S. Bureau of the Census, 1988.

The revenue per employee figure is fairly consistent with the detailed information that is discussed later in this chapter. It shows that while American firms enjoy higher revenue figures[2], they are also faced with higher overhead and employee costs. The result is a comparable level of profitability between the two industries.

The *ENR Magazine* published results for 1988 show Canadian firms as occupying a strong international position. The 12 firms ranked among the Top 200 international firms in the world generated export revenue of $806 million. Canadian firms derive considerably higher exports-per-sales than their American counterparts. However, as we discuss in Chapter 4, Canadian firms have slipped since this peak position, while American firms (helped by a change in definition) have expanded export sales considerably.

[1] The trade data is from ENR Magazine's 1988 survey of the world's Top 200 international design/engineering firms. More recent data is discussed in Chapter 4.

[2] The higher revenue per employee figure could reflect a number of variables including the need to pay higher salaries in order to attract people, higher overhead costs (insurance, space, etc), societal value of engineering and scientific achievement, societal value of the role of outside consultants, the productivity of the particular employee, and the marketing expertise of the firm.

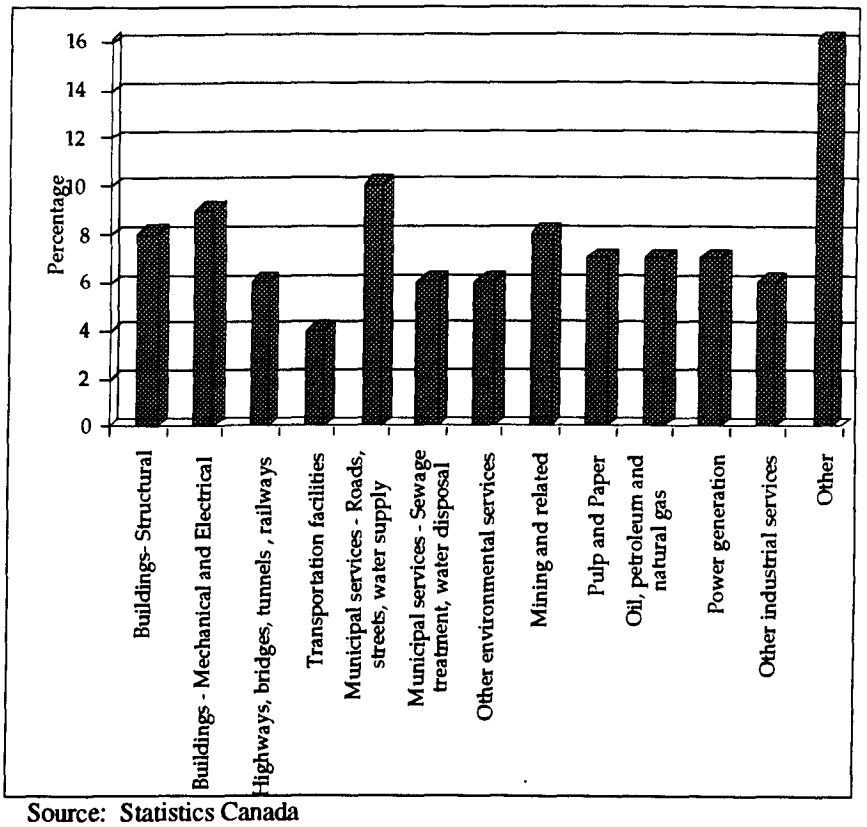
2.3 Regional and Sector Segmentation

Canadian Industry

In 1989, approximately 38 percent of total revenues of the Canadian consulting engineering industry accrued to Ontario firms, 29 percent to Quebec, 15 percent to B.C. firms and 13 percent to Alberta companies.

In many respects, the CE industry mirrors the Canadian nation. Origins in servicing the agriculture and mining sectors have extended to energy developments, industrial projects, transportation work, and environmental projects. Where CE firms in British Columbia, for instance, have particular expertise in forestry developments, those in Alberta have emphasized oil and gas skills and those in Saskatchewan have developed around agricultural fields. Engineers are involved in the smallest of municipal projects and in the largest of energy projects. Total revenues earned by the industry in 1989 were derived from the fields of specialization shown in Exhibit 5.

Exhibit 5: Segmentation of Canadian CE Revenue, 1989



Source: Statistics Canada

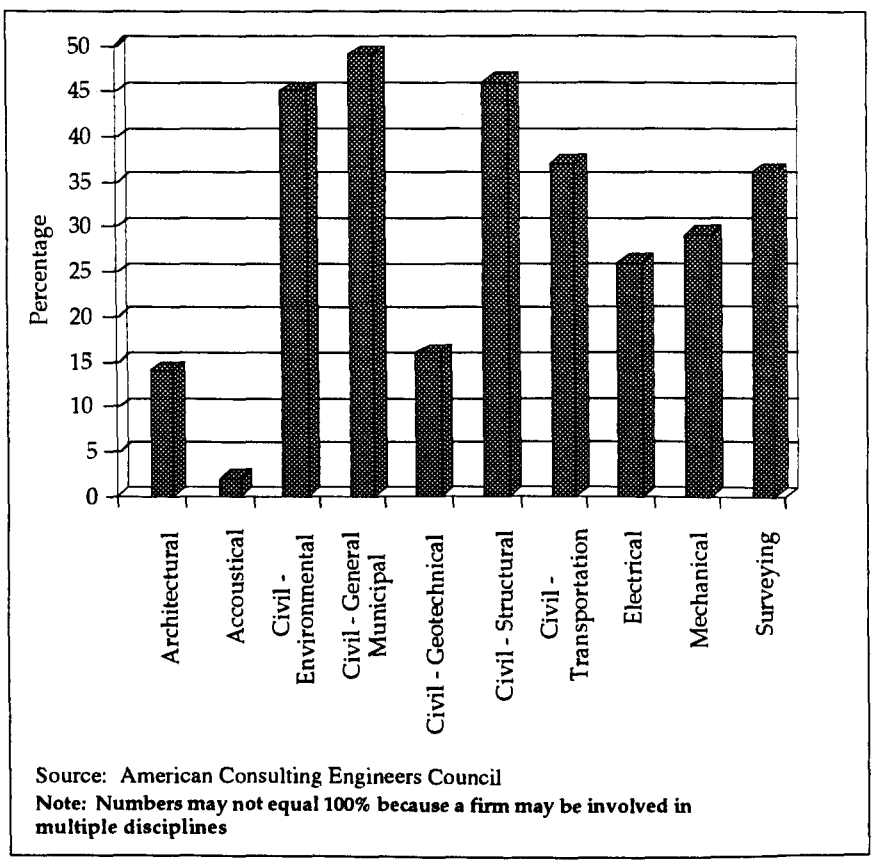
The size range of companies extends from small firms in specialized coastal engineering fields to huge organizations covering all engineering fields and many geographic regions. In 1989, fully two-thirds of the firms generated annual revenues below $250 thousand. These firms received only 6 percent of total industry revenue. At the large company end, the 1.5 percent of the firms that have annual revenues exceeding $10 million generated 51 percent of total industry revenues.

American Industry

In the United States industry, the top ten states (ranked in decreasing order of magnitude of consulting engineering industry revenue) are California, Texas, Pennsylvania, Massachusetts, New York, Virginia, Maryland, New Jersey, Florida and Michigan. These ten states account for approximately 71 percent of all revenues earned by CE firms in the U.S. market in 1989. This level of concentration among the top one-fifth of the states is similar to the level in Canada where the top one-fifth of provinces account for 67 percent of industry revenues.

Exhibit 6 provides an indication of the main fields of specialization of U.S. consulting engineering companies.

Exhibit 6: Emphasis of U.S. Consulting Engineering Firms, by Discipline



Source: American Consulting Engineers Council

Note: Numbers may not equal 100% because a firm may be involved in multiple disciplines

The U.S. segmentation illustrates the disciplines (and some sectors) that are offered by the respondents. The fact that firms offer more than one discipline explains why the totals amount to some 300 percent.

While the segmentation is not directly comparable to the Canadian breakdown, it is nonetheless evident that civil and municipal work is a leading revenue generator in both industries, as is environmental work and building mechanical and electrical work. The Canadian industry appears to focus more on resource fields such as mining, pulp and paper and power generation projects.

2.4 Comparison of Data from a Survey of Canadian and U.S. Firms

2.4.1 Description of the Survey

In addition to the above general comparisons, this study has been able to draw upon a wealth of detailed information compiled through an annual survey by the *Professional Services Management Journal.*

The PSMJ data is unique in that it draws comparisons between the findings of a Canadian and a U.S. service industry survey. The data has been gathered with the cooperation of the Association of Consulting Engineers of Canada and the American Consulting Engineering Council in the United States, among other organizations. The PSMJ data are captured primarily from consulting engineering firms. Because many CEs also work in architectural, construction, and survey fields, it is often difficult to separate data among the various related activities and thus the PSMJ data is most accurately described as referring to "design firms". All of the Canadian responses to the PSMJ survey are from consulting engineering firms.

Exhibit 7: Survey Respondents

By Region[3]

	# of Respondents	Percent
Multi-Region, U.S.	46	12
Northeast	43	11
South	53	13
Midwest	67	17
Southwest	26	7
Mountain	17	4
West	84	21
Multi-Region, Canada	5	1
Eastern Canada	3	1
Central Canada	31	8
Western Canada	19	5
Missing	3	1
	397	100

By Size

	U.S	%	Canada	%
0-15	78	24	12	21
16-50	114	33	14	25
51-150	83	26	15	26
151-500	47	14	12	21
>500	14	4	4	7
	337	100	57	100

The Canadian figures in the PSMJ tables are presented in Canadian dollars. For the purposes of this report, we have converted the American figures (at an exchange rate of 1.25) to Canadian dollars in order to be consistent in our comparisons. All figures are therefore presented in Canadian dollars. Exhibit 7 provides a breakdown of the respondents to the 1993 survey. The data is for the year 1992.

[3] The Northeast region includes Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvannia, Rhode Island, and Vermont. The Mountain region includes Colorado, Idaho, Montana, Nevada, Wyoming, and Utah while the West encompasses Alaska, California, Hawaii, Oregon, and Washington. Central Canada includes Ontario and Quebec while Western Canada includes British Columbia, Alberta, Saskatchewan, Manitoba, Yukon, and the N.W.T. The multi-region category includes those firms that classified themselves as operating in more than one of the country's regions.

As shown above, there is a reasonably close parallel between the two countries in terms of respondent by size. A higher portion of U.S. respondents are grouped in the small-size 1 to 50 employee range while a higher portion of Canadian respondents are in the 150-plus employee size range. Identical proportions are in the 51 to 150 employee size range. It is not known whether the higher Canadian response from large firms would skew the responses and, if so, in what direction they would be skewed. For example, there is no obvious reason to believe that larger CE firms should be more profitable (on a per-employee basis) than smaller firms.

The survey is based upon a response rate of approximately 5 percent. Given the large size of the survey form, it is perhaps not surprising that only 5 percent of distributed forms are returned in a fully-completed manner. The PSMJ has been conducting the annual survey for many years and typically obtains a response rate of around 5 percent. The federal government may wish to conduct a Canada-US comparative industry survey of its own in order to obtain a higher return rate, although we would hasten to add that such exercises can be extremely expensive.

As is the case with any comparison of international data, the reader should interpret the findings of this survey with care. The data reflects many differences between the two nations, including differences in accounting techniques and differences in definitions of terms. In some cases, considerations such as bonus payments and employee ownership payments may cause the data to be reflected differently in Canada than in the United States. Despite these limitations (which apply for any international comparison), it is unlikely that any better information exists elsewhere on this particular subject. The data should be viewed as providing a general indication of the relative position of the two nations in the various criteria.

It should also be noted that the data reflect only the findings for one year. They thus represent a snapshot of that year and reflect the economic realities of that particular point in time. For example, a slowdown in the oil patch in 1991 would probably impact upon the results of CE firms in Western Canada in that year. Readers interested in a broader assessment of several years may wish to obtain the survey results document from *Professional Services Management Journal* for previous years.

Because of the few number of respondents in Eastern Canada, we have avoided drawing comparisons involving this region. Similarly, there is insufficient data to divide the Canadian results by firm size in any region. The responses of multi-regional firms in Canada and the United States are somewhat more reliable although these comparisons must be interpreted with some reservations. They simply provide a general indication of how these multi-region Canadian firms compare with their American counterparts.

The most reliable relevant aspects of the survey relate to the comparisons that can be drawn involving Central Canadian and Western Canadian firms. The numbers for Central and Western Canada are sufficient to draw some interesting comparisons and, in the discussion that follows, we have focussed on comparing these border regions. In other words, Central Canadian figures have been compared with those in the U.S. Northeast and Western Canadian figures contrasted with those in the U.S. Mountain and West regions. The figures provide a valuable indication of how 31 engineering firms in Ontario and Quebec, say, stack up against 43 firms in the U.S. Northeast in terms of profitability, leverage, overhead, backlogs and other key measures.

2.4.2 Summary of Key Findings

Some of the more interesting findings of the survey comparisons are summarized in Exhibits 8, 9 and 10.

Exhibit 9: Overhead and Indirect Costs of American and Canadian Consulting Engineering (Design) Firms

	Payroll Taxes	Sick Leave Holidays	Group Insurance	Pension	Bonus, Profit Distrib	Indirect Labor	Computer Expense	Space Costs	General Insur	Liab Insur	Telep	Registr& Licences	Interest Expense	Bad Debts	Training, Education	Legal Accounting	Production Supplies	Office Supplies	Taxes, Permits	Total
	Average Percentage of Direct Labour																			
Multi-Region, U.S.	13.0	13.8	7.6	4.8	10.3	32.8	4.2	18.2	2.4	6.2	2.8	.8	2.0	1.8	1.4	3.3	2.7	3.4	3.4	124.8
Multi-Region, Canada	8.0	12.1	3.6	5.0	7.8	27.5	2.8	13.4	.8	5.1	2.8	.8	3.6	3.0	1.1	2.6	3.1	3.3	1.7	97.1
Northeast U.S.	12.6	14.4	7.9	2.6	6.9	37.2	2.9	14.8	2.3	7.4	2.8	.9	4.3	2.5	1.1	3.1	2.9	3.4	2.7	126.1
Central Canada	8.6	12.0	3.5	5.0	8.0	29.2	2.5	13.7	1.0	5.5	2.6	.8	3.4	3.1	1.2	2.6	2.2	3.0	1.6	98.0
Mountain U.S.	12.5	12.5	7.1	5.3	10.2	36.7	2.4	14.8	2.5	8.6	3.3	.9	2.5	3.0	1.1	3.7	3.4	3.6	2.5	112.9
West U.S.	13.3	13.9	8.5	4.6	9.3	35.9	4.2	15.8	2.9	7.5	3.0	1.1	2.9	2.6	1.2	3.1	2.6	3.5	3.2	123.9
Western Canada	6.0	11.8	3.5	5.0	7.2	28.7	3.2	13.4	.8	5.0	3.2	.9	4.3	3.0	1.1	2.5	4.9	3.6	2.0	98.9

As shown, firms in the United States and Canada report similar profitability results. American firms, on average, have both higher revenues and higher costs, with the result being that profitability is comparable.

American firms are more likely to have implemented particular computer systems - the example shown here is that of marketing systems where American firms have a considerable lead. The final column shows that Canadian firms have a sizeable advantage in total insurance costs. The main contributor to this is the fact that Canadian health insurance costs are primarily covered under government policies while American costs are largely absorbed by industry.

Exhibit 8: Selected Key Findings

	Net Profit/ Net Revenues	Total Hourly Cost	Percent with Marketing Systems	Total Insurance/ Total Staff
	%	$C	%	$C
Multi-Region, U.S.	2.2	64	88	5319
Multi-Region, Canada	2.0	53	45	2533
U.S. Northeast	1.7	66	66	6399
Central Canada	1.8	51	41	2720
U.S. Mountain	4.3	54	57	4698
U.S. West	.4	75	65	5911
Western Canada	2.5	54	33	2198

Exhibit 9 provides a more detailed assessment of the cost breakdown of Canadian and American firms. The costs are expressed in terms of *average percent of direct labour costs*. As shown, Canadian firms in all three comparison regions have lower cost structures. Multi-region Canadian firms report a cost structure as percent of direct labour that is about 20 percent below that of multi-region American firms. Similar differences can also be seen for Central Canadian and Western Canadian firms.

Drawing upon this detailed breakdown, it is possible to combine the revenue, direct labour and overhead expenses into one table, as presented below.

Exhibit 10: Comparisons of Net Revenue, Direct Labour, Overhead Costs, and Profit

($C Per Hour Figure)	Multi-US	Multi-Cda	NE-US	Centr-Cda	Mount-US	West-US	West-Cda
Net Revenues	66	54	63	54	56	70	53
Direct Labour	24	22	24	22	20	25	21
Overhead Expenses	28	21	30	22	22	31	21
Profit (before inc tax)	14	11	9	10	14	14	11

Exhibit 10 indicates that Multi-region U.S. firms and Western Region U.S. firms probably have higher profitability before taxes than their Canadian counterparts, while Northeastern U.S. firms probably have lower profitability than their Central Canadian counterparts. In order to substantiate these general findings to any serious level of detail, the federal government would have to conduct a more in-depth study of the comparisons - probably on a case-by-case individual company basis.

These and other findings are discussed in the following pages.

2.4.3 Discussion of Individual Variables

Profitability

The profit-to-revenues ratio is one of the basic measures of the profitability and hence success of an industry. As shown below, Canadian CE firms exhibit comparable profitability to their U.S. counterparts.

Firms serving more than one Canadian region ("Multi-Region, Canada") report a 2.0 percent profit (after taxes) to revenues percentage versus 2.2 percent for firms serving more than one U.S. region, while CEs in Ontario and Quebec report a 1.8 percent figure - greater than the 1.7 percent figure reported by companies in the northeastern United States. The after-tax figure for Western Canada appears is between the two figures of respondents in the U.S. West and Mountain regions.

Exhibit 11: Selected Profitability Comparisons

	Net Profit/ Net Revenues *Average Percentage*	Profit/ Total Staff *Average $C*	Profit/ Partner/Principal *Average $C*
Multi-Region, U.S.	2.2	6,791	63,903
Multi-Region, Canada	2.0	5,446	50,340
U.S. Northeast	1.7	5,153	50,024
Central Canada	1.8	6,486	69,701
U.S. Mountain	4.3	6,261	72,616
U.S. West	.4	3,455	34,570
Western Canada	2.5	3,766	20,714

The profit per total staff calculation is based on profits before discretionary distribution of bonuses, profit sharing, and incentive compensation. It is considered operating profit. This amount is then divided by total staff (technical and non technical) to determine profit per staff member. Combining the higher revenues of U.S. firms with their higher overhead costs generates profits per staff in Canada that are comparable to those figures in the United States. For example, Central Canadian firms report around 25 percent higher profitability under this measure than firms in the Northeastern U.S. region, while multi-regional firms in Canada report figures around 20 percent lower than those for their U.S. counterparts. Western Canadian firms report an average figure between those of the West and Mountain regions.

The profit per principal/partner findings varies by region. Canadian firms report a higher return in Central Canada than their Northeastern U.S. colleagues and a lower return in Western Canada vis-a-vis firms in the Western region of the United States.

Advantage - Even

Hourly Revenues and Costs

The net revenue per hour measure is the value of typical hourly revenue achieved by firms. It is calculated by dividing the net revenues (after deducting subconsultants and reimbursable expenses) by the total number of hours charged to projects. As shown, Canadian consulting engineers in all comparable regions reported 10-20 percent lower revenues per labour hour than their American competitors. The direct labour cost measure is an indicator of average direct cost being incurred by a firm in the performance of one hour of professional service. The industries in the two countries report similar results in this measure.

Exhibit 12: Selected Revenue and Cost Comparisons

	Net Revenues/ Direct Labour Hour *Average $C*	Direct Labour Cost/ Direct Labour Hour *Average $C*	Total Hourly Cost *Average $C*	Compensation Per Total Staff *Average $C ('000)*
Multi-Region, U.S.	66	24	64	51
Multi-Region, Canada	54	22	53	44
U.S. Northeast	63	24	66	51
Central Canada	54	22	51	45
U.S. Mountain	56	20	54	44
U.S. West	70	25	75	55
Western Canada	53	21	53	41

Total hourly costs reflect an allocation of overhead and fringe benefits to each labour hour. As shown above, these costs for Canadian CEs are considerably lower than those for U.S. competitors. Firms in Ontario and Quebec generally pay total costs of $51 per hour while counterparts in the U.S. Northeast pay $66 per hour - a difference of around 30 percent. Similarly, CE firms in Western Canada pay $53 per hour while colleagues in the Western U.S. region pay $75 per hour - a difference of 37 percent. This descrepancy, as discussed below, is due mainly to high U.S. social and insurance costs.

Compensation per total staff is computed by adding firm spending for direct project labour, fringe benefit labour (vacation, sick, holiday), indirect labour and marketing labour and dividing by total staff. This equates to an average salary rate, excluding bonuses, for an average firm. As shown, Canadian CE firms pay compensation levels that are fairly consistent from coast to coast - around $40-45 thousand annually. Levels paid by American firms tend to exceed Canadian levels by around five thousand dollars

Advantage - U.S. firms on the revenue side, Canadian firms on the cost side.

Collection of Receivables

The accounts receivable outstanding figure measures the average length of time required by a firm to collect for invoices sent to clients.

Exhibit 13: Selected Billing-Related Comparisons

	Accounts Receivable Outstanding *Average Days*	Unbilled Fees in Work in Process *Average Days*
Multi-Region, U.S.	72	30
Multi-Region, Canada	84	28
U.S. Northeast	85	29
Central Canada	89	31
U.S. Mountain	59	25
U.S. West	72	27
Western Canada	77	26

Canadian CE firms appear to be slightly less vigilent in collecting their accounts receivable. For instance, firms in Ontario and Quebec have an average of 89 days worth of receivables outstanding

compared to 85 days for firms in the U.S. Northeast while Western Canadian engineering consultants take 77 days to collect receivables versus 59-72 days for firms to their immediate south. Multi-regional Canadian firms report 84 days to collect accounts receivable versus 72 days for the American counterparts.

The unbilled fees in work-in-progress is the time it takes from the day work is performed to the day the invoice is sent to the client. It primarily measures the efficiency of a firm's billing practices. Firms on both sides of the border appear to amass similar amounts of work in progress before billing - around 25-30 days worth.

Advantage - U.S. firms.

Bank Debts

As shown in Exhibit 14, there does not appear to be any consistent message from the comparison of debt to equity ratios, except perhaps to conclude that levels are reasonably similar between firms in the two countries.

Exhibit 14: Selected Debt Comparisons

	Bank Debt/Equity *Average Percentage*	Bank Credit/Net Revenues *Average Percentage*
Multi-Region, U.S.	41	10
Multi-Region, Canada	55	14
U.S. Northeast	67	11
Central Canada	56	14
U.S. Mountain	29	11
U.S. West	45	9
Western Canada	46	14

Canadian companies operating in Western Canada and in multi-regions carry a higher debt to equity load than their American counterparts while firms in Central Canada have lower ratios.

Negative cash flow is typical in the design profession, where the majority of expenses, such as payroll, must be paid on a current basis. Turning services into offsetting cash receipts requires many firms to establish lines of credit with banks or other lending institutions to have ready access to funds for operational expenses. This measure shows the level of this commitment by lending institutions as a percentage of net revenues. A line of credit does not signify funds have actually been borrowed, only that the firm has established the right to borrow up to a limit. As illustrated, Canadian firms appear to have established higher lines of credit - around 14 percent of net revenues versus 9 percent for their U.S. counterparts.

Advantage - uncertain.

Marketing Comparisons

Some interesting marketing-related comparisons are presented in Exhibit 15. The first column compares the percentage of companies that have a dedicated senior principal in charge of the firm's marketing efforts. It indicates that a considerably higher proportion of Canadian firms have a principal in charge of marketing. Taken on its own, however, this may not be a positive trait. Some firms follow a strategy where a marketing onus rests with all professional staff rather than with one or two individuals.

Exhibit 15: Selected Marketing Comparisons

	Firms with Principal in Chargeof Marketing *Average Percentage*	Total Staff/ Full Time Marketers *Average Ratio*	Total Marketing Costs/ Net Revenues *Average Percentage*	Labor Aspect of Marketing Costs *Average Percentage*
Multi-Region, U.S.	41	35	5.1	69
Multi-Region, Canada	67	41	5.3	59
U.S. Northeast	60	39	5.4	65
Central Canada	72	37	5.0	58
U.S. Mountain	60	32	4.8	76
U.S. West	50	30	5.1	72
Western Canada	71	NR	5.2	61

The two industries report similar ratios in the area of staff per full-time marketer. The two industries also report similar results (around 5 percent) in the area of the percent of revenues that are directed toward marketing efforts.

American firms report higher figures in terms of the percentage of marketing costs that are labour-related. This could suggest that American firms prefer more personal contact and networking in their marketing efforts and thus report significantly higher costs in this area (despite the fact that U.S. firms also invest more in automation of the marketing function). This variable, like many covered in the survey, can be affected by the tax and policy regime that exists in the two countries (and 60 states/provinces).

Advantage - even

Backlogs

Backlog is an important measure for all professional service firms. It measures the amount of work that is secured for the days ahead. Thus, to take one example, CE firms in Western Canada have an average of around $2 million worth of future work in-house.

Exhibit 16: Comparisons of Backlog

	Backlog *Average $C Million*	Percent Change from Last Year *Average Percentage*	Backlog As Days Revenue *(Average Days)*
Multi-Region, U.S.	50	23	282
Multi-Region, Canada	5	(8)	234
U.S. Northeast	6	10	253
Central Canada	7	(15)	233
U.S. Mountain	2	2	221
U.S. West	15	13	271
Western Canada	2	12	227

While firms on Central Canada have comparable backlogs (around $6 million) to firms in the U.S. Northeast, the American companies have considerably larger backlogs than their Canadian counterparts in the Western region and among multiple-region firms. Canadian firms in Central Canada and in the multi-region grouping report significant declines in backlog from the previous year while U.S. firms report strong improvements in the area.

The backlog-as-days-revenue measure provides an indication of how many days worth of future revenue the average firm has "in the hopper". To take one example, companies in multiple Canadian regions have sufficient work in-hand to carry the firm for 234 days.

The differences are not as significant when expressed in these terms, because of the higher cost structure carried by American firms. However, U.S. engineering firms still report slightly greater backlogs in terms of days of revenue. This is probably related to the depth of the economic downturn that has affected Canada and its CE firms.

Advantage - U.S. firms.

Employee Measures

The technical to non-technical staff ratio is the ratio of the number of technical staff (persons charging more than 50 percent of their time to projects) to the number of non technical staff (those spending less than 50 percent of their time on projects). Firms on both sides of the border report employing around 4-5 technical personnel for each non-technical staff member.

Exhibit 17: Selected Employee Ratio Comparisons

	Technical/ Non Technical Staff *Average Ratio*	Technical Staff/ Partner/Principal *Average Ratio*	Change in Firm Staff Size *Average Percentage*	Staff Turnover *Average Percentage*
Multi-Region, U.S.	4.7	11.7	2	21
Multi-Region, Canada	4.7	7.4	(8)	22
U.S. Northeast	4.4	10.6	(7)	21
Central Canada	4.6	8.8	(8)	22
U.S. Mountain	4.4	8.4	(1)	19
U.S. West	4.2	7.4	(9)	27
Western Canada	4.7	5.8	(8)	21

U.S. firms appear to be higher leveraged in terms of the number of technical staff employed per partner/principal. For example, an average respondent in the Northeast reports almost 11 technical staff per partner/principal versus 9 for an average Central Canadian firm. Similarly an average firm in the multiple-region category reports a ratio of almost 12 versus around 7 for Canadian multiple-region companies. While the leverage ratio can be an important contributor to profitability for an engineering firm, one cannot automatically make this linkage. In some cases, firms cannot be as highly leveraged because their work may be more technical and require a greater role for senior personnel.

The firm staff size change measures the change in total staff between the beginning and end of the fiscal period. It is a good measure of overall prosperity of the profession, as firms tend to increase staff in a strong market. As discussed in the backlog section, Canadian firms seem to be more affected by the recession than their U.S. competitors - a finding that is also reflected in the above table. All Canadian regions report decreases in staff size of around 8 percent during the previous year which is generally a larger decline than in the corresponding American regions.

It is costly for service businesses to hire and train new employees. Measuring turnover is intended to help in assessing a firm's human resources management by tracking its ability to retain people. The staff turnover figure compares total employees terminated (including resignation, retirement, terminations, etc.) in the fiscal reporting period to total staff. As indicated, staff turnover rates appear to be comparable between the two nations.

Advantage - uncertain

Automation

The following table describes the percentage of total firms in each category that report computer capabilities for each of the four major areas of design firm automation. As shown, Canadian firms appear to lag marginally in the important area of automation. In technical systems, for example, only 85 percent of Central Canadian firms report having invested in such systems versus 97 percent of their competitors in the U.S. Northeast region.

The difference in automation is most noticeable in the area of marketing where approximately 60-80 percent of U.S. firms report having invested in such software versus 30-40 percent of firms in Central and Western Canada.

Exhibit 18: Automation Comparisons

	Word Processing	Accounting/ Financial	Technical	CADD	Marketing
	Average Percentage				
Multi-Region, U.S.	100	100	97	95	88
Multi-Region, Canada	98	92	88	98	45
U.S. Northeast	100	97	97	97	66
Central Canada	96	93	85	96	41
U.S. Mountain	100	94	100	100	57
U.S. West	100	97	97	96	65
Western Canada	100	94	87	100	33

The above findings are also supported by the following tables which shows that firms in Western Canada, for example, invest $110 in marketing systems while their American counterparts in the West Region invest over three times this amount. Similarly, multi-region Canadian firms invest $186 in such systems versus $243 by their U.S. colleagues.

Exhibit 19: Automation Cost Comparisons

	Word Processing	Accounting/ Financial	Technical	CADD	Marketing	Total Computer Costs Capital	Operating
	Average $C per Employee						
Multi-Region, U.S.	695	795	1201	2500	243	5574	3000
Multi-Region, Canada	606	626	1392	1759	186	4342	2153
U.S. Northeast	818	954	1171	2731	205	5158	2160
Central Canada	557	636	1352	1906	183	4256	1772
U.S. Mountain	938	950	1500	2703	684	5498	1685
U.S. West	873	875	1634	2536	371	6418	2806
Western Canada	608	583	1280	1594	110	4160	2531

Canadian consulting engineering firms spend lower amounts on computer capital (depreciation) and operating (maintenance) expenses. For example, as shown in Exhibit 19, an average Central Canadian firm invested around $4300 per employee in capital and $1800 in operation of its computers while an average Northeastern U.S. respondent invests $5200 and $2200 respectively - a difference of around 20 percent. Similarly, an average firm in western Canada invests $4200 and

$2500 per employee in computer capital and operating costs respectively. These amounts are considerably lower than the $6400 and $2800 invested per employee by an average firm in the American West region.

These differences may be even more pronounced when one considers that Canadian respondents tend to respresent larger firms, on average, than U.S. respondents.

Advantage - U.S. firms

Overheads

Canadian firms have a considerable advantage in some key areas of overhead cost. In the area of space costs (rent, utilities, maintenance of the physical space), for instance, Central Canadian firms pay one-third less per employee than do Northeastern U.S. firms while Western Canadian firms enjoy a similar advantage over their Western U.S. counterparts.

Exhibit 20: Comparison of Expenses

	Costs Per Employee						
	Space/ Total Staff	Mktg/ Tech Staff	Train/Educ/ Tech Staff	RegisLice/ Total Staff	Grp Insur/ Total Staff	Total Insur/ Total Staff	Overhead/ Total Staff
	Average $C						
Multi-Region, U.S.	5150	5423	441	585	3034	5319	47500
Multi-Region, Canada	3549	3197	376	673	1108	2533	32436
U.S. Northeast	4038	4410	400	690	3528	6399	45000
Central Canada	2661	3780	382	738	1072	2720	34097
U.S. Mountain	4065	3931	289	571	2481	4968	40000
U.S. West	4493	4021	449	854	3908	5911	45000
Western Canada	3192	2516	394	583	1052	2198	29529

The biggest advantage for Canadian firms is enjoyed in the area of group/total insurance costs. Group insurance costs is the total expense paid by the firm, net of employee contributions, for group insurance plans. Total insurance costs is the cost of professional liability, group and general business insurance per total staff. Canadian firms typically have an advantage of $2000 or more per employee in the area of group insurance costs and $3000 or more in total insurance costs. Among other factors, this reflects the fact that U.S. firms typically absorb health care insurance costs for their employees. These costs are primarily absorbed by the taxpayer under the Canadian system.

The marketing costs per technical staff measure includes all marketing labour and other marketing costs for each technical person (over 50 percent chargeable to projects). Canadian firms, whether in the West, in Central Canada, or in multi-region, appear to spend a lower amount on marketing than their U.S. counterparts.

The training and education expenses per technical staff measure includes the total expenditure for training/education divided by the number of technical staff. It includes expenses or tuition, educational programs and educational materials and expenses, including travel costs to educational programs. Canadian firms in all regions spend a lower amount than their U.S. competitors in this area.

Registration and licensing costs include the cost per total staff for professional registrations and state professional licenses. The reported figures vary considerably by region and reflect the fact that these rates tend to be established at the state/provincial level.

The area of general overhead also indicates a significant advantage for Canadian CE firms. For example, companies in Central Canada have a 33 percent advantage relative to their competition in this area while Western Canadian firms have a 33-50 percent advantage over their southern competitors.

Advantage - a considerable advantage for Canadian firms.

3.0 Brief Description of the Consulting Engineering Industries of France and Holland

3.1 Comparison of the Canadian, Dutch and French Industries

The data in the following table represent the most recently available information on the consulting engineering industries as obtained from the statistical agencies of Canada, the Netherlands, France and the United States. (We have included U.S. data in this table for comparative purposes. The previous chapter provides a more detailed discussion of the Canada-U.S. situation).

The comparisons in this chapter should be interpreted with caution as there are important factors (particularly differing definitions) that reduce their reliability. The comparisons with France are most limited by definition - France's statistical agency adopts a broader definition of "études techniques" for its industry than does the Canadian or Dutch agency. It is difficult to discern the exact differences in definition between the France categorization and that of Canada, although it appears that the French definition captures aspects of other design and management service sectors. In addition, the data are from different years and industry performance can change significantly from one year to the next. Some of these variables are likely reflected in the significant differences between the French and Canadian industries, as described below. A more comprehensive benchmarking assignment could examine these matters in further detail.

Tombstone Data

As shown in Exhibit 21, the United States has the largest consulting engineering industry among the four countries being compared. With roughly 35,600 firms and $50 billion in sales, it is respectively 2.5 and 1.8 times larger than the next largest national consulting engineering industry in France. The CE industry of France is roughly four times larger than the Canadian industry while the Dutch industry is about three-quarters the size of Canada's.

Exhibit 21: Selected Consulting Engineering Statistics

	Canada	*Netherlands*	*France*	*United States*
Industry Gross Sales ($C billion)	5.2	4.0	19.7	49.9
Number of Firms (000)	5.6	4.2	19.2	35.6
Number of Employees (000)	71	45	132	592
Average Revenue per Establishment ($C million)	0.9	0.9	1.0	1.4
Average Revenue per Employee ($C 000)	74	88	151	84
Profit before income taxes (as % of revenue)	8.4	7.7	7.6	5.2[1]
Exports ($C million)	499	932	2972	na
Exports as Percentage of Total Sales	9.6	23.6	15.1	na

Source: Statistics Canada, 63-234 and 63-537, 1988/89; United States Bureau of the Census, 1988; Institut National de la Statistique et des Etudes économiques, France, 1990/91; CBS - Centraal Bureau voor de Staistiek, Netherlands, 1990/91.

In terms of average revenue per establishment, the Canadian industry achieves comparable numbers to those of the Netherlands and France. The average revenue per establishment in the

[1]Profits vary according to the specialization of the design firm, from a low of 0.6 percent for those in commercial developments to almost 13 percent for those in energy.

U.S. consulting engineering industry, however, is approximately one and a half times greater than the Canadian industry's. The information on average revenues per employee indicates that French employees derive about double the per-employee revenue of the other countries. It appears that Canadian, Dutch and French firms have comparable profitability when expressed as a percentage of revenue.

According to the trade statistics of the respective statistical agencies, the French and Dutch industries are out-performing the Canadian industry - both in terms of absolute exports and exports as a percent of sales. (However, it should be stated that these statistics are not entirely consistent with those provided in ENR Magazine's annual international report, as discussed in Chapter 4. The federal government may wish to explore this apparent inconsistency in further detail).

Company Size

As illustrated in Exhibit 22, Canada and France seem to have a similar proportion of firms within the small size category. In France, over 15 thousand companies, or 81 percent of the total number, have five or fewer employees and some 7800 firms have zero employees (sole practitioners).

While the proportion of firms by size category are similar, the exhibit shows that a higher portion of total Canadian revenue accrues to large and medium size companies.

Exhibit 22: Key Information by Company Size

	Canada		Netherlands		France	
Company Size[2]	*% of cos*	*% of revs*	*% of cos*	*% of revs*	*% of cos*	*% of revs*
Small	98	39	90+	90+	98	49
Medium	1	10	na	na	1	8
Large	1	51	na	na	1	43

Source: Statistics Canada, 63-234 and 63-537, 1988/89; Institut National de la Statistique et des Etudes économiques, France, 1990/91; CBS - Centraal Bureau voor de Staistiek, Netherlands, 1990/91.

Exhibit 23 highlights an interesting contrast between the industries of Canada and France. As shown, France has a larger percentage of small companies who are successful in exporting. Fully one-third of France's exports are accounted for by small firms, versus only 7 percent in the Canadian case.

Exhibit 23: Size Structure of Firms that Export

Company Size	Canada		Netherlands		France	
	% of cos	*% of exps*	*% of cos*	*% of exps*	*% of cos*	*% of exps*
Small	98	7	na	na	98	33
Medium	1	3	na	na	1	11
Large	1	87	na	na	1	56

Source: Statistics Canada, 63-234 and 63-537, 1988/89; Institut National de la Statistique et des Etudes économiques, France, 1990/91; CBS - Centraal Bureau voor de Staistiek, Netherlands, 1990/91.

The anecdotal views that we have gathered (expanded upon in Chapter 6) suggests that this significant difference results from a combination of a) France's small companies working together to secure foreign contracts, b) greater efforts on the French Government's part to encourage aid

[2] small = <50 empl or $5 mil sales; medium = 51-100 empl or $5-10 mil; large = >100 empl or >$10 million.

recipients to purchase services from French contractors and c) the close relationship between France's financial and engineering communities.

Segmentation

Exhibit 24 illustrates the concentration of Dutch consulting engineering firms in the various areas of work as measured by the percentage of revenue earned in each area and the percentage of companies in each area. (We have been unable to obtain a similar segmentation of French industry revenue, although the federal government could investigate other possible sources of this information in a more comprehensive study). Similar to the United States and Canada, the Dutch firms have a strong presence in civil engineering fields.

Exhibit 24: Segmentation of Dutch CE Revenue, 1990/91

Field	*Percent of Revenues*	*Percent of Companies*
Production	34	6
Broad Specialization	33	4
Civil	11	35
Mechanical	9	26
Heating, Cooling, Sanitation	3	11
City Planning, Landscaping	1	2
Physics, Noise, Vibration	0	3
Other	9	13
Total	*100*	*100*

Source: CBS - Centraal Bureau voor de Staistiek, Netherlands, 1990/91.

As shown, it is very difficult to draw any direct comparison with the segmented Canadian data of the previous chapter. The Dutch industry derives a very portion of revenue from the "production" area. As well, the industry has a number of firms with broad specialization. The information presented in Chapter 4 suggests that Dutch firms are quite strong in the area of water and transportation engineering (NEDECO and Nethconsult are ranked in the world's Top 10) and in building engineering (Nethconsult and Fugro-McClelland are ranked in the world's Top 10).

Prominent International Firms of France and the Netherlands

Exhibit 25 lists the French and Dutch companies that are present among the list of the Top 200 exporters. As shown, there are four Dutch firms that derive over $100 million in export revenues (Nethconsult, Fugro-McClelland, NEDECO and DHV Beheer) and a total of 9 firms with over $20 million. This compares to two and six firms respectively for Canada and three and six respectively for France.

Canadian firms seem to have particular expertise in power projects and in industrial/petroleum projects (pulp and paper, steel, refineries, petrochemical plants, offshore installations and pipelines). Dutch firms indicate particular focus on water projects (dams, reservoirs, canals, tunnels, mains, treatment plants, pumping stations, etc) and on transportation projects (airports, bridges, dredging, marine facilities, railroads, subways, etc). French firms report a similar emphasis on water projects and transportation projects.

Further discussion of the international performance of France and the Netherlands is presented in Chapter 4.

Exhibit 25: Dutch and French Firms Ranking Among the 200 Largest International Consulting Engineering Companies

1993 Rank		Firm type	Intr'l % of total	Percent of 1992 billings: Building	Industrial/ petro.	Manufacturing	Water	Sewer/ Waste	Transportation	Hazardous waste	Power	Other
Dutch Firms												
International billing totaled $100 million or more												
7	Nethconsult, Netherlands	E	66	12	30	1	10	2	16	20	1	10
14	Fugro-McClelland NV, Netherlands	CE	87	15	40	0	5	0	15	25	0	0
16	NEDECO, Netherlands	E	100	5	0	1	41	4	37	1	1	10
25	DHV Beheer BV, Netherlands	E	48	15	10	15	10	15	16	10	5	4
International billings totaled $50 million to $99.99 million												
54	Euroconsult, Netherlands	E	100	0	0	0	5	0	0	0	0	95
International billings totaled $30 million to $49.99 million												
66	Ballast Nedam Construction International BV, Netherlands	EC	69	15	5	0	5	0	75	0	0	0
International billings totaled $20 million to $29.99 million												
91	Haskoning BV, Netherlands	E	38	0	5	0	45	15	25	5	5	0
96	Delft Hydraulics, Netherlands	E	44	0	20	0	30	0	45	0	5	0
98	NACO BV, Netherlands	EA	74	0	0	0	0	0	100	0	0	0
International billings totaled $10 million to $19.99 million												
111	de Weger Architects and Consulting Engineers, Netherlands	EA	36	5	0	0	35	5	25	0	0	30
International billings totaled $4.60 million to $6.99 million												
193	Witteveen + Bos Consulting Engineers, Netherlands	E	14	0	0	0	0	10	90	0	0	0
French Firms												
International billing totaled $100 million or more												
17	Bouygues, France	EC	92	9	9	9	18	18	18	18	0	0
20	TECHNIP, France	EC	68	0	91	7	0	0	0	0	0	2
26	SOFTRETU-SOFRERAIL, France	E	81	0	0	0	0	0	100	0	0	0
International billings totaled $50 million to $99.99 million												
45	Sogelerg-Sogreah, France	E	52	3	0	7	10	10	25	0	30	15
46	BCEOM French Engineering Consultants, Guyancourt, France	E	75	6	0	0	15	12	52	6	5	4
International billings totaled $30 million to $49.99 million												
73	Coyne et Bellier, France	E	74	5	0	0	69	0	4	0	20	2
International billings totaled $7 million to $9.99 million												
149	Sofremines , France	E	98	0	10	0	2	2	0	0	6	80
International billings totaled $4.60 million to $6.99 million												
170	GTM-Entrepose, France	E	8	25	5	0	20	0	50	0	0	0
International billings totaled $4.60 million to $6.99 million												
184	Europe Etudes Gecti, France	E	21	70	0	0	0	0	30	0	0	0

Key to Type of Firm: A=architect; EC=engineer-contractor; AE=architect-engineer; E=consulting engineer; EA=engineer-architect; P=planner

3.2 European Trends

In 1988, engineering services in European Community (EC) countries accounted for approximately 400 thousand jobs and a turnover of 20 billion ECU (approximately $C 27 billion). In Europe, on average, domestic revenue is generated equally between public and private sector clients. What is more interesting is that, public authorities and entities in the EC member states cover 70 percent of their needs in engineering services by in-house production[3] and only 30 percent is assigned to consultancy firms. If these public entities begin to contract out this work, it could result in substantial growth for the EC engineering services sector.

There are many important trends and issues affecting the European CE industry. The document *Panorama 93* provides a comprehensive overview of all industries in the European Community. It is the main source for the following observations.

- During most of the 1980s, the sector was severely hit by the decline of its traditional export market in developing countries. However, in the late 1980's this decline was offset by renewed Western demand and the emergence of intra-EC trade.

- EC consulting firms derive 70 percent of their revenues domestically and 30 percent from foreign sources, especially in developing countries. In 1987, intra-European trade was limited with American firms being more active in this area than European firms. Recently, with partnering activities such as MERGE[4], intra EC trade has been increasing. European firms are also increasingly active in overseas markets for civil engineering, such as the Middle East and Asia. So far this has not been negatively affected by the fact that bilateral and multilateral financing institutions are abandoning project-related forms of financial assistance. This applies also to the European Development Fund which is increasingly limiting its support for individual projects in favour of promotion of deliveries of materials and technological co-operation.

- Until the mid-1980s, most trade involving EC consulting engineering firms was with less-developed countries. For example, in 1986, less-developed countries accounted for 87 percent of the total exports of EC design services and for 76 percent of EC firms' contract awards. However, north to north trade has been developing steadily since this time. As of 1989, trade with developed nations accounted for 44 percent of EC design services exports and 44 percent of contract awards (up from 13 percent and 24 percent respectively). This is largely attributable to intra-EC trade which increased from 6 percent of EC design services exports in 1982 to 16 percent in 1989 and from 15 percent percent of EC foreign contract awards in 1982 to 23 percent in 1989.

- Trends such as stricter environmental regulations, rapid technological change, the building up of European transport networks, and the development of Eastern Europe suggest that prospects for the 1990s are promising for European CE firms. Many European firms are taking equity stakes or establishing branch offices to collect greater fee revenue from Eastern Europe. Many firms hold the view that Eastern Europe in the 1990's may offer returns similar to those in the Middle East market in the 1960's. The larger investments in

[3] Our understanding of the workings of the French industry suggests that there is a very close relationship between the state government, the financial community and the engineering industry. There are many instances of cross-ownership between these and other sectors. It may thus be difficult to segregate "in-house" production from "consultancy firm" production.

[4] In 1990, MERGE was formed to enable greater synergy by aligning firms from various European countries who can offer complimentary skills and an understanding of the legal requirements and procurement methods used in their home country. MERGE stands for Multidisciplinary Engineering Resources Group Europe and it now consists of 16 consulting engineering firms from 12 countries.

Eastern Europe are often supported with the financial guarantee backing of the CE firm's home country. Hotels and factories are areas of particular potential in the coming years in this region.

- In the civil engineering field, there has been a decline in demand since 1992 in most European countries. Nearly all countries in Europe have considerably reduced their investment budgets in order to reduce state indebtedness. This highlights the dependance of civil engineering activities on public expenditures for infrastructure projects. In France this decline is making itself felt mainly at local levels. Only the ongoing projects of a national scope have helped to prevent a major decline in overall demand. Special efforts in the field of new construction are being made principally in the countries with comprehensive plans for the development of transport. This is the case in Great Britain and France with new motorways, city ring roads, and the further development of the high-speed rail networks.

- Recent restrictions in Spain's budgets have led to what is probably a temporary slowdown in demand for transportation engineering. However, the linking of new route networks to the rest of the Spanish rail network, with its different operating standards, and to the European high-speed rail system will bring about a sustained demand for investment in this area. Spain's second national road plan will also stimulate demand for CE services.

- In the environmental field, a recent directive establishing European obligation to treat waste water in municipalities with more than two thousand inhabitants will stimulate demand in this area.

- The Dutch engineering industry continues to benefit from ongoing domestic work in water control and related fields. In 1991, the Netherlands industry experienced revenue growth of 25 percent over the previous year largely because of a multi-billion dollar infrastructure project, the Schelden Drainage Works in South West Holland.

- European road works and sewage disposal projects tend to be carried out by smaller firms (less than 50 employees), while construction of bridges, tunnels and shafts as well as extensive excavation works are typically conducted by firms with more than one thousand employees.

- Many European energy, petrochemicals, oil, gas and communications companies have embarked upon major programmes of investment, either by increasing capacity, rationalizing obsolete production units, or by extending infrastructure networks. Major programmes of investment also relate to protection of the environment and to improving the quality of life.

- It is notable that, in recent years, Japanese engineering companies (which are usually subsidiaries of major Japanese business groups) have consolidated their presence in Europe, particularly in Germany and Great Britain . These subsidiaries are playing an increasing role in European projects and, in many cases, are seeking European partners willing to share risks through forming consortia or joint ventures. Japanese engineering companies are also increasingly looking to European industry to supply equipment and machines or to provide assembly services. This is particularly true in the case of projects financed by European loans.

- Major technological trends in recent years have focused on computerised production control techniques, the organization of preventive maintenance and procedures for improving the quality of the industrial and urban environment. Particular emphasis has been placed on procedures for the removal of pollution from industrial installations.

- All the major mechanical and electrical engineering firms in the EC are active in the industrial engineering sector, and carry out a large part of their activities within the framework of large-scale industrial projects. Ansaldo, Fiatimposit and Nuovo Pignone (Italy), Mannesmann, Siemens and Krupp (Germany), Spie Batignolles, Alsthom and Air Liquide (France) and Fives Coil Babcock (UK) are among the notable firms in this area. Many of these firms are also active in other capacities, such as equipment production.

4.0 The Performance of Canadian Consulting Engineering Firms in the International Market

Perhaps the simplest measure of competitiveness uses the "share of world exports" as a proxy for the presence of competitive advantage in an industry. In other words, a nation that obtains a particularly high share of the world's export market in a given sector is deemed to be competitive in that sector. This definition is based on the view that it is export revenues that ultimately drive a nation's foreign exchange holdings, currency value, interest rates, and other economic fundamentals. In order to import desireable products, a nation and its citizens must have the foreign exchange required to pay for such products.

Canadian consulting engineers historically have done fairly well in the export marketplace. Indeed, as recently as 1988, Canadian engineers ranked second in the world in terms of export revenues - and this was a strong second to the United States. In recent years, however, the Canadian industry has slipped somewhat. It ranked fourth on the 1991 list and sixth on the 1992 list of world exporters of CE services, having been passed by the industries of the Netherlands, France, Germany and the United Kingdom. This chapter discusses these and related findings in more detail.

There are many reasons explaining Canada's relative decline in international success. Many of these are anecdotal reasons - without supporting statistical arguments - although they probably all contain an element of accuracy. These and other reasons are discussed in more detail in the concluding chapter of this report.

- ENR broadened its definition of design firms in 1989. In addition to design consultants (mainly consulting engineering services), ENR broadened its scope to include the design-related services (not design-build) of design-construct firms. This added some $2-3 billion worth of design billings and 67 new entrants to the top 200 tabulations. Most of the world's large design-construct firms are American and, as a result, this definitional change shed U.S. firms in the most positive light.

- Canadian firms have tended to not align as aggressively with other suppliers thus limiting their ability to capture large contracts. Canadian CE firms suffer from the overall weakness of the Canadian machinery and equipment sector - particularly when it comes to the export market - thus limiting their ability to "carry" or "be carried by" equipment companies on foreign projects.

- It is suggested that the Canadian CE community places a lower emphasis on marketing skills than the industries of competing countries.

- The Canadian government lacks the clout of a nation such as France or the United States in terms of its ability to support broad export market penetration efforts by Canadian engineering firms.

- Individual Canadian firms have undergone mergers during the period and may have thus lost some of their international market focus. This factor may therefore have only a temporary effect.

- Finally, and quite importantly, Canada lacks the international network of multinational subsidiaries spread around the world. This global network of American, Japanese, British

and other corporations often demand engineering services from CE firms with which the parent company is most familiar.

For these, among other reasons, Canadian firms appear to have declined in their export market success.

4.1 Canada's Overall Export Performance

The best measure of the performance of Canada's engineering industry in the international market is the annual survey of *The Top 200 International Design Firms* conducted by ENR Magazine. We have thus devoted some effort to assessing the findings of the past four surveys.

As illustrated below, Canada has shown the most significant decline in terms of the number of companies ranked in *ENR's Top 200 International Design Firms* list. The number of Canadian firms ranked among the world's Top 200 exporters has fallen from 11 in 1989 to 8 in 1992.[1] During a period when the U.S. has shown a steady 20 percent increase in its number of large international players, Canada has shown a decline of a similar amount (although note that this is partly due to a consolidation of some Canadian firms). France lost one firm from the Top 200 over this time period while the Netherlands maintained its number of Top 200 firms at eleven.

Exhibit 26: Number of Companies Ranked Among the Top 200 International Firms

	1989	*1990*	*1991*	*1992*
Canada	11	12	10	8
United States	67	71	78	80
Netherlands	11	11	10	11
France	10	10	5	9
German	19	16	14	16
British	19	25	20	20
Italian	11	8	8	6
Japanese	14	15	14	14

Source: ENR Magazine, various issues

Again, it should be noted that the Canadian industry was going through a reorganization during this time period with some significant mergers taking place involving the country's largest CE firms.

A similar pattern is shown for Canada in Exhibit 27. Canadian firms have suffered a $63 million (11 percent) decline in export revenues during the 1989 to 1992 period. The only other listed country that also registered a decline was Italy. In contrast, the United States registered a 90 percent increase in international sales, France a 76 percent increase and the Netherlands a 98 percent increase.

Canadian firms in the top 200 in 1989 obtained 26 percent more export revenues than Dutch firms and 84 percent more than the French companies. However, Canada's relative postion had shifted to a 76 percent and 7 percent deficit respectively three years later.

[1]The companies in 1989 were Lavalin, Simons, SNC, Golder, Monenco, Sandwell, Tecsult, Acres, Cansult, Hatch, and Dessau. The companies in 1992 were SNC Lavalin, Agra, Golder, Sandwell, Tecsult, Acres, Hatch, and Metchem.

Exhibit 27: International Billings of Companies Ranked Among the Top 200
($US million)

	1989	*1990*	*1991*	*1992*
Canada	594	510	612	531
United States	3229	3728	4154	6138
Netherlands	471	589	741	933
France	323	425	274	569
German	452	422	531	668
British	1182	1539	1948	1567
Italian	121	164	140	71
Japanese	257	285	317	307

Source: ENR Magazine, various issues

The shift in the competitive export positions of Canada, France and the Netherlands is further illustrated in Exhibit 28 which presents the average exports per firm. As shown, the growth in average export earnings of Canadian firms in the top 200 was 22 percent between 1989 and 1992. French and Dutch design firms, however, achieved growth rates in their export earnings of 97 and 98 percent respectively. It should also be noted that U.S. firms' export earnings grew at roughly three times the rate of Canadian firms' in the Top 200.

Exhibit 28: Average Exports per Company Ranked Among the Top 200 International Firms
($US millions)

	1989	*1990*	*1991*	*1992*	*Growth (3 yr)*
Canada	54	43	61	66	22%
United States	48	53	53	77	60%
Netherlands	43	54	74	85	98%
France	32	43	56	63	97%
German	24	26	38	42	75%
British	62	22	97	78	26%
Italian	11	21	18	11	0%
Japanese	18	19	23	22	22%

Source: ENR Magazine, various issues

As mentioned earlier, part of this decrease in Canada export earnings can be explained by internal matters having diverted firms' attentions from the export marketplace. The bankruptcy of Lavalin, the merger of SNC and some Lavalin assets, and the merger of Monenco and Agra affected the international efforts of these firms. There is no available evidence to suggest that the industries of other nations were affected by similar merger activity among the largest players, although this may be worthy of a more detailed investigation.

Canada's Export Performance, by Region

Exhibit 29 provides an indication of the geographic regions where Canada has lost the most ground. As shown, the largest Canadian declines have been in the African, Latin American, Asian and Middle Eastern markets where exports have declined by $91 million, $16 million, $77 million and $3 million respectively. On the other hand, Canadian consulting engineers have increased their sales in the United States and Europe since 1989, achieving increased exports of $36 million and $92 million, respectivley.

U.S. design firms over the period 1989 to 1992 increased their sales in every geographic market except Canada. American firms draw over $100 million in revenues from all regions and over $1

billion from three regions. Canadian firms draw over $100 million only from the U.S. and European market.

Exhibit 29: Top 200 Firms' Exports by Home Country and Export Region (1989 and 1992)
($US million)

	Canadian Firms		*U.S. Firms*		*Dutch Firms*		*French Firms*		*Total*	
Export Region	'89	'92	'89	'92	'89	'92	'89	'92	'89	'92
Middle East	25	22	437	1046	53	99	12	53	803	1626
Asia	150	72	889	1442	136	256	30	64	2017	2982
Africa	175	84	161	479	79	96	87	105	938	1223
Europe	13	105	1142	2347	107	263	18	123	1774	3691
United States	165	201	--	--	60	160	169	179	1034	1187
Latin America	63	47	233	657	34	48	6	43	444	1107
Canada	--	--	361	146	1	11	1	3	404	207
Total	594	531	3229	6138	471	933	323	569	7423	12045

Source: ENR, August 2, 1990 and July 26, 1993

The Dutch firms increased their sales revenue by a significant amount in every geographic region during the 1989 to 1992 period. Over the three years, they have made strong gains in the U.S. market. There does not appear to be any export market regions, with the possible exception of Europe, where Canadian engineering consultants are capturing market share at the expense of Dutch firms. French firms have shown particularly strong growth in the Middle East, Latin America, Europe and Asia.

Another interesting observation can be derived from Exhibit 30 by comparing the amount of international business obtained versus the amount of international business rendered by each region's home market. For instance, Canadian firms captured $531 million in international business in 1992 while the Canadian market provided $207 million in international business to the Top 200. American firms in the Top 200 international design companie captured over five times as much business abroad as their own home market rendered to foreign firms. This is significantly greater than the figure for Canada or Europe.

Exhibit 30: International Business Obtained Versus Rendered, by Country, 1989 and 1992

	Obtained ($US million)		Rendered ($US million)		Obtained/Rendered (ratio)	
	'89	*'92*	*'89*	*'92*	*'89*	*'92*
United States	3229	6138	1034	1187	3.1	5.2
Europe	3118	4668	1774	3691	1.8	1.3
Canada	594	531	404	207	1.5	2.6

Source: ENR, August 2, 1990 and July 26, 1993

Exhibit 30 also illustrates how the ratio of Obtained/Rendered has changed over the last four years. Canada, despite a decrease in exports by its top companies, is not rendering as large a share of its domestic market to imports (relative to the size of its exports) as it had in the past. The ratio of U.S. exports to imports is also moving in the same direction. This is probably a reflection of the weak state of the Canadian and U.S. economies rather than any increase in the competitiveness of the leading domestic firms.

The regional strengths and weaknesses of the major nations are further reinforced in Exhibit 31. As shown, six large American firms dominate the Middle East market, five American firms occupy the top five spots in the European market, and American firms also occupy eight of the ten ranks in

Exhibit 31: Top Ten by Region, 1992

Middle East - Top 10 billed $1.0 billion of $1.63 bil. total
1. Bechtel Group Inc., U.S.
2. ABB Lummus Crest Inc., U.S.
3. Dar Al-Handasah Consultants, Egypt
4. Brown & Root Inc., U.S.
5. CRSS Inc., U.S.
6. The Parsons Corp., U.S.
7. Day & Zimmerman Inc., U.S.
8. John Brown/Davy, U.K.
9. Nethconsult, Netherlands
10. Khatib & Alami Consolidated Enrg. Co., Lebanon

Asia - Top 10 billed $1.3 billion of $2.98 bil. total
1. Foster Wheeler Corp., U.S.
2. ABB Lummus Crest Inc., U.S.
3. Fluor Daniel Inc., U.S.
4. John Brown/Davy, U.K.
5. Bechtel Group Inc., U.S.
6. Maunsell Group, U.K.
7. Mott MacDonald, U.K.
8. Louis Berger International Inc., U.S.
9. Pacific Consultants International, Japan
10. Nippon Koei Co. Ltd., Japan

Africa - Top 10 billed $543 million of $1.22 bil. total
1. ABB Lummus Crest Inc., U.S.
2. The M.W. Kellogg Co., U.S.
3. Louis Berger International In, U.S. c.
4. John Brown/Davy, U.K.
5. The Badger Co. Inc., U.S.
6. NEDECO, Netherlands
7. Dorsch Consult. Ingenieur GMbH
8. SNC-Lavalin International, Canada
9. BCEOM French Engineering Consultants, France
10. Bechtel Group Inc., U.S.

Latin America - Top 10 billed $743 mil. of $1.11 bil. total
1. Fluor Daniel Inc., U.S.
2. John Brown/Davy, U.K.
3. ABB Lummus Crest Inc., U.S.
4. Jaakko Poyry Group, Finland
5. Bechtel Group Inc., U.S.
6. SNC-Lavalin International, Canada
7. The Badger Co. Inc., U.S.
8. TECHNIP, France
9. Louis Berger International Inc., U.S.
10. NEDECO, Netherlands

Europe - Top 10 billed $1.9 billion of $3.69 bil. total
1. Foster Wheeler Corp., U.S.
2. Brown & Root Inc., U.S.
3. Fluor Daniel Inc., U.S.
4. The M.W. Kellog Co., U.S.
5. The Badger Co. Inc., U.S.
6. John Brown/Davy, U.K.
7. Jaakko Poyry Group, Finland
8. Bechtel Group Inc., U.S.
9. ABB Lummus Crest Inc., U.S.
10. Nethconsult, Netherlands

U.S. - Top 10 billed $1.1 billion of 1.19 bil. total
1. John Brown/Davy, U.K.
2. Bouygues, France
3. Philipp Holzmann AG
4. Fugro-McClelland NV, Netherlands
5. AGRA Industries Ltd., Canada
6. Nethconsult, Netherlands
7. Golder Associates Corp., Canada
8. Sandwell Inc., Canada
9. Dar Al-Handasah Consultants, Egypt
10. Jaakko Poyry Group, Finland

Canada - Top 10 billed $165 million of $207.4 mil. total
1. John Brown/Davy, U.K.
2. Fluor Daniel Inc., U.S.
3. Brown & Root Inc., U.S.
4. Bechtel Group Inc., U.S.
5. CH2M Hill Cos. Ltd., U.S.
6. Dames & Moore, U.S.
7. Nethconsult, Netherlands
8. Foster Wheeler Corp., U.S.
9. Morrison Knudsen Corp., U.S.
10. Stone & Webster Engineering Corp., U.S.

Source: ENR, July 26, 1993

the Canadian market. The Canadian firms of AGRA, Golder and Sandwell all rank among the ten largest exporters in the American market, while SNC-Lavalin ranks among the largest firms in the African and Latin American markets.

The Dutch firm, Nethconsult, makes the top ten ranking in Canada, Europe, the Middle East and the United States, while the firms NEDECO and Fugro-McClelland are prominent in Africa and the U.S. respectively. Among French companies, Bouygues ranks second in the American market while Technip and BCEOM also appear on top ten listing in Latin America and Africa respectively.

Exhibit 32 illustrates which regions are enjoying the fastest growth in terms of revenues by the Top 200 design firms.

Exhibit 32: Growth in Regional Markets for the Top 200
(percent)

	1990	1991	1992
Canada	(33)	(7)	(17)
United States	9	13	(4)
Europe	32	18	34
Latin America	46	15	49
Asia	16	16	10
Africa	(6)	19	15
Middle East	51	8	24

Source: ENR Magazine, various issues

As illustrated, all markets except the United States and Canada have experience strong growth over the last three years. The Latin American market has experienced very rapid growth in 1990 and 1992 (40-50 percent in each year). Yet Canadian CE firms have actually seen their sales to this region decline during this period.

The decline of international revenues from the Canadian market is testimony to the stagnant state of the Canadian economy during recent years.

Canada's Export Performance, by Industry Segment

The examination of Top Ten results is quite useful, primarily because the Top Ten firms typically account for one-half or more of all exports in the given segment or region. As indicated in Exhibit 33, for example, the top ten hazardous waste firms account for 68 percent of all Top 200 export revenues while the top ten industrial engineering firms account for 79 percent of all Top 200 export revenues.

American engineer-construct firms dominate most segments of the CE export market. In industrial and petroleum engineering work, for example, U.S. companies occupy eight of the top ten positions. In the growing area of hazardous waste engineering consulting, American engineer-construct firms with design capabilities hold six of the top ten positions, while in the power segment such firms account for six of the ten largest export firms. (A listing of all American and Canadian firms on the Top 200 is provided in Appendix B.)

Canadian firms are represented in the category of hazardous waste (Golder ranks first), power (AGRA ranks fifth), and water where SNC-Lavalin is in third position among international engineering firms.

Exhibit 33: Top Ten by Market Segment, 1992

Buildings - Top 10 billed $432 million of $1.04 bil. total
1. CRSS Inc., U.S.
2. Bechtel Group Inc., U.S.
3. Dar Al-Handasah Consultants, Egypt
4. Ove Arup Partnership U.K.
5. Sufer & Sufer Corp., Switzerland
6. Nethconsult, Netherlands
7. Holmes & Narvar Inc., U.S.
8. Fugro-MClelland NV, Netherlands
9. Dorsch Consult Ingenieur GmbH Germany
10. Schmidt Reuter Partner Germany

Manufacturing - Top 10 billed $414 million of $568 mil. total
1. Fluor Daniel Inc., U.S.
2. Philip Holzmann AG Germany
3. Jacobs Engineering Group Inc., U.S.
4. Agiplan AG Germany
5. The Austin Co., U.S.
6. Lockwood Greene Engineers Inc., U.S.
7. Tractebel Egineering
8. Suter & Suter Corp., Switzerland
9. DHV Beheer BV, Netherlands
10. Bouygues, France

Power - Top 10 billed $347 million of $816 mil. total
1. ABB Lummus Crest Inc., U.S.
2. Black & Veatch, U.S.
3. Fichtner Consulting Engineers Germany
4. Lahmeyer International GMBH Germany
5. AGRA Industries Ltd., Canada
6. Morrison Knudsen Corp., U.S.
7. Burns and Roe Enterprises Inc., U.S.
8. Harza Engineering Co., U.S.
9. Sargent & Lundy, U.S.
10. Electrowatt Engineering Services Ltd., Switzerland

Water - Top 10 billed $340 mil. of $717 bil. total
1. NEDECO, Netherlands
2. Mott MacDonald, U.K.
3. SNC-Lavalin International, Canada
4. Dorsch Consult. Ingenieur GmbH, Germany
5. Bouygues, France
6. Nethconsult., Netherlands
7. Nippon Koei Co. Ltd.
8. Montgomery/Watson Inc., U.S.
9. Coyne et Bellier, France
10. Dar Al-Handasah Consultants, Egypt

Industrial/petro- Top 10 billed $4.5billion of $5.72 bil. total
1. John Brown/Davy U.K.
2. ABB Lummus Crest Inc., U.S.
3. Foster Wheeler Corp., U.S.
4. Fluor Daniel Inc., U.S.
5. Brown & Root Inc., U.S.
6. Bechtel Group Inc., U.S.
7. The N.W. Kellog Co., U.S.
8. The Badger Co. Inc., U.S.
9. Jaakko Poyry Group, Finland
10. The Parsons Corp., U.S.

Transportation - Top 10 billed $728 million of 1.66 bil. total
1. Louis Berger International Inc., U.S.
2. SOFRETU - SOFRERAIL, France
3. Bechtel Group Inc., U.S.
4. Maunsell Group U.K.
5. NEDECO, Netherlands
6. Dar Al-Handasah Consultants, Egypt
7. Pacific Consultants International, Japan
8. Nethconsult, Netherlands
9. Mott MacDonald U.K.
10. Parsons Brinckerhoff Inc., U.S.

Hazardous Waste - Top 10 billed $370 million of $544 mil. total
1. Golder Associates Corp., Canada
2. Nethconsult, Netherlands
3. Foster Wheeler Corp., U.S.
4. Fugro-McClelland NV, Netherlands
5. ERM Group, U.S.
6. Bouygues, France
7. Dames & Moore, U.S.
8. ICF Kaiser Engineers Inc., U.S.
9. Bechtel Group Inc., U.S.
10. Groundwater Technology Inc., U.S.

Sewer/Waste - Top 10 billed $247 million of $503 mil total
1. Foster Wheeler Corp., U.S.
2. Montgomery/Waston Inc., U.S.
3. Bouygues, France
4. Louis Berger International Inc., U.S.
5. Dar Al-Handasah Consultants, Egypt
6. Dorsch Consult Ingenieur CmbH Germany
7. Binnie & Partners U.K.
8. DHV Beheer BV, Netherlands
9. The M.W. Kellog Co., U.S.
10. Camp Dresser & McKee Inc., U.S.

Source: ENR, July 26, 1993

Dutch firms offer particular strength in water and transportation engineering (NEDECO and Nethconsult are ranked in both) and in building engineering (Nethconsult and Fugro-McClelland). The French engineering firm, Bouygues, is the only firm in the world to be ranked among the ten largest in four different segments (water, sewer, hazardous waste and manufacturing).

Appendix B illustrates where Canadian firms in the top 200 design companies worldwide are concentrating their efforts. Four of the eight large Canadian consulting engineering companies obtain 40 percent or more of their export revenues from the industrial/petrochemical market segments. Large American firms are obtaining 67 percent or better.

Among the ranked Canadian firms, only Golder and perhaps Agra appear poised to capture significant high-growth environmental revenues. Conversely, there are 15-20 U.S. firms with a legitimate presence in the hazardous and/or sewer/waste areas.

4.2 Canada's Performance at the World Bank

The World Bank data that is available in an organized manner does not distinguish engineering consultants from other types of consultants. Thus the figures encompass management, engineering, architectural, forestry and other types of consulting services.

As illustrated below, in 1992, Canadian consultants received $US 56 million worth of payments from the International Development Agency (IDA) and the International Bank for Reconstruction and Development (IBRD). This is approximately 8.3 percent of all consulting payments made by these two World Bank organizations during the year. The level is fairly consistent with previous years as, according to other World Bank data, Canadian consultants have received between $45 million and $54 million each year since 1987. In examining consulting contracts awarded to Canadian engineering consultants during the past five years, power projects, highway projects, and water supply rehabilitation projects are the areas of most success.

Exhibit 34: World Bank (IBRD and IDA) Payments to Supplying Countries for Foreign Procurement in 1992
($US million)

Supplying Country	Equipment		Civil Works		Consultants		Other Goods		Total Disbursements	
	Amount	*%*	*Amount*	*%*	*Amount*	*%*	*Amount*	*%*	*Amount*	*%*
Australia	34	0.8	+	*	10	1.5	60	1.3	104	1.0
Canada	57	1.4	4	0.7	56	8.3	74	1.6	192	1.9
France	360	8.9	93	15.8	92	13.7	198	4.3	743	7.5
Germany	414	10.2	62	10.5	49	7.3	322	7.0	846	8.5
Italy	193	4.8	75	12.8	4	0.6	114	2.5	386	3.9
Japan	618	15.2	15	2.5	29	4.2	185	4.0	846	8.5
Netherlands	94	2.3	12	2.0	22	3.2	118	2.6	246	2.5
Sweden	83	2.0	1	0.1	5	0.7.	60	1.3	148	1.5
Switzerland	135	3.3	13	2.2	14	2.1	328	7.1	489	4.9
United Kingdom	357	8.8	13	2.2	91	13.5	267	5.8	727	7.3
United States	582	14.3	24	4.1	108	16.1	678	14.6	1,393	14.0

Source: Canadian Procurement at the World Bank and Inter-American Development Bank, January 1993.

Canadian consultants leads the Netherlands in this area, although they trail France, the U.K. and the United States by considerable margins. The 8.3 percent share obtained by Canadian consultants is a very high proportion, particularly on a per-capita basis. It is also a very strong

result relative to the performance of Canadian companies in the other areas (equipment, civil works and other goods). Consultants account for 30 percent of all disbursements received by Canada from the two organizations versus 12 percent for France, 9 percent for the Netherlands, 13 percent for the U.K. and 8 percent for the United States.

In terms of total disbursements received, Canada ranked ninth on this list of eleven nations, while Canadian consultants ranked fourth. Another means of measuring this relatively impressive Canadian performance of consultants is as shown in Exhibit 35.

Exhibit 35: World Bank - Ratio of Consultants Sales to Equipment Sales, 1992

Canada	1.0
United Kingdom	.25
France	.25
Netherlands	.23
United States	.19
Germany	.12
Japan	.05

Source: Canadian Procurement at the World Bank, January 1993.

Canada has the highest ratio for all 11 nations by a considerable margin. (Australia is second with a ratio of around one-third.) This high ranking can be interpreted in two ways. First, that Canadian consultants have been enjoying success even without the help that equipment firms could bring through themselves capturing World Bank work. Second, that Canadian consultants have not been sufficiently helpful to Canadian equipment firms through specifying/recommending their products. In reality, both of these interpretations probably contain an element of truth.

Contributions made by the G7 nations to the World Bank in 1990 (the most recent year for which complete data is currently available) are as indicated below. The ratio of total World Bank disbursements received by a country versus the contributions made by the country are indicated in the middle column. The final column presents the ratio of World Bank disbursements received by a country's consultants versus the contributions made by the country to the World Bank.

Exhibit 36: World Bank Disbursements as a Share of Contributions, by Country, 1992

	Contributions ($US million)	Disbursements/Contributions (percent)	Consultants/Contributions (percent)
France	122	609	75
Italy	112	345	4
Great Britain	326	223	28
Germany	499	170	10
United States	847	164	13
Japan	731	116	4
Canada	250	77	22

Source: Canadian Procurement at the World Bank and Inter-American Development Bank, January 1993.

Exhibit 36 suggests that Canada ranks a distant last among the G7 nations in terms of disbursements over contributions. Work obtained by Canadian firms from the World Bank amounted to only 77 percent of Canadian contributions. Other countries, particularly France, Italy and Great Britain, exceed this ratio by several fold. Similar results can be seen in analyzing the results of all years from 1984 to 1990. During these seven years, French firms received 4.3 times the value of its contributions in the form of disbursements from the World Bank. France was

followed in order by Italy (3.4), the United Kingdom (2.7), Germany (2.0), Japan (1.4), the United States (1.2), and Canada (1.1).

By this same measure, Canadian consultants receive disbursements totalling 22 percent of our contribution. This is a fairly high ratio and its ranks Canada behind only France and Great Britain.

The overall World Bank figures indicate that France is the most favoured supplier to the World Bank. The French strategy and success factors may be worthy of a more detailed analysis by the federal government.

4.3 Canada's Performance at the Inter-American Development Bank

The Inter-American Development Bank (IDB) has a four-year lending program through to the end of 1993 of some $US 23 billion. Since joining the Bank in 1972, Canadian companies have received $0.71 in disbursements for every dollar contributed to the IDB by the Canadian government. This is based on cumulative contributions of $US 395 million and total disbursements of $US 279 million.

Exhibit 37: IDB Procurement Disbursements for Goods and Services from Selected Countries (1976 to 1991)

	Disbursements ($US million)	Percent of Total (percent)	Voting Power (percent)
Canada	247	1.2	4.4
United Kingdom	333	1.6	1.0
France	1142	4.8	1.0
United States	5188	23.2	34.7
Germany	956	4.6	1.0
Japan	947	4.5	1.1
Italy	1257	5.5	1.0
Sweden	241	1.1	0.2

Source: Canadian Procurement at the World Bank and Inter-American Development Bank, January 1993.

As is the case with World Bank contracts, Canadian firms taken as a group fair poorly relative to other G7 nations. Canadian companies received 1.2 percent of total IDB disbursements, which is approximately one-quarter the share received by French, German, and Japanese firms and one-fifth the proportion received by Italian companies. Canadian firms received around one dollar of business for each twenty dollars of business received by American firms.

As is the case with World Bank contracts, French firms appear to receive contracts considerably out of proportion with values received by Canadian firms. With regard to an organization like the IDB that lends over $5 billion annually, this is an apparent weakness that may be worthy of further investigation.

4.4 Canada's Performance at the Asian Development Bank

The Asian Development Bank (ADB) is involved in the procurement of around $US 2.5 billion worth of goods and services annually of which consulting services usually amounts to around $100 million. Canada's ranking as a supplier of consulting services has varied significantly during the past five years. In 1988, Canada ranked sixth by supplying about $US 3.7 million worth of

consulting services. This ranking changed to 16th in 1989, third in 1990, 11th in 1991, and third in 1992 with revenues of $US 9.3 million.

As shown in Exhibit 38, Canadian consultants do quite well in Asian Development Bank work having captured about 7 percent of the total consulting disbursements in 1992. This again comes despite a very weak performance by Canadian equipment firms. Canada captured only 0.8 percent of ADB goods and civil works procurement in 1992.

Exhibit 38: ADB Procurement Disbursements for Consulting Services (1992)

	Disbursements ($US million)					Ranking				
	88	89	90	91	92	88	89	90	91	92
Canada	4	1	10	2	9	6	16	3	11	3
United Kingdom	11	8	16	20	12	3	3	2	2	2
France	4	0	7	14	1	7	22	5	3	17
United States	13	7	10	11	3	2	4	4	5	12
Japan	23	2	3	4	4	1	12	11	9	10
Netherlands	3	9	3	3	7	8	2	10	10	5
Indonesia	9	16	17	11	27	4	1	1	6	1

Source: Procurement Statistics, ADB, March 1993.

4.5 Key Success Criteria for the U.S. Industry

The American consulting engineering industry has shown a significant increase in its international successes during the past five years. During the same period, Canadian firms have not experienced similar growth. Our discussions with certain experts on the U.S. industry (in the U.S. Department of Commerce and elsewhere) suggest that there are a few basic explanations for the success of U.S. firms.

- First, most U.S. firms involved in consulting engineering in the international market have been active globally for a decade or longer. Such a commitment is necessary - particularly in the design industries. This long-term presence eventually pays off.

- Second, American firms have increased their expertise in offering "one-stop shopping". The role of construction firms has become more important and U.S. construction firms are world-leaders particularly in terms of technology and project management expertise. The line delineating construction firms from CE firms has become quite blurred in recent years for the successful international U.S. companies. International clients, particularly in development agencies, are increasingly attempting to shift entire project responsibility to an organization capable of handling all aspects. American firms are grabbing these opportunities.[2] In contrast, Canadian CEs often have difficulty on major projects (such as the Fixed Link to Prince Edward Island) arranging a competitive and experienced full-service capability.

- Third, American firms have done very well in Europe (and more recently in Eastern Europe) in serving the large U.S. multinationals operating in these regions. The United

[2] It should be noted that a change in definition in 1989 by ENR Magazine allowing design/construct firms to be counted boosted the exports of the ranked U.S. companies from the $1-2 billion range in 1988 to the $3-4 billion range the following year. This is testimony to the significant impact of this "one-stop shopping" point.

States is the world leader, by a considerable margin, in terms of its levels of direct investment abroad. Such a position pays significant dividends for American service firms. The multinationals firms hire the consulting engineers they have worked with previously and, in effect, "pull" American engineering firms around the world.

- Finally, the simple fact is that economic opportunities in areas such as Europe (with EC 92), Eastern Europe and Asia (Thailand, Malaysia) have exceeded those in recession-plagued North America. American firms have been pursuing these infrastructure opportunities with an increased level of interest and aggressiveness.

The first point, above, also applies to Canadian firms. It is mainly the second, third and fourth points that explain the relative success of American firms. They have been successful in capturing turnkey projects - a market of growing importance. They have been successful in capturing contracts through their international contacts. In addition, they have placed an increased emphasis upon marketing, and they have derived greater benefits from a more demanding U.S. military and aid presence around the world.

5.0 Public Policy Considerations

Public policy impinges directly on the competitiveness of service firms through various measures such as taxation, minimum wage legislation, health care insurance and other legislated benefits/costs, industry regulations, export promotion, export financing, and training programs. Public policy also influences the competitive capabilities of service firms indirectly through its effects on client industries.

The scope of this assignment did not allow for any detailed examination of the impact of public policy measures on the competitiveness of the consulting engineering companies in the four countries of interest. As such, we have provided a selection of information that was both readily available and of some relevance to the engineering community. This includes some data from an annual survey by the *Professional Services Management Journal* (PSMJ) which compares the Canadian and U.S. tax situation for consulting engineering firms. Other data from the Department of Finance and the OECD provides some interesting insights, as does the annual World Competitiveness Report.

5.1 Competitiveness Framework

The simplest, and perhaps most reliable, measure of competitiveness uses the "share of world exports" as a proxy for the presence of competitive advantage in an industry. In other words, a nation that obtains a particularly high share of the world's export market in a given sector is deemed to be competitive in that sector. This definition is based on the view that it is export revenues that ultimately drive a nation's foreign exchange holdings, currency value, interest rates, and other economic fundamentals. In order to import desireable products, a nation and its citizens must have the foreign exchange required to pay for such products. (Canada's relative position in the export market has been discussed in an earlier chapter.)

Some of the more advanced thinking in the field of international competitiveness is reflected in the observations of Michael Porter and his "diamond of national advantage". This theory divides competitiveness factors into four groups, namely: factor conditions (labour, capital, infrastructure); demand conditions (sophistication of home market demand); supporting industries considerations (the existence of internationally competitive supplier industries); and firm strategy considerations (conditions governing how companies are organized, the nature of domestic rivalry). Firms that feature strong characteristics in these four areas will be internationally competitive. Conversely, it is unlikely that firms suffering from moderate weaknesses in a couple of these factors will be able to compete internationally in the long-term.

Porter has used his diamond analytical framework to make a number of competitiveness-related observations. We believe that some of these observation are particularly pertinent to the engineering industry.

- Competitiveness depends on industrial innovation and upgrading. Innovation is manifested in the form of new design processes and new marketing approaches, by serving ignored market segments, and by anticipating domestic and foreign market needs. Innovators are often outsiders from a different industry or country, or from senior managers who are new to an industry, or from diversification which brings new skills to another industry. Because almost any advantage can be imitated, relentless improvement is required in order to sustain

competitive advantage once it is achieved. While there are clearly some exceptions, in general Canada probably lacks innovative thinking in the marketing of engineering services.

- A basic rule for sustaining competitive advantage is that companies must adopt global strategies, selling goods and services worldwide, under its own brand name, and through channels which it controls. Given the need for local presence, professional service industries such as consulting engineering invariably have to relinquish some control of their "distribution channels". Nonetheless, the idea of global strategies and maximizing control over one's destiny hold merit for all companies.

- According to Porter, "change is opposed by powerful forces - past approaches become institutionalized in operating procedures, management controls, bricks and mortar, and company culture. This environment operates like an immune system which expels hostile individuals who challenge established thinking - and eventually innovation ceases". Individual Canadian design firms should examine the extent to which this culture exists in their company.

- Suppliers and end-users located near each other can interact and influence each other. The partial result can be a "cluster" of efficient inter-connected industries. As well, suppliers may sometimes enter the industry they've been supplying, or buyers may enter a supplier industry. This point may be more relevant to goods industries where the quality of the supply chain has direct impact on the quality and competitiveness of the final product. However, the aspect of this point that may be relevant to CE firms is that a cluster of CE, construction, geomatics, software, architecture, and management firms will be more likely to succeed than will each group operating in isolation. Canada has historically lacked such clusters - particularly in the export market.

- "Nations are competitive in activities that people admire and from which the nation's heroes emerge." Canada probably fairs reasonably well in this regard. Both industries, although particularly engineering, have historical aspects to them in terms of charting and building a new nation. Many engineering achievements are viewed by Canadians with pride (although mainly limited to civil projects).

- Companies often attribute the success of foreign rivals to "unfair" advantages - such excuses are unavailable vis-a-vis domestic rivals. In the Canadian case, many firms do seem to claim that foreign companies have advantages pertaining to tied aid money, government financing and other matters.

- Competing domestic rivals will benefit from constructive forms of government assistance, such as efforts to open foreign markets and investments in focused educational institutions. According to Porter, governments should not manage industry structure, protect the market too long, or insulate inefficient industries. Specialized apprenticeship programs, university-business research efforts, trade association activities and information channelling, and private sector investment are the things that governments should be encouraging.

- Tight enforcement of safety and environmental standards are positive in the long-term, as they pressure companies to improve quality, upgrade technology and precede their competitors in developing products and processes that will eventually be developed elsewhere. Canada's enforcement and stature in this field generally tends to lag that of many European countries (and of U.S. states such as California and New Jersey).

- "Companies should seek out pressure and challenge, not avoid it. Exceed the toughest norms, source from the advanced suppliers, treat employees as permanent to stimulate skills upgrading, study the best competitors, investigate emerging new buyers, bring some

outsiders into the management team, maintain relations with research centres and sources of talented people, and play an active role in forming clusters".

- "As it is better to grow internationally than dominate domestically, a foreign acquisition that can supplement home-based advantages and speed globalization is better than merging with leading domestic competitors." The recent Canadian mergers of SNC Lavalin and Monenco Agra would seem to go against this Porter credo.

The above general competitiveness observations may not be entirely applicable to the Canadian context or to the consulting engineering industry. However, in general, they offer suggestions and insights that help to position a nation and its companies. Efforts by all government, business and labour organizations should attempt to infuse the above types of characteristics into Canada's public policy framework and industrial strategies.

5.2 Canada's Competitive Strengths and Weaknesses

The World Competitiveness Report is an annual analysis of how national environments are conducive or detrimental to the domestic and global competitiveness of enterprises operating in those countries. The report assesses 371 separate criteria and is one of the most comprehensive studies available guaging the relative competitive abilities of industrialized nations. The criteria are based on both hard data obtained from international organizations and soft data obtained (via survey) from the perceptions of Senior Executives involved in day-to-day decisions in the various countries.

While the Report covers a broad range of criteria and provides a fairly comprehensive assessment, its findings must nonetheless be interpreted with caution. The data collection suffers from the same limitations that inhibit any international comparison - varying definitions, different information gathering techniques, dated material, and so on. As well, many of the criteria are based upon a survey of subjective opinion. The accuracy of this source thus depends upon the degree to which each respondent is informed and unbiased.

With these limitations in mind, we have selected 31 criteria that are particularly relevant to the design industries. The following table illustrates the competitive position of Canada, the United States, France and the Netherlands in these criteria.

Exhibit 39: Ranking of the Four Countries in Various Competitiveness Factors Relevant to the CE Industry
(out of 23 ranked industrialized nations)

Criteria	Canada	U.S.	France	Netherlands
Overall Ranking in Competitiveness	11	2	12	6
Value Added Characteristics	13	2	7	10
Capital Goods Capabilities	17	6	8	14
Industrial Production Capabilities	19	11	9	14
Exports of Goods and Services	18	5	6	12
Export Diversification	22	4	5	20
Foreign Direct Investment Abroad	9	1	5	6
State Control of the Industry	9	14	19	7
Managerial Freedom	7	5	16	20
Environmental Protection Legislation	8	19	2	20
Availability of Finance	2	4	13	1
Energy Consumption	17	16	3	14

Exhibit 39: (cont.)

Criteria	Canada	U.S.	France	Netherlands
Business Infrastructure	4	1	10	12
Business Productivity	11	2	4	16
Entrepreneurship	9	1	8	15
Management Use of Information Technology	8	4	12	10
Long-Term Orientation of Management	21	11	13	4
International Experience of Management	14	22	11	5
Corporate Performance - Price/Quality Ratio	15	11	13	7
Corporate Performance - Customer Orientation	7	1	16	8
R&D Expenditure	20	8	6	15
Business R&D Expenditure	17	13	12	18
Research Cooperation	17	5	14	8
R&D Personnel - Scientists and Engineers	6	1	9	17
Technology Management - Production Technologies	15	11	8	12
Technology Strategies	15	9	7	8
Availability of Skilled People	11	10	9	19
Brain Drain	16	2	4	7
Education	6	13	12	11
In-Company Training	22	16	13	7
Worker Motivation	11	4	14	7
Total	397	235	300	350

Source: World Competitiveness Report, 1993

The above table portrays Canada's performance as quite poor relative to the other nations. Indeed, using the rather crude method of adding together the various rankings shows Canada to finish a distant last among the four countries. The United States finishes first by a considerable margin. This finish is consistent with the overall performance of U.S. engineering companies internationally. For instance, eighty of the top 200 international engineering firms are American companies.

In these World Competitiveness Report criteria of most relevance to the engineering sector, the United States scores particularly well in:

- the value added of its economy;
- the diversification of its exports;
- its levels of foreign direct investment abroad;
- its business infrastructure and productivity;
- the entrepreneurial nature of its economy;
- the use of IT by its management;
- the customer focus of its businesses;
- the number of scientists and engineers in R&D;
- its low brain drain; and
- the motivation of its workers.

Each of these contribute to the competitiveness of a design industry such as engineering. The United States has a stronger industrial base. Its export efforts are more diversified. Its network of multinational affiliates is very broad. Its relative role in R&D, particularly for engineers, is very advanced. Its use of information technology is highly competitive. And so on.

In contrast, Canada scores very poorly in many of these same areas, including:

- export diversification;
- our capital goods and industrial production capabilities;

- the price-quality ratio of our industries;
- the technology strategies and lack of long-term focus in our companies;
- our R&D and training efforts; and
- brain drain, among other areas.

Until the nation's design industries and policy-makers address these shortcomings, Canada's industries will continue to operate at a competitive disadvantage. Firms will continue to export in isolation from other firms in the design-build-operate chain. Firms will continue to depend on the U.S. market for the bulk of our exports (although this need not necessarily be a bad trait). Manufacturers will disregard the benefits of hiring an engineering firm to help become more energy efficient or to raise its product quality. Canadian industries will continue to pursue short-term payoffs (such as purchasing a new computer system) at the expense of long-term profitability (such as engineering advice). These are areas which should be improved upon.

5.3 General Tax Comparisons

The subject of taxes is extremely complex and it can be quite misleading or inaccurate to attempt to summarize tax differentials in a simple table. The PSMJ survey data suggests that Canadian engineering firms have an advantage vis-a-vis their U.S. counterparts in the area of total taxes per staff. The total cost of taxation includes payroll taxes, property taxes, business licenses and income taxes per total staff. The figure does not include many miscellaneous taxes paid by firms, such as excise taxes on airline tickets, hotel occupancy taxes, gasoline taxes or sales taxes on purchases that are normally not recorded separately. Thus the true total tax cost would be higher than this reported cost.

Exhibit 40: Tax Comparison - Canadian and US Consulting Engineering Firms, 1992

	Total Taxes/ Total Staff *Average $C*	Local Taxes and Permits/ Total Staff *Average $C*
Multi-Region, U.S.	5611	706
Multi-Region, Canada	3240	419
Northeast	4679	559
Central Canada	3355	400
Mountain	7233	569
West	6025	861
Western Canada	3445	480

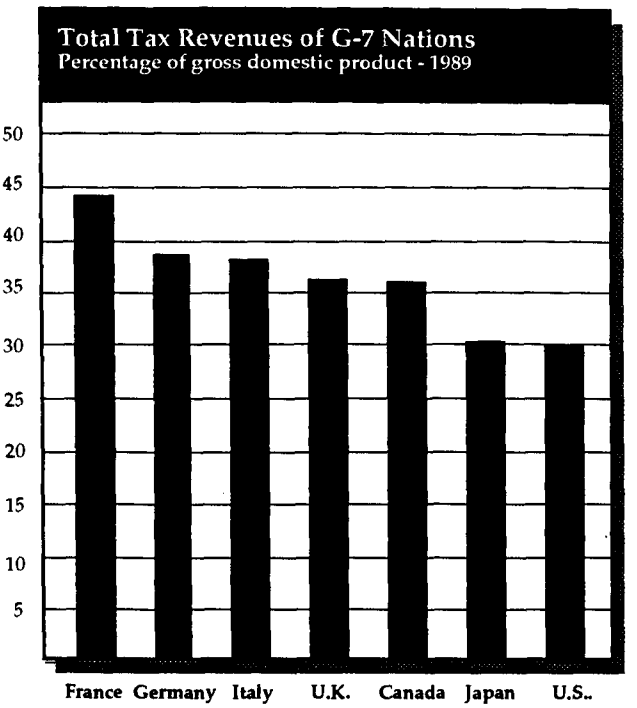
Source: Professional Services Management Journal, 1993 Industry Survey

The second column denotes the cost of local taxes and permits and includes property taxes, business licenses, and similar taxes. The data also suggests that Canadian firms, in all regions, have a competitive advantage in this area.

Exhibit 41 compares the total tax burden in the G7 nations, as a percentage of Gross Domestic Products. As shown, Canada's total tax revenues (federal, provincial and local) were approximately 36 percent of GDP - a figure lower than that existing in France, Germany, Italy and

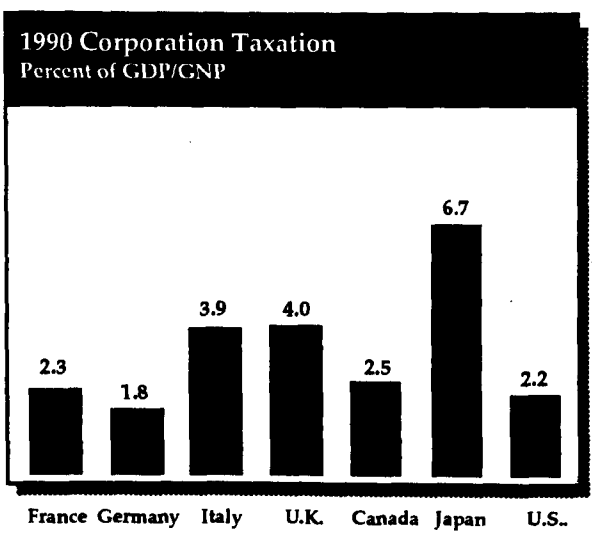
the United Kingdom. At around 30 percent, the United States and Japan had lower total tax revenues than Canada as a percentage of GDP.

Exhibit 41: Total Tax Revenues of G7 Nations



Source: Department of Finance (1992).

Exhibit 42: Corporate Taxation Levels in G7 Nations



Source: OECD

Exhibit 42 reinforces the findings of the previous exhibit. Canada ranks in the middle of G7 nations in terms of corporate income tax revenues. At 2.5 percent of GDP, Canadian levels are comparable to those of the United States and France and lower than those of Italy, the UK and Japan.

The above illustration seem to indicate that Canadian tax levels are not out of line with those of our major competitors. This is similar to the situation that exists in the R&D tax field.

Exhibit 43 reports the findings of a Conference Board of Canada study which examined the international competitiveness of Canadian R&D tax incentives. As illustrated, the Canadian corporate tax system provides greater overall incentives for companies engaged in R&D than does the tax system of any other major industrialized country examined. The United States ranked fifth in terms of its overall incentives while France was ranked fourth. This finding, showing a high Canadian position in R&D tax treatment, is reinforced in many other such studies.

Exhibit 43: Comparison of International R&D Tax Incentives

	1989 (Current Study)		**1981 (Previous Study)**	
Country	*B-index*	*Rank*	*B-index*	*Rank*
Canada	.657	1	.84	1
United States	.972	5	.95	2
Australia	.703	2	1.01	5
Japan	1.003	7	.98	3
Korea	.805	3	1.01	5
France	.813	4	1.02	6
West Germany	1.027	8	1.05	8
Italy	1.033	9	1.03	7
Sweden	1.04	10	.95	2
United Kingdom	1.00	6	1.00	4

Source: Conference Board of Canada, 1989
Note: The comparison assumes a Quebec corporate tax system for Canada and a California system for the U.S.

The R&D comparison data is particularly relevant to research-intensive industries. The consulting engineering industry is not particularly research intensive, although there are many firms that are quite active in the R&D field. As well, some engineering firms have extended their operations into fields such as geomatics where R&D spending is high relative to revenues.

5.4 Opinions Regarding Canada's Foreign Aid and Trade Financing

Our research for this project has generated a number of industry comments regarding Canada's aid/trade policies.

Linking Foreign Aid

Many interviewees conveyed the view that Canada requires a strengthening of the link between aid money and trade money. Company representatives feel that the Canadian government should enhance its financial and political support of Canadian interests overseas through such measures as directing CIDA and other government agencies to put pressure upon international aid customers to buy increasingly from Canadian firms.

In the opinion of one executive, in the late-1980s, CIDA made a decision to stop its support of infrastructure projects in favour of training and human resources related projects. This shift in emphasis has had a significant effect as CIDA had traditionally been quite active in introducing Canadian engineering and design firms to developing markets. Without this active government support, "Canadian firms have been left behind by competitors who had the support and active involvement of their governments". Simultaneous to CIDA's shift in emphasis, Canadian CE export contracts in developing nations started to decline. Combined with the recessionary constraint on firms, Canadian CEs cannot afford to spend the money necessary to cultivate the initial contacts.

The aid versus trade issue is always subject to controversy. The pendulum usually shifts toward an aid focus during more buoyant economic times and to a trade focus during slow economic periods. Given the current economic climate in Canada, and the probability that the affluent 1980s will not return for some time, there may be a need to examine this issue once again to determine whether a more aggressive aid/trade link is required at this time.

Another aspect of the same issue was raised by our interviewees. They suggested that Canadians are losing projects because aid money is spent too quickly and thus unavailable in most projects. The remaining commercial money is then no incentive for a customer "because all of our competitors offer some mix of free aid money in each proposal". Canadian firms have been told by prospective clients in several instances that they "are superior in many technical ways but that they cannot compete against free money". A solution advanced by these firms is the mixing of aid and trade money together and the resulting spread of aid money over more projects. "There should be no 100 percent aid projects. Limit the aid content to 20-30 percent of the deal. Canada will win more contracts as a result".

Trade Financing

Some Canadian firms interviewed during this assignment were also critical of the emerging role of the Export Development Corporation (EDC). The EDC is felt to be lagging relative to other development agencies in terms of its willingness to provide concessional financing (soft credits), interest-free financing or grace periods. These and related views are expressed in the *challenges* section of the following chapter.

6.0 Summary of Trends and Challenges Facing the Canadian Consulting Engineering Industry

This chapter summarizes some of the major trends and challenges that face the Canadian industry. Many of these have been alluded to in previous chapters. However, we have also obtained a number of opinions and insights (from industry interviews and literature review) that have not been mentioned elsewhere in this report. They are included in this chapter.

6.1 Key Industry Trends

There are four trends that we believe are of most importance to shaping the future direction of the Canadian industry.

1) Traditional Markets are Declining

For several decades, the engineering industry has prospered in building the Canadian nation and in developing international business. The CE sector designed and supported the building of Canada's infrastructure. Hydro dams, national highways, sewer and water systems, mining and forestry developments, and a host of other advances were made in large part courtesy of Canada's consulting engineering community. Internationally, the Canadian industry developed into one of the world's largest in terms of export revenues generated and it became an active agent for advancing and developing many economies around the world.

Indeed, one could formulate a strong argument suggesting that the CE sector became Canada's single most impressive industry in terms of contribution to the nation. It is domestically controlled. It is active in export markets. It remains state-of-the-art in many niche areas. Its educational and professional rigour is highly demanding.

However, in recent years, the industry has come under greatly increased pressures. In the resource sector, for example, many raw material and commodity prices are near 20-year lows. The emergence of low cost producers elsewhere in the world has been one factor behind this trend. When such a situation exists, it is evident that the revenues for all players in resource development, including consulting engineers, will be constrained.

In the infrastructure sector, to take a second example, Canada has in place an advanced and broad network of basic infrastructure. Municipal services, transportation networks, energy grids and the like are already established. Indeed, the most recent World Competitiveness Report produced annually by the World Economic Forum, ranked Canada's infrastructure as the fifth most competitive of 22 advanced industrial nations. Thus, while there remain some infrastructure opportunities, for the most part Canada's fundamentals are in place and highly competitive.

Consulting engineers have played major roles in each of these two areas. The recent and likely continued decline of domestic activity does not bode well for future CE revenues in these traditional fields. This is doubly true when one introduces other realities for CE firms such as almost five years of slow economic growth, high government deficits, and besieged manufacturing companies.

2) New Markets are Emerging

In harmony with these declining areas, however, there are also emerging fields that offer considerable potential for consulting engineers. In the environment, for instance, the annual Canadian market of $8 billion and the U.S. market of $130 billion is growing at 10-15 percent per year and brings with it an opportunity of major proportion for CE firms.[1] Many Canadian companies are already capturing shares of this market. However, Canadian firms will encounter strong competition in this field. As indicated in a recent U.S. industry survey regarding practice areas offering the most future potential, environmental engineering, private developments, and joint venturing are the three most-frequently mentioned areas.

With regard to the environmental market, key questions remain regarding who will control what future portions of which contracts. Will environmental audits, for example, be controlled by the accounting profession drawing upon outside technical engineering expertise or by the engineering profession drawing upon outside audit expertise where needed? Given the likely future importance of environmental audits, this is an important question.

Potential also exists for CEs to help manufacturing firms with their process engineering and productivity problems. This is a field of traditional weakness of Canadian CEs (with some exceptions) and, perhaps not coincidentally, Canadian manufacturers continue to encounter productivity problems. The fact that Canada lacks any substantial history/icons of process engineering success is one factor which hinders further penetration of the market. In a recent study for the Association of Consulting Engineers of Canada, we examined this opportunity in some detail and concluded that this is a crucial weakness for the CE industry, for the manufacturing sector and for the Canadian economy. The low productivity growth during the 1980s, and the relatively low technology implementation levels of Canadian manufacturers, have direct implications on the ability of these firms to compete in the rapidly globalizing economy. This in turn contributes to the type of job loss that Canada has witnessed in its manufacturing sector during the past five years.

According to the *Sloan Management Review*, many existing manufacturing processes meet the following characteristics. The processes have never been subject to analysis, measurement, or re-design and they have resulted from a series of ad hoc decisions made by functional units. They were developed before modern computers and telecommunications existed and they have not been analyzed with the capabilities of information technology in mind. They have no individual or sub-unit responsible for the entire process - namely for the integration of the processes of individual organizational sub-units. Viewed in this sense, the opportunity for CEs to solve a major Canadian problem is significant and substantial.

3) Customers' Priorities are Changing

The opportunities facing the CE sector are not simply related to a shifting customer base. There is also a shift taking place within each individual client group. Clients, whether they are a shoe manufacturer or a municipal government, are universally placing a greater emphasis on quality, service, and value-for-money considerations. All aspects of Canadian society are facing tighter revenues and budgetary constraints. In this respect, Canadian CE firms must examine whether they are emphasizing the cost/benefit aspects of their services, whether they are responding to the concerns of existing clients and whether they are capturing revenues associated with helping clients increase their quality?. If CE firms are not reflecting these shifts in their day-to-day operations, then it is likely that the industry will decline in importance.

[1] This information is derived from a recent Ernst & Young study of environmental market opportunities in the United States.

One implication of this shift is that CE firms may have to increasingly present a business case for their services. In other words, a marketing effort to a manufacturing firm may be centered around presenting the payback period - the time needed for productivity improvements to pay for the CE firms work. Similarly, an effort to sell environmental expertise may focus on the savings associated with reduced energy, reduced water processing, reduced waste disposal fees and other savings. Again, engineering economics and payback periods may be an integral part of the skill set required of Canadian CE firms if they are to remain internationally competitive.

4) International Development Policies and Priorities are Shifting

On the international front, Canadian consulting engineers have been at the forefront of infrastructure development projects for many years. Indeed, a simple review of the Directory of the Association of Consulting Engineers of Canada provides a good indication of the importance of this market. To take a few selected examples, Acres International has assisted in airport projects in Nepal, coal mine projects in Iran, farm management projects in Ghana, and hydro projects in Uganda, among others. ADI has handled wastewater projects in India and bridge projects in Jamaica. The large firms of Monenco Agra and SNC Lavalin have handled dozens of international projects in developing nations.

An ongoing shift of relevance to these firms is the aim of the Canadian International Development Agency to pass more project management intricacies and turnkey aspects over to the consulting engineer.[2] Other international development organizations are also increasingly demanding turnkey capabilities - one stop shopping - in order to reduce overhead, minimize bureaucratic interventions, and increase contractor accountability.

This shift suggests a greater demand for CE skills in the area of project management. The demand for CE interaction and partnership with other parties may be increased as a result of this international thrust. It is also possible that CIDA will be called upon to increasingly emphasize Canadian industrial benefits as part of its development funding. In this case, CE companies will be encouraged to partner with construction firms, equipment suppliers, systems integrators and other parties more than they have in past years.

Another issue of relevance to the international development question is that of project financing. The trend toward turnkey projects means that access to financing will play a key role in the ability of CE firms to capture the business. In this regard, Canadian CE firms must assess whether they have sufficient access to Canadian lending/guarantee institutions such as the Export Development Corporation and the major banks. Build-own-operate-transfer (BOOT) projects, where project operation and revenue generation pay for the project, will also become more important - a trend which reinforces the importance of project management, operation and contracting skills.

[2] Canada's CIDA is not the only national development body undergoing such a shift. In a March 1992 news article in *Het Financieele Dagblad*, a number of leading Dutch consulting engineers publicly criticized the way Dutch development aid policy was being implemented. Leading executives from firms such as Euroconsult, DHV and Haskoning lamented about inefficiencies and professional shortcomings in the Department of Development Co-operation (DGIS). These leading consulting firms are dependent on the agency for between 10-35 percent of their business revenues. The department provides funds and enables financing of development projects and aims to help Dutch firms maintain a competitive edge when applying for projects through bodies such as the Inter-American Development Bank.

6.2 Challenges Facing the Consulting Engineering Community

The Consulting Engineering industry has traditionally been one of Canada's strongest and most internationally competitive industries. For example, in 1988, the Canadian industry (by one measure) ranked second in the world in terms of its export success. However, in recent years, the Canadian industry has experienced a decline in its international market performance, particularly as measured in the annual survey of *ENR Magazine*. Canada has fallen from second (1988) to sixth (1992) place in its annual international survey rankings.

In the domestic market, there are indications to suggest that Canadian engineers are not as highly valued (relative to other occupations) as are engineers in, say, Germany or Japan. This relates to the broader question of how scientific occupations are perceived in Canada. As documented by the Ontario Premier's Council, there are startling differences between Canada and Japan - differences in areas that are integral to maintaining a competitive and innovative manufacturing sector. For instance, measured on a per-worker basis, Japan has about 4 times as many engineers as Ontario, while Ontario has 14 times as many accountants and 39 times as many lawyers as Japan. Canadian manufacturing firms also appear to have low in-house engineering and scientific capabilities - studies suggest that only around three percent of all Canadian manufacturing establishments employ research scientists/engineers.

Another guage of the role played by engineers in Canadian society is shown by the fact that, according to Revenue Canada, engineers receive average salaries around one-half those of lawyers, 44 percent of those of doctors, and two-thirds those of accountants. That information which we have for Germany[3] suggests that a chemical engineer makes 20 percent more than a bank accountant and 94 percent of that of a physician. A German petroleum engineer makes 14 percent more than an accountant and 90 percent of that of a physician. These figures suggest that engineering work is much more highly valued in Germany than in Canada.

This chapter discusses some of the reasons why Canadian engineering firms are facing increased pressures and some of the prescriptions that might help Canadian firms adjust to, and benefit from, the new global environment. Some of these prescriptions relate specifically to the engineering community while others relate to the Canadian economy in general. *They all affect the international competitiveness of the Canadian CE industry and they also all suggest possible areas of focus for the federal government.*

The challenges are classified into fourteen inter-related themes. The first six of these themes have been drawn from our review of existing material while the final eight are based upon our discussions with leading Canadian CE firms. In some cases, the challenges echo opinions that we have received and we may not necessarily support their accuracy. They may require further research and substantiation before being shaped into policy recommendations.

Challenges - as Derived from Our Review of Existing Material

1) Consulting Engineers Must Improve People-Related Skills

There is an increased emphasis in today's economy on such things as business process improvement and re-engineering. Both of these areas require those involved in delivering the expertise to have strengths in dealing with people. Traditionally, understanding and dealing with the many non-technical aspects of a process improvement or turnkey project has been an area of weakness of Canadian CE firms. In the view of a former *Engineering Management* professor at a

[3] Supplement to the Bulletin of Labour Statistics, International Labour Office, Geneva, 1992.

Canadian university, "fourth year engineering graduates don't know what's going on in the world". In this view, the progression from physics to statics to dynamics to structural mechanics, etc, which engineers follow through their courseload causes the student to place less value on business, marketing, human relations and the like. "Where architects set out to develop their liaison skills, engineers shunned this route. This is why the architect hires the engineer today, rather than the other way around".

Another area that requires people skills is that of technology implementation. Studies suggest that companies invariably under-estimate the costs, efforts and changes associated with making a successful implementation of technology. Companies fixate efforts on the technical aspects, while the human aspects (employees' perceptions, skills and biases) are neglected. Engineering firms must also not lose focus on the importance of handling the human aspects to succeed in this engineering field.

Our perception and experiences suggest that Canadian CE firms do not handle these aspects as well as CE firms in competing nations. Typically, CE firms in Japan and the United States have much closer relationships with equipment firms, computer companies, construction firms and other players. Indeed, in some cases there is cross-ownership between manufacturing companies and CE firms. In many international bids, American CE companies highlight previous and current relationships with equipment firms like Westinghouse and General Electric as a prime selling feature.

Some high profile researchers on management issues also reinforce this point, suggesting that manufacturing process engineering is becoming even more oriented to soft issues than in past years and that American firms are adjusting to this future reality. As stated by management guru, Tom Peters, former paradigms of "volume, scale economics, tonnage mentality, and capital" are being replaced by an American CE emphasis on "focused factory, engineers living in the plant, manufacturing as a marketing tool, industrial engineers on call, suppliers as a close part of the manufacturing team" and various other representative clichés.

A representative of a successful Canadian consulting engineering firm summarized this issue by stating that "engineers have to realize they work in five environments - social, economic, financial, legislative and physical - rather than simply the physical environment".

2) Consulting Engineers Must Improve Their Marketing Skills

Our experience in interviewing buyers of engineering services suggests to us that Canadian engineers are not particularly strong marketers. University curricula are highly oriented toward technical matters. Marketing, in particular, has historically been minimized by engineers as being an area that falls beyond the scope of the profession. Some interviewees have suggested that engineers fear that marketing will tarnish their image, and that human relations and people management matters receive minimum respect in what is largely a male-dominated mindset. Others have suggested that engineers construe "marketing" in a stereotypical form of door-to-door selling, rather than as the strategic exercise that it should be.

The degree of accuracy of these generalizations is difficult to quantify. What is not difficult to quantify is the fact that many people perceive this to be the case - and that perception is often as important as reality.

Many sources in previous interviews have suggested that CE firms lack a willingness to interact and liaise actively with other professions. Our examination of World Bank disbursements suggests that Canadian CE firms operate in isolation from Canadian equipment suppliers. Similarly, the anecdotal evidence obtained on the Dutch and French industries suggests that these companies are more active in teaming with governments, other CE firms, computer firms, and

equipment manufacturers. According to these sources, Canadian CE companies should be more aggressive marketers toward other CEs, equipment suppliers, management consulting firms, and systems integrators. In so doing, each of these occupations could be made fully aware of the benefits of having a CE firm as part of a systems integration project or export bid effort.

An interviewee in a previous study suggested that Canadian CE firms are addressing the above problem, although perhaps not in the best way. This interviewee stated that many firms have developed into two strata - the "business/marketing people" form one strata while "the techies" form another - to improve the firm's overall marketing capabilities. The optimal solution, in the view of this source, would be for "the techies" to also develop skills in the people, business development, and related areas.

With regard to this need for increased business development emphasis, some have suggested that Canadian CE firms do not capture a proportion of World Bank contracts commesurate with Canada's contribution. (Chapter 4 examines this international market question in greater detail.) It is evident from this analysis that Canada fairs poorly in terms of capturing World Bank disbursements, although this weakness is attributable primarily to the poor performance of Canadian equipment firms. Canadian consultants fair relatively well in terms of obtaining World Bank disbursements. However, Canadian CE firms are decreasing in terms of their share of overall international CE market share, according to ENR magazine.

3) Canadian Policy Must Enhance Canada's Implementation of Technology

In comparison to the United States, the Canadian industrial community displays a deficiency in its levels of implementing advanced manufacturing technologies (AMT). According to a Statistics Canada study, as shown below, Canadian firms in all size categories[4] lag their U.S. competitors in this important determinant of competitiveness. Generally, Canadian firms across all size categories are about 1.5 times as likely as American firms to have ignored AMT in their manufacturing facilities.

Exhibit 44: Percent of Manufacturing Establishments Using Zero Technologies

	Canada	U.S.
All Establishments	42	26
Small Establishments	50	33
Medium Establishments	19	11
Large Establishments	2	2

Source: Indicators of Science and Technology, Statistics Canada, 1989.

Segmented by type of AMT, Canadian firms also lag their American competitors in all areas. Canadian firms are only 80 percent as likely to have implemented CAD/CAE, 60 percent as likely to have implemented numerically controlled machines, 65 percent as likely to have implemented programmable controllers, and 55 percent as likely to have implemented local area networks. Exhibit 45 indicates the levels of use of seventeen technologies, by size of company. In this table of 51 cells, Canadian firms lead their U.S. competitors in only two areas. In the other 49 fields, American companies lead (a few ties) their Canadian competitors.

This characteristic impacts on Canadian CE firms in two ways.

- First, it reduces the potential business that can be obtained by CE firms that focus on industrial modernization and technology implementation. Firms that do not invest in

[4] Small establishments have 20-99 employees, medium have 100-499 employees, and large have 500 or more employees.

Exhibit 45: Use of Technology in Canadian and U.S. Manufacturing Establishments

This table presents the percentage (%) of small, medium and large manufacturing establishments in Canada and the United States which have implemented the particular manufacturing technology.

Technology (17 different types)	Percent of Establishments (by employees and technology)					
	20 to 99		*100 to 499*		*500 or More*	
	Canada	*U.S.*	*Canada*	*U.S.*	*Canada*	*U.S.*
Design and engineering:						
Computer aided design (CAD) and/or computer aided engineering	27	33	51	58	75	87
CAD output used to control manufacturing machines	9	15	19	21	34	42
Digital representation of CAD output used in procurement activities	4	8	12	13	18	31
Fabrication and assembly:						
Flexible manufacturing cells (FMC) or systems (FMS)	7	7	13	17	31	38
Numerically-controlled/Computer numerically-controlled machines	21	39	42	54	65	73
Materials working lasers	1	3	3	6	13	23
Pick and place robots	3	3	10	14	30	46
Other robots	1	3	9	9	38	37
Automated material handling:						
Automated storage and retrieval system (AS/RS)	1	1	3	4	11	26
Automated guided vehicle systems (AGVS)	2	1	1	2	12	14
Automated sensor based inspection and/or testing equipment:						
Performed on incoming or in process materials	4	6	14	15	30	44
Performed on final product	6	9	16	19	43	47
Communications and control:						
Local area network for technical data	11	14	24	28	51	62
Local area network for factory use	7	12	19	25	47	53
Inter-company computer network linking plant to subcontractors	8	11	21	24	38	44
Programmable controllers	16	25	42	52	76	82
Computers used for control on the factory floor	11	21	32	44	55	71

Source: Indicators of Science & Technology, Statistics Canada, 1989

modernization will be less likely to need outside engineering help. It also reduces the likelihood that Canadian CE firms would be hired to provide up-front advice before investing in new technology.[5] In so doing, it sets the Canadian CE industry back relative to its international competition.

- Second, it serves to minimize the level of interaction and synergy between the CE community and the manufacturing community. As a result, Canada brings fewer turn-key options and joint bids to foreign work. Relative to European and American competition, Canadian firms are more likely to bid on international work in isolation.

Both of these impacts weaken the Canadian consulting engineering community and constrain its ability to sell technology and process improvement expertise abroad.

4) Canadian Policy Must Increase R&D Spending and Relevance

Canada is one of the weakest performers of industrial research and development in the industrialized world. As indicated in a recent OECD study, Canadian industrial R&D levels are about one-third of Japanese, German and American levels. Canadian levels are about one-half of those in the Netherlands and France.

Exhibit 46: Industry R&D Spending Levels
(as % of GDP in 1989)

Japan	2.1
Germany	2.1
U.S.	2.0
Sweden	1.8
France	1.4
Netherlands	1.3
Canada	0.7

Source: OECD, Main Science and Technology Indicators, 1990

The 1993 World Competitiveness Report ranked Canada 17th of 23 industrial nations in business R&D spending and 20th in total R&D spending. The impact of this weakness upon the consulting engineering community can be described under three categories:

- First, it reduces the potential business that can be obtained by CE firms that focus on conducting R&D work on behalf of clients.

- Second, it serves to restrict the productivity of Canadian industry because, as stated by one process engineering authority, "companies that are inactive in applied manufacturing research tend to also have uncompetitive production processes simply because process issues can be better resolved if one understands the physical/chemical makeup of the product". As stated by the April 1991 Report of the National Advisory Board on Science and Technology, "without a solid base of R&D activity, firms will lack the skills and corporate culture to embrace continuous innovation and to adopt leading-edge techniques".

[5] This point also highlights an additional challenge for Canadian CE firms. There is considerable anecdotal evidence to suggest that Canadian manufacturers are more likely to purchase a tangible, touchable piece of advanced manufacturing equipment from a vendor than what they may perceive as the (less tangible) conceptual and advisory services from an engineering consultant. This tendency is potentially quite costly as it risks simply computerizing an inefficient process. It risks ignoring the savings and/or productivity improvement that could flow from an informed and relevant piece of advice.

Low productivity means low profitability which in turn means lower demand for CE services (and higher deficits for governments).

- Third, a nation with a culture of research and innovation is more likely to respect the role of engineering consultants and similarly inclined professions. As discussed earlier, this appears to be reflected in the relative salary comparisons of Canada and Germany.

It is evident from our analysis of the tax situation that Canadian R&D tax incentives are very competitive. Thus, rectifying this weakness does not mean providing further tax incentives. Rather, the solutions relate to many other issues, such as instilling greater product orientation to that R&D work that is done in Canada and addressing the problem of low R&D spending of foreign-owned subsidiaries.

5) Canadian Policy Must Encourage Investment by Foreign-Owned Subsidiaries

It is difficult to overlook the role that Canada's most fundamental economic development strategy has played in stunting the growth of the nation's engineering capabilities. The nation has relied, virtually since the 1890s, on a large infusion of foreign capital in order to develop its economy, particularly in the manufacturing sector.

The high-tariff policies adopted as part of Canada's *national strategy* essentially forced foreign manufacturing firms to establish operations in Canada to serve the Canadian market, as a means of avoiding high tariffs on finished goods. General Electric, Westinghouse, Otis, International Harvester, DuPont, IBM, John Deere, Ford, GM, Sperry, RCA, Chrysler, Goodyear, Ralston Purina, General Foods, and Pratt&Whitney are among the manufacturers which incorporated in Canada during the 1890-1929 period. Once established, these firms were thereafter protected from substantial foreign competition by Canada's high tariff barriers. The accumulation of retained earnings by these firms, combined with the influx of other foreign-owned subsidiaries mainly during the 1950s and 1960s, meant that, by 1963, about sixty percent of Canada's manufacturing industry assets were foreign-owned. The current level is around 50 percent.

The influx of foreign capital brought with it certain benefits (high living standards, quicker access to parent company technology), although these benefits were most pronounced in a closed and insular world trade environment. The downside of the strategy - one which has become most evident in the open and competitive trade environment of the past 15 years - is that Canada developed small-scale manufacturing facilities that relied heavily on imported parts and components and that largely ignored export markets.

There is some Statistics Canada evidence, albeit dated, that suggests that foreign-controlled firms have an import propensity (imports/total sales) that is approximately double that of Canadian-controlled firms. A firm with a high import propensity relies extensively on imports and adds only limited value to these imports. A firm with a low import propensity adds, relatively speaking, a high amount of value within Canada. Statistics Canada does not compile import propensity information for services (the above estimate refers strictly to goods) although there is a body of anecdotal evidence suggesting that the branch plant element of the Canadian economy either relies upon parent company in-house engineers or engaged CEs used by parent companies when requiring outside CE expertise. This may stem from explicit firm policy or from "procurement managers being inclined to play it safe" by purchasing through proven channels. If a plant manager in, say, Mexico requires some outside engineering help, he or she will often speak with parent company contacts for directions and/or suggestions regarding who to hire.

The impact of the branch plant syndrome upon Canada's R&D performance is also strongly negative. The automotive industry situation in Canada provides an interesting illustration of this point. In 1987, the Canadian auto industry (parts and assembly) spent about 0.3 percent of sales

on R&D. According to OECD statistics, this level is approximately one-tenth of the industrialized country average for the auto industry. An adherence by Canada to these average OECD figures would see Canadian automotive R&D boosted from approximately $100 million annually to $1 billion annually. Such increases would stimulate demand for technical researchers and developers and would in turn increase Canadian capabilities in the industrial engineering field. However, traditional practices in the industry are that R&D spending is concentrated in Detroit or other locations dictated by head office. Thus, through no particular fault of their own, Canadian CEs would be totally shut out of this potential market niche.

A similar story could be told in the machinery and equipment sector, in the pharmaceutical sector, in the computer hardware sector, and in any other sector where foreign control is high. These industries all tend to spend lower amounts on R&D in Canada than in their home country and they arguably also provide less support to the Canadian engineering industry through procurement.

The above criticisms do not exclusively pertain to the foreign-controlled segment of our economy. Many Canadian-controlled industries also suffer from a lack of investment, a lack of R&D, and a lack of value-added. A long-standing criticism of Canada's industrial practices concerns the low value-added that is often applied to our resources and manufactured product. The common practice of shipping lumber rather than wood products, or raw fish rather than fish products, means that less processing is conducted in Canada than might otherwise be the case. This weakness has clear implications for the demand for Canadian engineering services.

6) Accreditation and Education Bodies Must Adjust.

While individual consulting engineering firms must respond to the challenges and opportunities facing them, it is equally important that the surrounding infrastructure also adjust. Regarding the responsiveness of institutions and accreditation bodies, we believe that the following observations are of relevance to the continued competitiveness of the Canadian CE community.

a) One interviewee, in addressing the question of how to best develop Canadian engineering capabilities, suggested that the educational development and licensing requirements for an engineer should encompass the following four areas:

- Business organization issues such as evaluation and compensation, training and human resource development, organization structures, administrative staff roles, etc;
- Product development issues such as methods of generating new ideas, anticipation of customer expectations, evaluation of technology, reduction of lead and cycle times, etc;
- Delivery process issues such as competitive assessments, relative cost and price positions, and market concentration and segmentation; and
- Quality/Strategic issues such as leadership marketing, emphasis on quality, product and service reputation, etc.

b) The limitations of engineers on the "soft side" have been discussed in the public domain for many years. In recent years, some academic institutions have introduced business and "soft side" courses as a mandatory part of their engineering curricula, although the impact of this trend is unclear. For instance, in the case of the University of Sherbrooke, it is still possible to complete the engineering program without having taken a "human relations" course. Furthermore, the one mandatory engineering economics course and the two soft side courses (human relations or administrative principles, engineers in society or ethics in engineering) are not taken until the third year when pre-conceived notions/biases against learning softer skills may have already been established.

c) Interestingly, our conversation with a provincial Association of Professional Engineers - the accreditation body - revealed a certain sense of frustration regarding the "soft side" question. The source stated that the issue of soft side accreditation had been "talked about for ages" and was "of great concern to the accreditors", although not much had been accomplished in the area.

The accreditation body has discussed the concept of pre-engineering (as in pre-meds and pre-law) wherein a Bachelors Degree (or 1-2 years) might be first required before formally entering the engineering program. The body has also discussed the possibility of adding another year, and additional accreditation recognition, in order to better address economics, marketing, humanities, and other fields. In each instance, the body has encountered what it described as "considerable resistance" from the university community and from the umbrella organization - the Canadian Engineering Accreditation Board.

The professional engineer exam, which is currently written in most provinces by engineering graduates with 2 years of engineering work experience, does not address any technical or humanities matters. It addresses solely matters of liability, legalities, ethics, and professional conduct.

Challenges - as Derived from Our Discussions with Canada's Leading Engineers

We have supplemented our research of existing documents with lengthy discussions with a small selection of Canada's leading engineering firms. The points that follow summarize the challenges facing Canadian consulting engineering firms in the eyes of these people. They primarily reflect the views of two of Canada's leading engineers. The government may wish to investigate some of these views in more detail in order to substantiate or disprove them.

7) The Recession is a Major Challenge for Canadian CEs

The most significant challenge facing CEs at present is simply the recession that has plagued many of the industrialized nations. The growth of the consulting engineering sector is linked closely with overall economic growth because economic growth ensures that there is ample money to pay for large infrastructure projects, among other activities. Economic slowdowns reduce the amount of infrastructure work, they reduce the monies directed toward international development projects, and they serve to enhance the levels of international competition and price cutting.

The economic slowdown in Canada has been more severe than that in other nations for one main reason. A significant restructuring of Canada's economy has been taking place concurrent with the recession. Many companies, induced by the Free Trade Agreement and other factors, have been re-evaluating the focus of their Canadian operations. This is particularly true of the substantial foreign-owned element of Canada's manufacturing sector.

The result has been the loss of several hundred thousand jobs - permanently - in the manufacturing sector. This loss filters through the economy, worsening government finances and delaying infrastructure modernizations, among other impacts. The effect upon the CE sector was quite direct - bankrupting the nation's largest firm, forcing consolidations, and tightening CIDA funding, among others. Many Canadian CE firms have unfortunately spent the past 3-4 years in "survival mode" rather than in a significant international development and growth mode.[6]

[6] The recession has also negatively impacted the U.S. domestic market for consulting engineering services. As indicated in a recent industry survey, the response of U.S. consulting engineers to the recession has been (in decreasing order) an expansion of marketing activities, a reduction of overhead costs, a reduction in personnel and a diversification of services. Many firms have implemented a combination of these responses.

8) Canadian Government Trade Support and Focus is Weak

Some Canadian firms are quite critical of the weak support that has been accorded to exports of CE services. Trade Officials and Ministers have been criticized by the Canadian industry as offering no significant support (aside from verbal exhortation) for such exports. In the view of these firms, the national effort lacks the focus and prioritization necessary to succeed in international markets. There is a sense that the federal government has been unwilling to support strategic areas of the economy. Where Japan has supported heavy industry, automobiles, consumer products and electronics in focusing on a plan to grow its economy, the Canadian government has been reluctant to support priority areas. "Traditional Canadian policy has been to provide a minor amount of help to everyone and therefore end up helping no one."

9) Canadian Governments are Too Reluctant in Tying Aid to Trade

Many engineering firms are also of the view that it is time for Canada to strengthen its commitment to link aid money with trade money. As expressed by one firm, "we must abandon a policy of being Boy Scout to the world while we continue to lose jobs". In this view, the Canadian government should enhance its financial and political support of Canadian interests overseas. This entails encouraging CIDA and other government agencies to place greater pressure upon international customers to either buy increasingly from Canadian firms or face an elimination of funding.

In the opinion of one executive, in the late-1980s, CIDA made a decision to stop its support of infrastructure projects in favour of training and human resources related projects. This shift in emphasis has had a significant effect as CIDA had traditionally been quite active in introducing Canadian engineering suppliers to developing markets. Without this active government support, Canadian firms were left behind by competitors who had the support and active involvement of their governments with customers. Simultaneous to CIDA's shift in emphasis, Canadian CE export contracts in developing nations started to decline. CIDA funds are elapsed earlier in the year. Combined with the recessionary constraint on firms, Canadian CEs cannot afford to spend the money necessary to cultivate the initial contacts.

The aid versus trade issue is always subject to controversy. The pendulum usually shifts toward an aid focus during more buoyant economic times and to a trade focus during slow economic periods. Given the current economic climate in Canada, and the probability that the affluent 1980s will not return for several decades, if ever, there is a need to shift Canada's policies toward a more aggressive position. The view expressed by our sources suggests that Canadians are losing projects because the aid money is spent too quickly and thus unavailable in most projects. The remaining commercial money is then no incentive for a customer "because all of our competitors offer some mix of free aid money in each proposal". Canadian firms have been told in several instances that they "are superior in many technical ways but that they cannot compete against free money". A solution advanced by these firms is the mixing of aid and trade money together and the resulting spread of aid money over more projects. "There should be no 100 percent aid projects. Limit the aid content to 20-30 percent of the deal. Canada will win more contracts as a result".

10) Canada's Trade Financing is Not Competitive

Canadian CEs are also less than praiseworthy when discussing the emerging role of the Export Development Corporation (EDC). In their views, the EDC "is starting to act like a conservative, Canadian bank. The countries on EDC's Open-Market list have been decreasing in recent years. This ensures that Canadian firms will be discouraged from seeking contracts from many companies because the EDC will not even look at the financing."

The EDC is felt to be lagging relative to other development agencies in terms of its unwillingness to provide concessional financing (soft credits), interest-free financing or grace periods. "EDC put all of its money from the Canada Account into two huge projects with a limited chance of proceeding. Other applicants are then refused on the basis of all money already being alotted". Regardless of the objectivity of these particular remarks, there is a prevailing sentiment that Canadian CEs are losing projects on financing grounds.

The limitations attributed to the EDC are in fact most legitimately attributed to the federal government. Requests for low-interest financing policies or grace periods must be approved by the Treasury Board and the Finance Department. Such requests would increase the federal government's exposure and risk. Thus, while the mechanisms are in place for the Canadian government to offer competitive financing to match countries like France or Japan, the key departments are being criticized for an unwillingness to offer such assistance.

A suggestion was also advanced that Trade Officers who work to advance Canada's efforts should be shifted toward a bottom line orientation similar to that existing in Japan. In this sense, officers would tabulate not how many contacts they helped establish but rather how many contracts they helped Canadians sign and how many jobs they helped create in Canada. Remuneration and advancement should then be partly based on these criteria.

The federal government may wish to investigate these sentiments in more detail. They were advanced by some of Canada's leading international engineers.

11) Canada's Weak Equipment Sector Hinders Export Efforts

A further limitation expressed by CEs, and one that we discussed in Chapter 4, is the growing importance of integration. A nation, and its design firms, should be able to meet the equipment and goods demands that may arise from particular international projects. Most large projects increasingly demand that an engineering company organize and manage all elements of the project. The customers want "one-stop" shopping and will reward the firm that can provide such comprehensive service.

The weakness of the Canadian manufacturing sector, particularly in capital goods and equipment, presents a disadvantage for Canadian CEs pursuing export contracts. The importance of this sector is perhaps best described in Panorama 93, a directory examining European markets. "Given that engineering services frequently determine the choice of material and equipment to be used in a project, the strategic importance of the engineering sector exceeds by far its small share of the construction industry. Engineering services thus represent less then 5 percent of the construction industry but the economic significance of the sector is far more important. These services indeed play a crucial role in the process of investment and tend to forge forward and backwards linkages in national economies. As they set the techno-economic specifications of investment projects, and determine both the civil engineering part as well as the materials and equipment to be used, engineering services fix the technology dimension of the investment. They thus play a vital role in the diffusion of new processes, materials and technologies throughout the economy and constitute an important link between R&D and production. Engineering services are a crucial determining factor for efficiency, productivity and competitiveness."

Without strong progress in Canada's capital goods expertise, the truncated nature of the Canadian economy suggests that Canadian CEs may have to increasingly link up with offshore equipment suppliers.

12) Canadian CEs Must Build on a Domestic Market Base and Expertise

In order to succeed internationally, whether in a service sector or as a manufacturer, it is important that one have a domestic base of strength. Such a base provides the revenue and critical mass necessary to launch an international penetration effort. As stated by one CE, "you can only be a strong competitor internationally if you are on the leading edge of your domestic market".

One of the Exhibits presented in Chapter 4 provides an indication of the fact that Canada's domestic CE market is approximately twice as dominated by imports as is the case with our major competitor's market. Foreign CEs (ranked among the top 200) capture $207 million in Canadian revenues while foreign CEs capture around $1.2 billion in American revenues. Given markets that traditionally differ in size by a factor of ten, this is a clear indication that Canadian firms have a considerably smaller share (compared to the U.S. situation) of their own market.

While major Canadian hydro developments, for instance, have helped some major Canadian CEs to develop into international players, there are not many other sectors where this is the case. The manufacturing sector is dominated by foreign owned firms who arguably either shun the expertise of CEs or they purchase it through parent company channels. As a result, in this field, few if any Canadian firms have the resources or expertise to compete internationally.

13) The Growing Private Orientation of International Work Means Greater Marketing Costs

The type of international client for CE work has changed quite significantly during the past five years. In the early-1980's, a large majority of international CE work was conducted for the development banks and/or national governments. In the late-1980s, the clientele for such services shifted to the private sector as governments and quasi-government agencies could no longer finance projects to the same degree. In the case of the National Malaysian Highway project, for example, a corporation was formed to build and operate the highway. The project involved no public money and will be wholly financed by the corporation through user fees.

The international environment facing CEs today is one of an increased private sector orientation of infrastructure projects, reduced funding of CIDA, minimal funding of External Affairs, and an aversion of EDC toward providing low interest or other forms of risk financing. Yet, at the same time, the task of developing business and contacts has become more costly. When the market was dominated by government funded projects companies needed only to cultivate a few contacts. In the current environment, firms may have to cultivate several dozen contacts and devote considerable time and effort establishing the necessary business relations. Such efforts cost money of a magnitude that rules most Canadian firms out of the game.

14) Canadian Efforts Lack Coordination.

Canadian trade efforts also require better coordination. As a trading nation, Canada relies to a very large extent on the U.S. market and on natural resource exports. With some exceptions, Canada's trade emphasis in other segments and regions is relatively weak. It has been suggested that the export orientation of Canadian CE firms is particularly weak during good economic times when domestic markets (infrastructure and resource development projects) are more appealing.

By contrast, France and Holland have a well developed international presence in many fields and regions. France is an acknowledged expert in presenting a coordinated team of government, industry and financial players. French policies also routinely tie aid to trade and will use every influence of the government to advance French interests abroad. The British are similarly adept at ensuring that there is only one British bidder for each international project. Through a combination of influence and pressure, the British government encourages the industry to present a united front

on the global scene with no external rivalry. Canada, by contrast, often has 3-4 bidders competing for the same project with the result that they end up splitting Canadian support.

The United States has a very similar structure to Canada's consulting engineers and also has a history of being inward looking. However, the American approach differs from that of Canada in some key respects. The U.S. government, for instance, often uses its political and military muscle to fight for American business interests. American CE firms do very well in markets that have benefitted from U.S. military intervention or assistance. The United States also has a considerable advantage through its network of multinational companies. As stated by one interviewee, "American multinationals hire American engineers. If an engineer helped build a state-of-the-art mining facility in Utah, then you will call them to do the same project for you in Chile".

The Canadian industry could probably benefit from a more coordinated "team" approach to many foreign projects.

Appendix A

The Comparative Tax Situation

Appendix A: The Comparative Tax Situation

One of the most significant expenditures related to a foreign assignment are taxes. Depending upon the company's particular tax policies or business structure, taxes at both the personal and corporate level must be addressed.

The Netherlands, France, United States, and Canada all provide different rules regarding the taxation of individuals and corporations that undertake work in a foreign country. In this section we will address how each respective country taxes both the individuals assigned to work in the foreign country and the corporation carrying out the contract in the foreign country. Our objective will be to identify how each of the countries provide either incentives or disincentives to undertake contracts in a foreign country.

In a subsequent section we will also address the tax incentives provided in the Netherlands, France, United States, and Canada to perform research and development activities in each respective country. Each of the countries provide different research and development tax incentives which could influence the costs which a company in each respective country would be required to charge in a proposal in the foreign country. In other words, if research and development costs 10¢ on the dollar in country 'X' but 40¢ on the dollar in country 'Y', the competitiveness of a company in country 'X' in enhanced when costs are included in the bid for the assignment.

It is not possible to arrive at a general conclusion regarding which nation provides the most generous tax treatment to its industries and workers. For instance, the U.S. allows expatriate workers an up-front exclusion of $70,000 of foreign earned income from U.S. taxable income, while the Canadian system provides an overseas employment exemption tax credit. Thus, the U.S. approach may be more favourable for high income earners while the Canadian approach may be more attractive for lower incomes. Further complicating the issue is the fact that the U.S. requires a longer period of overseas employment before qualifying for this treatment.

In the R&D tax field, Canada provides R&D tax credits that lower the effective tax rate and also allow a faster write-off than does the United States. However, it is possible that these incentives are not adequate to compensate for such facts as Texas having a zero percent corporate tax.

In the overall corporate tax area, Canada has a general corporate tax rate of around 44 percent (this includes the provincial rate) of taxable income while the American rate is around 35 percent plus whatever the particular state rate may be. The state tax is deductible when arriving at the federal tax. However, what appears to be a slight U.S. advantage overall could disappear depending on the lower rates that apply in each country to smaller companies.

If the federal government desires a more detailed assessment of how Canadian and American (or European) design firms compare, it would be necessary to study particular scenarios incorporating company size, region, write-offs and other variables.

Taxation of Expatriates

When a company undertakes a foreign assignment, one question which must be addressed is the taxation of the employees of the company both in the foreign country and in the home country. Canada, the United States, France and the Netherlands each provide different tax treatment of individuals residing abroad and provide different tax incentives to their expatriates. We will review the tax treatment of expatriates in each of the four countries and attempt to identify some tax planning opportunities available to expatriates in each country.

1) France

(i) Income Tax

The basis on which an individual is liable for French tax will depend on his residence status. Residents of France are taxable on their world-wide employment income wherever paid or earned, except if relief is available under a Tax Treaty. Non-residents are subject to French income tax only on their French source income. Therefore, if an employee was transferred on a foreign assignment, it would be necessary for him/her to demonstrate that they have severed their ties with France in order to avoid taxation of income in France. Under French internal law a person will be considered as a French tax resident if one of the following four conditions is fulfilled:

(i) The person has his domicile in France. In general the domicile will be the place in which the person and his family normally live (the habitual place of residence).

(ii) The person's principal place of residence is in France.

(iii) The person exercises a professional activity in France unless the activity exercised there is secondary.

(iv) The person's centre of economic interest is in France. The centre of economic interest is the place in which the person concerned has made his main investments, from which he administers his assets, or more generally from which he receives most of his income.

The tax year in France is the calendar year and the taxable income of individuals is determined at the family level taking into account the combined income of husband, wife and any dependent children. Individuals are taxed on income including capital gains, net worth, and various municipal and local taxes.

Personal income tax is computed using a procedure known as the family coefficient system. It produces an effect similar to the income-splitting provisions applicable to married couples filing joint returns in the United States in that a couple can benefit from the progressive tax rate structure in France. French income tax is levied at progressive rates up to a maximum rate of 56.8% as indicated in the appendices.

(ii) Social Security Tax

A French employee carrying out employment activities in a foreign country is not required to contribute to the French social security system. However, a special status is given to French employees seconded abroad which allows employees paid by their employer company registered in France to remain within the French Social Security System provided the assignment period does not exceed six years. The employee must remain on the payroll of the French company which pays French Social Security charges on the same basis as if he were working in France. The

system does not provide for voluntary contributions if the employee does not qualify for the special social security status.

2) Netherlands

(i) Income Tax

Residents of Netherlands are subject to tax on their worldwide income. Non-resident individuals are subject to Netherlands income tax only on income from certain sources within the Netherlands which is similar to the French system. Income tax is imposed only by the Federal Authorities with no additional income taxes being levied by local authorities. The appended tables illustrate the Dutch tax rates for 1993.

Whether a person is a resident of the Netherlands for income tax purposes is a subjective determination based on particular facts and circumstances. Although there are no written rules, certain criteria have developed over the years to determine the question of residence status. The main criteria are physical presence, family residence, availability of a permanent home, scope of activities and relationship of the individual to the Netherlands.

Non-residents are subject to Dutch income tax on only the following specified types of income:

- profit from a business in the Netherlands;
- income from employment in the Netherlands;
- income from real estate in the Netherlands;
- income from profit sharing in a domestic enterprise other than through securities or employment;
- dividend or interest income or profit received or derived from a resident company by a non-resident with a substantial interest (one-third of nominal paid-up capital); and
- periodic receipts from a Dutch public entity.

In principle, the same tax rates apply to residents and non-residents. However, non-residents are entitled to personal allowances only if 90% of their worldwide income is subject to taxation in the Netherlands. In addition, non-residents whose only taxable income is employment income subject to wage withholding tax may not always be able to file an income tax return and claim a refund for wage withholding tax.

(ii) Social Security Tax

The Netherlands has an extensive social security system to which both employer and employee contribute. The social security system consists of both a general insurance programme and premiums for National insurance programs.

Premiums for National Insurance programmes, based on taxable income, are applicable to all individuals resident in the Netherlands and to non resident employees whom are subject to Dutch wage (withholding) tax for employment performed within the Netherlands. These premiums are withheld by the employer or paid directly on assessment.

For Dutch employees transferred abroad to a country within the European Country or to a country where a social security agreement exists with the Netherlands, the same rules apply as for transfers into the Netherlands. That is a Dutch employee sent by a Dutch employer to work temporarily in a foreign country will remain subject to the Dutch Social Security system for a period of up to a maximum of 60 months or as specified by the particular agreement.

3) United States

(i) Income Tax

The U.S. tax system is somewhat unique in that it levies tax both on the basis of citizenship or residency. U.S. citizens and resident aliens are subject to tax on their worldwide income. Non-residents are taxed only on their U.S. source income. The determination of residency status is critical. It serves as the basis for deciding the individual's tax return filing status, taxable income, and applicable tax rates. Ultimately, of course, these factors determine the amount of taxes payable.

Under the Internal Revenue Code, objective tests are used to determine whether an individual is a resident or non-resident alien of the US. These rules provide that, unless a treaty exemption applies, an individual who is either a lawful permanent resident of the U.S. or satisfies a substantial presence test will generally be treated as a resident alien for federal tax purposes.

The law provides that, if an individual meets either of two tests, the individual will be considered a resident alien for U.S. income tax purposes. The tests are:

- Lawful permanent residence (green card) test - Individuals who enter the U.S. as lawful permanent residents (using an immigrant visa commonly known as a "green card") are considered to be residents for U.S. tax purposes. Individuals who maintain their green cards will continue to be treated as residents for each following year even if they permanently reside outside the US.

- Substantial presence test - If an individual meets the substantial presence test, he will be considered a resident of the US. This will be deemed to occur if:

    - The individual was present in the U.S. for at least 31 days during the current year, and

    - The sum of the number of days the individual was present in the U.S. in the current year plus one-third of the days of presence in the preceding year plus one-sixth of the days of presence in the second preceding year is at least 183 days.

The tax law defines a non-resident alien as an individual who is not a resident alien. Accordingly, an individual who is not a U.S. citizen and does not meet either the green card or substantial presence tests is considered a non-resident alien for U.S. income tax purposes.

U.S. tax rates are dependent upon whether an individual is married or not and, if married, whether the individual files a joint return with his or her spouse. Certain individuals also qualify to file a "head of household". Some states, cities and municipalities also levy income tax, City and/or municipal income tax rates are generally 1% or less. State income tax rates generally range from 0% to 12%. Therefore, an individual's total income tax liability will depend on the state in which the individual resides or works and his filing status. Appended are tables which indicate the 1993 U.S. tax rates under different filing status.

The United States is one of the few countries that taxes the worldwide income of its citizens and resident aliens employed abroad. All their income is subject to tax, regardless of where it is earned, paid, or received. This fact requires such individuals to focus not only on the tax burden that may arise in their country of assignment, but also on U.S. taxes during the same period of assignment.

In view of the potential for double taxation that arises from the retention of such U.S. taxing jurisdiction, the Internal Revenue Code provides for two potential benefits:

- Special elective exclusions that can reduce taxable income by substantial amounts for U.S. expatriates who are qualified individuals. These exclusions include a foreign earned income exclusion and a housing exclusion.

- Where country of assignment taxes are imposed on a U.S. expatriate, the expatriate will likely be subject to taxes both in that country and the United States. A foreign tax credit offset is available, within limits, to eliminate the double taxation of foreign source income by providing for an offset on the U.S. return.

In order to qualify for the elective exclusions, a U.S. expatriate must:

- meet either a bona fide residence or physical presence test, and
- have a foreign tax home.

Generally, a U.S. resident alien can qualify only if the physical presence test is satisfied.

Qualified individuals may elect to exclude a maximum of $70,000 of foreign earned income from U.S. taxable income. The exclusion of foreign earned income is computed on a daily basis for each qualifying day during the bona fide residence period or the 12 consecutive month physical presence period that falls within a tax year. It is limited to the foreign earned income in excess of the housing cost amount exclusion.

Only income attributable to services performed in a foreign country during the period in which the bona fide residence or physical presence test is met may be excluded. To be excludable, the foreign earned income must be received by the close of the year following that in which is was earned.

In general, earned income is income received for the performance of personal services. It does not include income of a passive nature, such as dividends and interest. For purposes of the exclusions, the term "foreign earned income" does not include income earned within countries where travel has been restricted under the Trading With the Enemy Act, pensions, annuities, certain deferred income, and amounts paid by the U.S. government or any of its agencies or instrumentalities. It can be in the form of cash or benefits in kind, including:

- Salaries, wages, bonuses, commissions, overseas incentive premiums, and the like.
- Housing allowance.
- Automobile allowance.
- Cost-of-living allowance.
- Education allowance.
- Home leave benefits.
- Moving expense reimbursement or allowance.
- Tax reimbursement or allowance.

In addition to the foreign earned income exclusion described previously, qualified individuals may elect to exclude from U.S. taxable income the excess of reasonable housing expenses over a base housing amount. The base housing amount is determined annually at 16% of the salary of a U.S. government employee, prorated on a daily basis for the number of days during the tax year in which the employee has a tax home overseas. Under certain circumstances, where living conditions at the expatriate's overseas tax home are adverse, the combined eligible housing expenses for both households are eligible for exclusion.

The other mechanism which may be used to eliminate double taxation is the foreign tax credit. While the foreign tax credit is intended to eliminate the impact of double taxation (that is taxation both in the country of assignment as well as in the United States), the rules are fairly complex and do not totally allow for full elimination of double taxation. U.S. relief for foreign taxes paid is limited to the amount of U.S. taxes assessed against foreign source taxable income. In generally terms this means earned income received from services performed within a foreign country less deductions applicable thereto.

One reason this may occur is because foreign countries may determine their tax base differently than does the United States. Also, since the relief is limited to the U.S. tax applicable to the so-called double taxed income, the U.S. expatriate effectively will pay the higher of the two tax rates applicable, that is, country of assignment or U.S. tax rate.

(ii) Social Security Tax

U.S. Social Security contributions are payable by both the employee and employer. An employee's Social Security contributions are not allowed as a deduction against income tax although excess employee contributions may be set against federal income tax.

The U.S. has agreements with many countries regarding the payment of Social Security Contributions. Each agreement outlines the circumstances that determine in which country contributions should be paid.

4) Canada

(i) Income Tax

An individual resident in Canada is taxable on his or her world income. Non-residents are taxed only on Canadian-source income.

The tax statutes do not contain a specific definition of "residence". Accordingly, the residence of an individual is determined by reference to such matters as the location of dwelling places, spouse and dependents, personal property, economic interests and social ties. However, the statute provides that a non-resident individual who stays temporarily in Canada for 183 days or more in a calendar year is deemed to be a resident of Canada for the entire year. This provision pertains only to an individual who would otherwise be considered a non-resident and not to an individual who purposely takes up residence in Canada or to an existing resident who ceases to be a resident upon moving from Canada. Such individuals may be treated as part-year residents.

Non-resident individuals generally must file Canadian income tax returns if they earn employment or business income (including resource income) in Canada or if they have capital gains from dispositions of "taxable Canadian property", which includes the following property:

- real estate in Canada;
- property used in carrying on business in Canada;
- shares of a company resident in Canada other than a public corporation;
- shares of a public company resident in Canada if the non-resident alone or with related persons held at least 25% of the shares of any class within the preceding five years;
- a capital interest in a trust resident in Canada; and
- an interest in a partnership having at least 50% of its value represented by the items listed above or resource properties (generally oil, gas and mineral rights) or both.

The federal and all provincial governments, as well as the territories, impose income taxes on resident individuals. However, only the province of Quebec collects its own individual income tax

and requires a separate return to be filed. The federal government collects the provincial tax on behalf of all other provinces, which means that only one combined federal/provincial return has to be filed.

The calculation of an individual's tax payable is a two-step process. An individual's federal income tax for a given year is calculated on taxable income using a single graduated tax-rate schedule. From this amount is deducted whatever federal personal tax credits are available to the individual and the dividend tax credit. The net result is the individual's basic federal tax payable. Federal surtaxes are then applied to this amount.

Income taxes for the provinces and territories, except Quebec, are calculated by applying the appropriate provincial rate to the "basic federal tax payable" for the year. The province of Quebec requires a separate calculation of taxable income and uses a single graduated tax-rate schedule in computing an individual's tax payable for the year.

For Canadian employees who are transferred overseas on a foreign assignment, perhaps the most significant income tax incentive available is the "overseas employment tax credit". Provided that certain conditions are met, the Overseas Employment Tax Credit ("OETC") is available to reduce the Canadian tax liability of individuals who have performed duties in a foreign country. The OETC is equal to that proportion of the amount that would, except for this credit, be the employee's Canadian tax payable for the year that the lesser of $80,000 and 80% of his net overseas income taxable in Canada is of his total net income for the year. The $80,000 is prorated where the employee is abroad in qualifying circumstances for less than a full year.

Net overseas income is the income for the year from employment that is reasonably attributable to duties performed during the qualifying period (see below for discussion of the criteria). This would therefore include base salary plus any taxable allowances and other benefits received by him during the period, net of any amounts attributable to this period which would be deductible under section 8 (professional dues, for example)

An individual will qualify for the OETC if he meets the following conditions:

1. He was resident in Canada throughout the period of foreign employment which was a period of more than six consecutive months that commenced before the end of the taxation year and included any part of the year;

2. He performed all or substantially all the duties of his employment outside of Canada in connection with a contract under which the specified employer carried on business outside Canada with respect to:

   (a) The exploration for or the exploitation of petroleum, natural gas, minerals or other similar resources, or

   (b) Any construction, installation, agriculture or engineering activity; and

   He was employed by a person who was a specified employer other than for the performance of services under a prescribed international development assistance program of the Government of Canada. In this regard, a specified employer would include a person resident in Canada, a corporation that is a foreign affiliate of a person resident in Canada (i.e. at least 10% its equity interest is owned by the resident), or a partnership in which at least 10% of the fair value of all interests in the partnership are owned by persons resident in Canada or corporations controlled by these persons.

The first condition necessary for this tax credit to apply to your employees requires that they be on a work assignment for more than six consecutive months. While the Act does not address whether a rotational work assignment would specifically meet the six consecutive month requirement if it extended that long, Revenue Canada has confirmed that for purposes of qualifying for this tax credit the total period can be used provided the employees either perform no duties or only a small portion of their duties while they are in Canada.

The second condition set out in the Act is that "all or substantially all the duties of his employment are outside Canada". Revenue Canada's administrative policy usually is to define "all of substantially all" as greater than 90%. Therefore, your employees could potentially perform some duties while in Canada, but in no case should they exceed 10% of all duties performed while on foreign assignment.

It should also be noted that if the employee pays income tax in the foreign country on his employment income, he will be eligible to claim a foreign tax credit on his Canadian tax return within certain limitations. The intent of this credit is to avoid any double taxation which may occur, but it does not avoid any incremental taxation. However, the foreign tax credit is limited to the lesser of the foreign taxes paid (scaled down to reflect the effect of the OETC) and the amount of the Canadian tax payable for the year.

(ii) Social Security Tax

Canadian social security contributions are payable by both the employee and employer. An employee's social security contributions may be allowed as a credit against federal income tax. Canada has agreements with many countries regarding the payment of social security contributions. Each agreement outlines the circumstances that determine in which country contributions should be paid.

Taxation of Corporations

When undertaking a contract in a foreign country it is necessary to consider whether any exposure will exist to corporate tax in the home country. We will address whether or how the Netherlands, France, Canada, or the United States levy tax on corporations operating abroad.

1) France

The principal entities subject to corporate income tax in France are stock companies, private limited companies (SARLs and EURLs), partnerships limited by shares and French branches of foreign corporations. General partnership, joint ventures and limited partnerships may elect to be subject to corporate tax.

Corporate tax is based on a territorial concept. Both French and foreign companies are generally taxed only on income that has a French origin, including dividends and interest income received in France. Income is deemed to be derived from France if the entity

- has a permanent establishment in France;
- does business in France through a representative who does not engage extensively in other business; or

- carries out a complete business transaction in France, such as the purchase and resale of goods within France.

Because of the territoriality principle, corporate income tax is not levied on income of foreign subsidiaries of French parent companies. Consequently, except for passive income, no foreign tax credit is available in France on these profits.

Expenses charged to the French parent are not deductible in France if they are related to expenses incurred for the benefit of the foreign subsidiary. Moreover, losses of the foreign subsidiary are not deductible against the French income of the parent. Nevertheless, if the company has received authorization to consolidate the accounts of its foreign subsidiaries and other overseas entities, the principle of territoriality does not apply. This authorization is rarely granted, however.

A French resident company that establishes a branch or a permanent establishment abroad is not liable in France for corporate tax on the profits from this establishment.

A French company that directly or indirectly owns more than 25% of an entity located in a tax haven is taxed under French rules on the parent company's proportionate share of the entity's income if French tax authorities determine that the entity's operations have no economic substance. Tax losses generated by such an entity are not deductible by the parent.

Interest, royalties and fees for services paid by a company or individual resident in France to companies or individuals resident in a tax haven are not deductible from the French entity's taxable profit, unless the taxpayer proves that the amounts paid were for benefits actually received and the prices were reasonable.

Dividends and other ordinary income distributions may qualify for the participation exemption if the recipient is a parent company. To qualify, the parent company must be an entity that is liable for corporate income tax at the standard rate and must hold a minimum of 10% of the share capital of the subsidiary at the time of the distribution. The holding may be less than 10% if the shares cost at least 150 million francs or were received in exchange for assets contributed in an authorized partial or total merger. The shares held must be either registered or deposited with an establishment approved by the tax administration. In addition, the shares must have been originally subscribed by the parent company or, if acquired later, must be subject to an agreement, entered into by the parent company, to hold them for at least two years.

If all the above conditions are met, the parent company is exempt from corporate income tax on dividends received. An amount representing deemed expenses connected with the collection of the dividend is added back to the taxable income of the parent. This amount may not exceed the lesser of:

- the actual amount of such expenses; and

- 5% of the sum of the net distribution and either the *avoir fiscal* if the dividends are received from a French company or the foreign withholding tax if they are received from a foreign company.

For fiscal years beginning on January 1, 1991, corporate tax is assessed at a standard rate of 34% of taxable income. Distributed profits are subject to an additional tax of 8 5/8 of the amount to be distributed out of taxes.

The tables in the appendices outline some of the other significant taxes levied in France on either employers or employees.

2) Netherlands

Corporate and individual income taxes in the Netherlands are levied under separate acts of parliament. For the determination of taxable business income, however, the rules are almost identical for both. A corporation established in the Netherlands is subject to corporate income tax on its worldwide profits, with certain exceptions. A foreign company is subject to Dutch tax only on certain types of income from Dutch sources.

Resident corporate taxpayers are legal entities specifically identified in the Civil Code, including limited liability corporations, mutual insurance companies and certain other associations carrying on a trade or business. These entities are generally deemed to be resident taxpayers if they are established under Dutch civil law, although a tax treaty may alter this status for treaty purposes only. Resident corporate taxpayers are subject to tax on their worldwide income, which is defined as all benefits derived from their activities.

The law provides that the amount of a corporation's annual profits for tax purposes must be determined on the basis of sound business accounting practices. Taxable amounts are generally the same as amounts determined for financial statement purposes, unless specific tax adjustments are required. For example, even though depreciation in financial statements is commonly based on replacement value, such depreciation is not allowed for tax purposes. The taxpayer may use accounting methods for tax purposes that differ from those used for financial reporting purposes; conformity is not required. Moreover, a change in accounting methods is generally allowed unless it is motivated by incidental tax considerations. The cash basis of accounting is not allowed to be used for tax purposes except by certain small businesses. Profits must be expressed in Dutch guilders.

Companies established in the Netherlands are subject to Dutch taxes on their worldwide income. The Netherlands prevents double taxation through the application of numerous treaties and through tax exemptions and the Decree for the Avoidance of Double Taxation (the Decree).

The Decree is a unilateral national instrument that in principle applies only to resident taxpayers. The Decree may be invoked only if no other provisions for the avoidance of double taxation, such as a treaty, apply.

If a company established in the Netherlands holds shares in a foreign company, dividends received from that company are subject to corporate tax unless the participation exemption applies. If the participation exemption applies, the dividend tax deducted at the source is not creditable, nor may it be deducted from profit as an expense.

Dividends received from and capital gains realized on the disposal of shares that constitute a qualifying participation are not includable in a corporation's profits for tax purposes. A "qualifying participation" is a shareholding to which all of the following conditions apply:

- The shareholding consists of at least 5% of the nominal paid-up capital.
- If the shares are those of a non-resident corporation, the non-resident corporation must be subject to a local profits tax. (The rate of the profits tax is not an issue.)
- The shares in the resident or non-resident corporation may not constitute a current asset held for the primary purpose of resale, such as shares of companies with only cash assets that banking institutions buy and sell.
- The shares in a non-resident corporation may not be a portfolio investment in the hands of the parent corporation. (Beginning January 1, 1992, this condition may not apply if the

subsidiary is established in an EC country.) Under case law, if the non-resident subsidiary is not an investment company but is engaged in an active business, the exemption may be invoked only if the parent performs active holding activities. Regulations provide that the exemption applies if the parent is engaged in management, policy-making or financial activities on behalf of the subsidiary. The exemption may also apply if a Dutch company is interposed between a (foreign) parent and foreign subsidiaries. Taxpayers ordinarily obtain a ruling from inspector concerning whether the participation exemption applies.

Expenses attributable to a foreign participation are generally not deductible. These expenses may be deducted by the Dutch parent company only if the parent is able to produce conclusive evidence that the expenses are directly or indirectly instrumental in making profits taxable in the Netherlands. A provision stipulates that the servicing costs of a loan contracted within six months prior to acquiring a participating interest will be assumed to have been incurred in connection with that participating interest unless the taxpayer proves otherwise.

If a company with a head office in the Netherlands maintains a permanent establishment abroad, the profit attributable to that permanent establishment is part of the total profit attributable to the head office. The Dutch head office can benefit from a tax deduction to avoid double taxation, however. The deduction is calculated by first ascertaining the profit of the foreign establishment as a fraction of worldwide profit and multiplying that fraction by the amount of corporation tax payable in the Netherlands.

The profit attributable to the foreign permanent establishment is calculated on the basis of fictional independence; that is, its profit is calculated as if the permanent establishment were a company independent from the head office. Transactions between the head office and the permanent establishment must be conducted at arm's length, and fictional independence does not apply to intercompany payments of interest, royalties and rents.

Most of the tax treaties that the Netherlands has concluded with other countries state that dividends, interest and royalties (royalties include payments for technical services in a developing country) received by a Dutch establishment of a foreign company are taxable in the Netherlands, although the source country may retain a limited right to tax these forms of income. Most of the Netherlands' tax treaties provide for foreign withholding tax to be credited against Dutch taxes. Dividend tax withheld is not creditable, however, if the participation exemption is applicable. The participation exemption is generally not applicable to shares held as part of a portfolio investment.

The corporate tax rate is 40% for taxable profits up to Dfl. 250,000. To the extent that taxable profits exceed Dfl. 250,000, the rate is 35%. The Netherlands uses the classical system of corporation tax. Thus, all profits are taxed at 40% or the 35% rate irrespective of whether distribution takes place.

We have attached an appendix which outlines some of the additional taxes exigible in the Netherlands.

3) United States

In the United States, taxable income of corporations is ultimately subject to two levels of taxation: first at the corporate level and again at the shareholder level when earnings are distributed.

Taxable income is generally computed according to generally accepted accounting principles, but is adjusted for certain statutory tax provisions. As a result, the amount of taxable income frequently differs from the amount of income stated for financial reporting purposes.

Domestic corporations are subject to U.S. income tax on their worldwide income from all sources, including the income of foreign branches, regardless of whether such income is repatriated. However, domestic corporations are generally not taxed on the earnings of a foreign subsidiary until the subsidiary remits its earnings, is sold or is liquidated. Exceptions may apply for certain income of controlled foreign corporations, foreign personal holding companies and passive foreign investment companies.,

Taxable income up to $75,000 is subject to graduated marginal rates of taxation: 15% on the first $50,000 and 25% on the next $25,000. Amounts in excess of $75,000 are taxed at a marginal rate of 34%; however, corporations with taxable income between $100,000 and $335,000 receive only partial benefit of the lower 15% and 25% rates, because an additional 5% is added (for a total applicable rate of 39%) to phase out the benefit of the lower rates. If a corporation has taxable income in excess of $335,000, the entire amount, including the first $75,000, is taxed at a flat rate of 34%.

We have also provided an appendix which outlines some of the additional taxes levied in the United States.

4) Canada

For Canadian income tax purposes, a corporation's income generally consists of income from business or property and net taxable capital gains realized on any disposition of the corporation's capital assets.

Corporations resident in Canada (whether owned by Canadians or non-residents) are taxed on their worldwide income from all sources, including income from business or property and net taxable capital gains. Non-resident corporations are taxed only on their Canadian-source income. Generally, a corporation is deemed to be resident in Canada if it is incorporated in Canada or has its central mind and management located there.

If a tax treaty exists between Canada and the country in which the taxpayer is resident, the determination of whether a non-resident if taxable in Canada may be restricted or modified. Generally, Canada's tax treaties provide that residents of the other country are subject to Canadian tax on income from carrying on business in Canada only if the non-resident has a Canadian permanent establishment.

All income earned from foreign sources by a Canadian resident is included in taxable income, whether or not remitted to Canada. Special rules apply to dividends received from foreign affiliates, as discussed below.

A non-resident corporation is considered a foreign affiliate if a Canadian corporation directly or indirectly owns at least 10% of any class of its shares. Dividends received by a Canadian corporation from foreign affiliates are included in income, and a deduction may be allowed for all or a portion of the dividends in computing the Canadian corporation's taxable income. The amount of the deduction depends on the nature of the accumulated earnings (tax surplus) of the foreign affiliate from which the dividends are determined to have been paid.

Tax surplus arising from active business income earned by a foreign affiliate carrying on business in a country listed in the regulations, usually a country with which Canada has negotiated a tax treaty, is generally treated as exempt surplus and excluded from the Canadian parent's taxable income when distributed as a dividend. Dividends paid from tax surplus arising from business income earned in unlisted countries are taxable, but the Canadian parent is permitted a deduction for underlying foreign taxes paid by the foreign affiliate on the foreign-source business income (including withholding taxes paid on the dividend). Dividends paid from tax surplus arising from

property income are also taxable when received by the Canadian parent, subject to relief for any underlying foreign taxes. Special rules apply if the property income is earned by a controlled foreign affiliate, as described below.

A Canadian shareholder of a controlled foreign affiliate is required to include in income an appropriate amount of the controlled foreign affiliate's passive income, or foreign accrual property income (FAPI), whether or not it is remitted to Canada.

FAPI includes income from property, business income from other than an active business, and net taxable capital gains from property not used or held in conducting an active business.

If FAPI has been included in income, a special deduction from income is allowed for foreign taxes paid by the affiliate, which has approximately the same effect as receiving a foreign tax credit. Corporate shareholders pay no further Canadian tax if the FAPI income is repatriated to Canada in the form of dividends, and additional relief may be granted for foreign withholding taxes imposed on such dividends.

A Canadian corporation may carry on business in a foreign country through a foreign branch. Income or losses from the branch operation, determined under Canadian rules, is included in taxable income in the corporation's Canadian income tax return.

A credit against Canadian taxes for foreign income taxes paid is generally allowed, subject to a formula limitation. Foreign tax credits are computed on a country-by-country basis, with credits for taxes paid in one country not being allowed to offset taxes in another. No relief is available for underlying foreign taxes incurred by foreign entities, except for foreign affiliates in limited circumstances (see below).

Different rules apply to foreign taxes paid on business income and non-business income and to income earned by corporations and individuals. Furthermore, the credits are determined separately for each country.

Foreign income taxes paid on business profits of branch operations may be credited against federal taxes. The amount of credit is limited to the federal Canadian tax deemed payable on branch income. Because foreign branch profits are not subject to provincial tax, no credit against provincial taxes for foreign income taxes is available.

Non-business income of a Canadian corporation includes all other foreign income except certain dividends received from foreign affiliates. Foreign taxes on non-business income may be credited against federal and provincial taxes based on a formula similar to that for business income, except that the federal tax to be prorated is the Canadian tax after the provincial abatement. A taxpayer may generally claim all or a portion of foreign non-business income taxes as a deduction in computing income for tax purposes. Excess foreign non-business income taxes are not eligible for carryover.

Corporations are taxed by the federal government and by one or more provinces or territories. For 1993, the basic rate of federal corporate tax is 38%, but it is reduced to 28% by an abatement of 10 percentage points on a corporation's taxable income earned in a province or territory. A 3% surtax is imposed on the amount of federal tax. Provincial and territorial tax rates are added to the 28% basic rate and vary between 0% (subject to certain exemptions) and 17% of taxable income.

The federal government and the provincial and territorial governments may apply lower rates of tax to active small business earnings and earnings derived from manufacturing and processing. We have attached a summary of some of the additional taxes levied in Canada.

Taxation of Research and Development

Engineering consulting companies may undertake research and development activities in the host country or the foreign market. We will compare the income tax incentives offered in respect of research and development in each of the four countries in this portion of the text.

1) France

The French system provides that increases in research expenditures are eligible for a tax credit computed on a marginal basis, beginning with the 1991 tax year. The credit is granted for research activities performed in France either directly or through government-approved research entities. Qualifying expenditure includes:

- depreciation of assets used specifically for research activities, including patents, as well as buildings purchased or the construction of which was completed on or after 1 January 1991;
- wages and related charges for staff exclusively assigned to research activities; and
- other expenses, which together may not exceed 75% of staff wages and related charges.

The credit is equal to 50% of the excess of research expenditure in the subject year over the average amount of such expenditure incurred during the two preceding years after revaluation using the consumer price index. The credit is limited to 40 million francs.

2) Netherlands

In the Netherlands, either a direct deduction is provided for research and development expenditures or the expenditures are capitalized and depreciated over the anticipated period that benefits will be derived from the R&D activities. Expenditures are capitalized under those circumstances where it is foreseeable that the benefits from the R&D extend beyond the current year.

In addition, the Netherlands also provides several subsidies in respect of R&D activities carried on in that country. A subsidy on labour costs is expected to be introduced shortly. This subsidy will be granted for relatively small R&D companies and the impact of the subsidy will be to decrease the cost of wages of employees that perform R&D activities.

Also, specific subsidies may be granted for various R&D activities. Each year the government identifies specific technology support programs which become eligible for subsidies. In 1994 the government has specifically listed R&D on information technology, biochemical technology, environment technology or equipment technology programs. The subsidy consists of a payment by the government of 37.5% of the costs connected with the development program in the mentioned areas.

The Netherlands authorities try to stimulate and support R&D activities by offering special borrowing facilities. A company may receive a loan for 40% of the development and market costs of a specific technology. The loan thus provided will bear an 8% interest rate. If the technology program fails the loan will be forgiven by the authorities.

3) United States

In the U.S. a taxpayer may elect to deduct research or experimental expenditures paid or incurred in connection with a recent or future trade or business or they can amortize these research and development costs over a period of not less than 60 months, beginning with the month the taxpayer first realizes benefits from the results of such research. A U.S. taxpayer cannot write-off the cost of capital equipment purchased in the year, however, the tax depreciation expense of such equipment will qualify for the deduction. In addition, R&D performers in the U.S. can immediately write-off current R&D expenses incurred outside of the US.

In the U.S. there are no specific carryforward provisions for R&D expenses. Eligible expenses must be written-off in the year in which they are incurred or, by tax election, amortized over future years, beginning at the time the R&D project translates into actual product.

In the US, a non-refundable R&D tax credit is available for certain qualified research and experimental expenditures paid or incurred in carrying on an active trade or business of the taxpayer, but only to the extent that current year research expenditures exceed the average annual amount of such expenditures in the specified base period. The base period is a fixed ratio of research and experimentation expenses to gross receipts for any five years during 1983-1988. The base is deemed always to be at least 50% of current year's research and experimental expenditures. The total R&D credit for the current year equals 20% of this incremental research amount.

4) Canada

In Canada, a taxpayer may immediately write-off current R&D expenses and capital R&D expenditures in Canada. The taxpayer can also choose to defer or claim such expenditures in a subsequent taxation year. In addition, R&D performers in Canada can immediately write-off current R&D expenses incurred outside of Canada. Capital R&D expenditures outside of Canada are subject to the normal capital cost allowance rules.

In Canada, a 20% R&D tax credit, known as the investment tax credit, is allowed for the amount of net qualifying scientific research and experimental development expenditures. The credit is increased to 35% for qualifying Canadian-controlled private corporations (CCPC's). The credit is considered to be income for tax purposes in the year following the year it is applied to reduce federal taxes payable.

For qualifying CCPCs, the application investment tax credit is 35% of the first $2 million of qualifying R&D expenditures where the following conditions are met:

- the corporation was a Canadian-controlled private corporation throughout the taxation year; and

- the corporation's taxable income, together with the taxable incomes of al its associated corporations, was less than or equal to $200,000 in the preceding taxation year.

R&D tax credits, earned by a taxpayer may be used to offset federal taxes payable for the year, within limits. Any R&D tax credit not used or refunded in the year in which it is earned may be carried back three years and forward ten years.

In addition to the federal R&D incentives, many provinces provide their own research and development tax incentives, such as both Ontario and Quebec, thereby further reducing the cost of performing R&D for a company in those locations.

France - Individual Income Tax Rates

The table below presents 1993 individual income tax rates for a married couple with no children.

Taxable Income		
Exceeding	*Not Exceeding*	*Rate*
FF	*FF*	*%*
0	38,440	0.0
38,440	40,160	5.0
40,160	47,600	9.6
47,600	75,240	14.4
75,240	96,700	19.2
96,700	121,380	24.0
121,380	146,900	28.8
146,900	169,480	33.6
169,480	282,380	38.4
282,380	388,380	43.2
388,380	459,420	49.0
459,420	522,580	53.9
522,580	-	56.8

France - Other Significant Taxes

Nature of Tax	**Rate (%)**
Value-added tax (standard rate)	18.6
Social security contributions, on gross salary (approximate percentage)	
Employer	35 to 45
Employee	16 to 20

Netherlands - 1993 Individual Income Tax Rates

Taxable Income			Premium		Total	
	Not		Under	Age 65	Under	Age 65
Exceeding	Exceeding	Tax	Age 65	or More	Age 65	or More
Dfl.	Dfl.	%	%	%	%	%
0	43,267	13	25.40	7.50	38.40	20.50
43,267	86,532	50	-	-	50.00	50.00
86,532	-	60	-	-	60.00	60.00

Netherlands - Other Significant Taxes

Nature of Tax	Rate (%)
Value-added tax	
General rate	17.5
Other rates	0\6
Employee insurance (Social Security) contributions	
Employer	7.99
Employee	15.84

United States - 1993 Individual Income Tax Rates

If taxable income is:	Then income tax equals:
	Single individuals
$0 - $22,100	15 percent of taxable income.
$22,100 - $53,500	$3,315 plus 28% of the amount over $22,100.
Over $53,500	$12,107 plus 31% of the amount over $53,500.
	Heads of household
$0 - $29,600	15 percent of taxable income.
$29,600 - $76,400	$4,440 plus 28% of the amount over $29,600.
Over $76,400	$17,544 plus 31% of the amount over $76,400.
	Married individuals filing joint returns
$0 - $36,900	15 percent of taxable income.
$36,900 - $89,150	$5,535 plus 28% of the amount over $36,900.
Over $89,150	$20,165 plus 31% of the amount over $89,150.
	Married individuals filing separate returns
$0 - $18,450	15 percent of taxable income.
$18,450 - $44,575	$2,767.50 plus 28% of the amount over $18,450.
Over $44,575	$10,082.50 plus 31% of the amount over $44,575.

Note: The Revenue Reconciliation Bill of 1993 has introduced a 36% tax bracket and a surtax on higher income individuals.

United States - Other Significant Taxes

Nature of Tax	Rate (%)
Branch profits tax	30
Branch interest tax	30
State and local income taxes, imposed by most states and some local governments	0 to 12
State and local sales taxes, imposed by many states and some local governments	Various
Payroll taxes	
Federal unemployment insurance (FUTA), imposed on first $7,000 of wages	6.2
Workmen's compensation insurance, varies depending on nature of employees' activities	Various
Social security contributions, imposed on	
Wages up to $57,600 (for 1993), paid by	
Employer	7.65
Employee	7.65
Wages in excess of $57,600 (for 1993) up to $135,000 (medicare component), paid by	
Employer	1.45
Employee	1.45

Canada

The top marginal tax rates for 1993 for each of the Canadian provinces and territories are as follows:

	Investment Income	Dividends	Capital Gains
British Columbia	51.11%	34.52%	38.33%
Alberta	46.07	31.40	34.55
Saskatchewan	51.94	36.51	38.96
Manitoba	50.40	36.33	37.80
Ontario	52.34	35.35	39.26
Quebec	52.93	38.72	39.70
New Brunswick	50.74	34.26	38.05
Prince Edward Island	50.30	33.97	37.73
Nova Scotia	50.30	33.97	37.73
Newfoundland	51.33	34.66	38.50
Yukon	45.94	31.02	34.45
NWT	44.37	29.96	33.28

Canada - Other Significant Taxes

The table below summarizes other significant taxes imposed in Canada.

Nature of Tax	Rate (%)
Goods and Services Tax (GST)	7
Provincial/territorial corporate income tax	0 to 17
Provincial/territorial capital tax	Up to 0.6
Provincial payroll tax paid by employers (varies by province)	0 to 4.5
Part VI tax on financial institutions,	1.25
Large Corporations Tax	0.2
Canada Pension Plan on pensionable earnings between $3,300 and $33,400 (1993 rates)	
Employer	2.4
Employee	2.4
Self-employed individual	4.8
(The Province of Quebec offers a similar plan for residents of Quebec)	
Unemployment insurance, on insurable earnings to a maximum of $38,740 (1993 rates)	
Employee	3.0
Employer (1.4 times the employee rate)	4.2

Appendix B

American and Canadian Design Firms Ranking Among the Top 200 Exporters

Appendix B: American and Canadian Design Firms Ranking Among the Top 200 Exporters

American Firms

1993 Rank		Firm type	Intr'l % of total	Percent of 1992 billings: Building	Industrial/ petro.	Manufacturing	Water	Sewer/ Waste	Transportation	Hazardous waste	Power	Other
International billing totaled $100 million or more												
2	ABB Lummus Crest Inc., U.S.	EC	73	2	88	0	0	0	0	2	8	0
3	Foster Wheeler Corp., U.S.	EC	98	1	85	0	0	6	0	8	0	0
4	Fluor Daniel Inc., U.S.	EC	52	0	81	19	0	0	0	0	0	0
5	Bechtel Group Inc., U.S.	EC	25	11	67	1	1	0	15	3	2	0
6	Brown & Root Inc., U.S.	EC	66	1	90	0	1	1	4	0	0	2
8	The N.W. Kellogg Co., U.S.	EC	60	0	85	5	0	5	0	0	0	5
9	The Badger Co. Inc., U.S.	EC	66	0	96	0	0	2	0	2	0	0
13	Louis Berger International Inc., U.S.	EA	85	2	0	0	6	15	76	1	0	0
15	The Parsons Corp., U.S.	EC	15	3	72	0	2	2	18	0	2	1
23	Law Companies Group Inc./ Sir Allexander Gibb, U.S.	E	27	14	8	5	19	4	32	8	5	5
International billings totaled $50 million to $99.99 million												
30	Jacobs Engineering Group Inc., U.S.	EC	12	0	32	60	0	0	0	8	0	0
34	Stone & Webster Egineering Corp., U.S.	EC	12	0	82	0	0	0	0	0	18	0
36	CRSS Inc., U.S.	EC	26	100	0	0	0	0	0	0	0	0
37	McDermott International Inc., U.S.	EC	64	0	100	0	0	0	0	0	0	0
38	Huntingdon Int'l Holdings Inc., US.	E	32	30	0	10	10	0	40	0	10	0
39	Black & Veatch, U.S.	EC	16	0	6	0	5	7	1	1	80	0
40	ICF Kaiser Engineers Inc., U.S.	EC	18	0	24	0	0	0	43	33	0	0
44	The Austin Co., U.S.	EC	15	5	10	35	0	0	10	0	0	40
47	Dames & Moore, U.S.	E	17	2	27	6	2	5	3	50	5	0
48	Montgomery/Watson Inc., U.S.	E	24	0	0	0	40	60	0	0	0	0
53	Morrison Knudsen Corp., U.S.	EC	22	0	33	0	7	0	0	2	58	0
55	Day & Zimmermann Inc., U.S.	EC	31	0	75	25	0	0	0	0	0	0

Key to Type of Firm: A=architect; EC=engineer-contractor; AE=architect-engineer; E=consulting engineer; EA=engineer-architect; P=planner

1993 Rank		Firm type	Intr'l % of total	Percent of 1992 billings								
				Building	Industrial/ petro.	Manufacturing	Water	Sewer/ Waste	Transportation	Hazardous waste	Power	Other
International billings totaled $30 million to $49.99 million												
56	United Engineers & Constructors, U.S.	EC	7	0	65	0	0	0	5	0	30	0
57	Frederic R. Harris Inc., U.S.	E	39	5	25	5	10	0	55	0	0	0
62	Holmes & Narver Inc., U.S.	EA	31	80	0	0	0	0	0	0	20	0
68	Lester B. Knight & Associates, U.S.	EA	45	5	60	30	0	0	5	0	0	0
69	ERM Group, U.S.	EC	16	0	0	0	2	6	0	91	0	1
70	Harza Engineering Co., U.S.	E	29	0	0	0	14	0	0	0	74	12
72	CH2M Hill Cos Ltd., U.S.	E	7	0	0	7	9	32	13	37	1	1
International billings totaled $20 million to $29.9 million												
75	Ebasco Services Inc., U.S.	EC	5	1	0	0	1	0	26	5	68	0
78	Burns and Roe Enterprises Inc., U.S.	EC	14	0	0	0	0	0	0	0	100	0
80	Camp Dresser & McKee Inc. U.S.	E	10	0	0	0	36	54	0	3	0	7
82	Metcalf & Eddy/Research-Cottrell, U.S.	EA	7	0	2	0	11	30	2	40	15	0
83	Gulf Interstate Engineering Co., U.S.	EC	61	0	90	0	0	0	0	0	10	0
87	Woodward-Clyde Group Inc., U.S.	E	9	9	15	15	12	10	1	33	5	0
88	Sargent & Lundy, U.S.	EA	11	0	0	0	0	0	0	0	100	0
90	Lockwood Greene Engineers Inc., U.S.	EA	14	10	10	80	0	0	0	0	0	0
94	T.Y. Lin International, U.S.	E	46	20	0	0	0	0	80	0	0	0
99	A. Epstein and Sons Int'l Inc., U.S.	EC	25	45	30	10	0	2	10	0	0	3
International billings totaled $10 million to $19.9 million												
102	Kohn Pedersen Fox Associates P.C., U.S.	A	40	100	0	0	0	0	0	0	0	0
110	Groundwater Technology Inc., U.S.	E	9	0	0	0	0	0	0	100	0	0
112	Hill International Inc., U.S.	EA	52	5	0	0	0	10	25	15	45	0
119	Hellmuth, Obata & Kassabaum, U.S.	AEP	12	100	0	0	0	0	0	0	0	0
122	Wilbur Smith Associates Inc., U.S.	EAP	25	0	0	0	0	0	95	0	0	5
124	PRC Environmental Management, U.S.	E	5	0	0	71	0	2	2	25	0	0
127	The Kuljian Corp., U.S.	EAP	91	6	0	12	9	6	0	0	60	7
128	RTKL Associates Inc., U.S.	AE	25	100	0	0	0	0	0	0	0	0
129	Skidmore, Owings & Merrill, U.S.	AE	15	100	0	0	0	0	0	0	0	0
131	The Stanley Consultants Group, U.S.	EA	37	8	0	2	5	25	55	1	2	2
132	Eagleton Engineering Co., U.S.	EA	44	5	94	0	0	0	0	0	1	0
133	Daniel, Mann, Johnson & Mendenhall, U.S.	AE	6	50	0	0	0	0	30	0	0	20

1993 Rank		Firm type	Intr'l % of total	Percent of 1992 billings								
				Building	Industrial/ petro.	Manufacturing	Water	Sewer/ Waste	Transportation	Hazardous waste	Power	Other
134	Wimberly Allison Tong & Goo Inc., U.S.	A	50	100	0	0	0	0	0	0	0	0
135	Rust International Inc., U.S.	EC	2	0	36	0	0	0	0	11	53	0
138	Gensler and Associates/Architects, U.S.	A	13	0	0	0	0	0	0	0	0	100
142	Fish Engineering & Construction Partners Ltd., U.S.	EC	29	0	100	0	0	0	0	0	0	0
International billings totaled $7 million to $9.99 million												
143	Gilbert Associates Inc., U.S.	EA	5	0	0	0	0	0	0	0	100	0
144	Michael Baker Corp., U.S.	EC	6	61	0	0	0	0	0	29	0	10
148	Burns & McDonnell Engineers-Architects-Consultants, U.S.	EA	9	1	7	3	7	5	56	4	17	0
152	EDAW Inc., U.S.	AP	40	75	0	0	0	0	0	0	0	25
157	Sverdrup Corp., U.S.	AEC	2	36	36	28	0	0	0	0	0	0
158	Swanke.Hayden Connell Ltd., U.S.	A	44	100	0	0	0	0	0	0	0	0
159	Pei Cobb Freed & Partners, U.S.	A	32	100	0	0	0	0	0	0	0	0
161	EQE International Inc., U.S.	E	26	15	50	5	0	0	0	0	30	0
International billings totaled $4.60 million to $6.99 million												
164	TAMS Consultants Inc., U.S.	EA	13	0	0	0	20	0	70	0	10	0
166	Perkins & Will, U.S.	AE	17	100	0	0	0	0	0	0	0	0
167	Rafael Vinoly Architects P.C., U.S.	A	79	100	0	0	0	0	0	0	0	0
169	Walk, Haydel & Associates Inc., U.S.	EA	17	10	45	15	5	5	5	10	5	0
175	AMEC Engineering Inc., U.S.	EC	12	0	0	0	0	0	0	0	0	0
176	Flack + Kurtz, U.S.	E	23	100	0	0	0	0	0	0	0	0
179	The Benham Cos., U.S.	EA	14	0	0	100	0	0	0	0	0	0
181	The Cannon Corp., U.S.	AE	19	100	0	0	0	0	0	0	0	0
182	Geraghty & Miller Inc., U.S.	E	4	0	0	0	0	0	0	100	0	0
186	STV Group, U.S.	EA	7	0	0	0	5	5	90	0	0	0
188	Greiner Engineering Inc., U.S.	EAP	4	0	0	0	0	0	100	0	0	0
189	AEPCO Inc., U.S.	EA	15	5	15	0	0	0	0	35	0	45
195	Minpro Engineers Inc., U.S.	EC	49	0	100	0	0	0	0	0	0	0
197	Heery International Inc., U.S.	AE	10	100	0	0	0	0	0	0	0	0
198	The Architects Collaborative, U.S.	A	44	100	0	0	0	0	0	0	0	0
200	Rosser Fabraq International, U.S.	AE	15	40	0	0	20	20	20	0	0	0

Canadian Firms

1993 Rank		Firm type	Intr'l % of total	Percent of 1992 billings: Building	Industrial/ petro.	Manufacturing	Water	Sewer/ Waste	Transportation	Hazardous waste	Power	Other
International billing totaled $100 million or more												
12	SNC-Lavlin International, Canada	EC	35	0	60	0	18	2	1	1	8	10
24	AGRA Industries Ltd., Canada	EC	43	5	20	0	2	5	10	13	32	13
International billings totaled $50 million to $99.99 million												
32	Golder Associates Corp., Canada	E	70	4	0	0	6	0	5	74	4	7
51	Sandwell Inc., Canada	E	59	1	59	10	0	2	18	2	8	0
International billings totaled $30 million to $49.99 million												
65	Tecsult Inc., Canada	E	40	5	5	0	15	0	20	0	20	35
International billings totaled $20 million to $29.99 million												
81	Acres International Ltd., Canada	E	56	0	3	0	3	0	3	6	80	5
International billings totaled $10 million to $19.99 million												
104	Hatch Associates Ltd., Canada	E	45	0	82	0	0	0	15	3	0	0
International billings totaled $4.60 million to $6.99 million												
177	Met-Chem Canada Inc., Canada	E	98	0	42	0	0	0	0	0	0	58