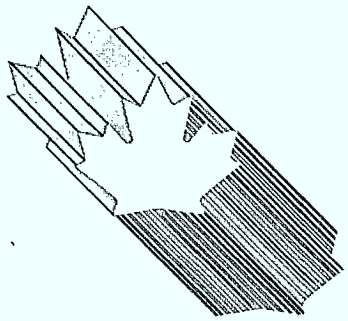
INDUSTRY PROFILE

Industry, Science and Technology Canada
Industrie, Sciences et Technologie Canada

Consulting Engineering

Canada



INDUSTRY PROFILE

CONSULTING ENGINEERING

1988

FOREWORD

In a rapidly changing global trade environment, the international competitiveness of Canadian industry is the key to survival and growth. This Industry Profile is one of a series of papers which assess, in a summary form, the current competitiveness of Canada's industrial sectors, taking into account technological and other key factors, and changes anticipated under the Canada-U.S. Free Trade Agreement. Industry participants were consulted in the preparation of the papers.

The series is being published as steps are being taken to create the new Department of Industry, Science and Technology from the consolidation of the Department of Regional Industrial Expansion and the Ministry of State for Science and Technology. It is my intention that the series will be updated on a regular basis and continue to be a product of the new department. I sincerely hope that these profiles will be informative to those interested in Canadian industrial development and serve as a basis for discussion of industrial trends, prospects and strategic directions.

Robert de Cotret

Minister

1. Structure and Performance

Structure

The Canadian consulting engineering industry is aggressive and dynamic and ranks among the most developed in the world. Three Canadian firms are listed among the world's largest.

The industry is predominantly Canadian-owned and comprises firms engaged primarily in providing design services normally associated with the development and construction of capital projects. These services include feasibility studies, planning, detailed design, project and construction management and operational management. Capital projects in construction cover many categories, from infrastructural facilities and buildings to industrial and resource projects. In addition, consulting engineers provide a variety of services in other fields, such as traffic flow analyses and environmental assessments.

Capital projects are usually undertaken in one of two ways — on a consulting/project management basis for a fee, or on a turnkey construction basis for a fixed price. Consulting/project management projects only provide services for the client and are nearly always undertaken by consulting engineering firms. Turnkey operations, often called engineer-procure-construct (EPC) projects, consist of a package of engineering services that includes procurement and equipment supply and construction activities. These turnkey or EPC projects include substantial financial involvement on the part of the contractor, and are normally undertaken by large, integrated firms from other countries. Canadian firms usually do not have the same depth of capability as the international integrated firms, and are more geared to offering services on a consulting/project management basis. However, some are developing the capacity to provide the complete range of EPC services.

While Canadian turnkey construction activity has been minimal, Canadians have successfully provided international consulting/project management services for capital projects in fields such as electric power, mining, forestry, transportation and municipal services. Another method for implementing capital projects is through the process of build-operate-transfer (BOT). This is a higher-risk activity and only a few Canadian firms are in a position to enter into such arrangements.

In 1986, the Canadian industry employed an estimated 52 000 persons in 3500 firms with total billings of $3.42 billion. Canadian billings in foreign countries were estimated at $450 million, or approximately 13 percent of the total.

Consulting engineering companies range in size from one-person operations to large corporations with more than 4000 employees. An average firm has a staff of about 15. Large firms, employing more than 200 persons, account for about 40 percent of employment, while those employing between 50 and 200 account for about 30 percent. However, most employ fewer than 50 persons, and account for about 30 percent of the industry's employment.

Canada

Industry, Science and Technology Canada
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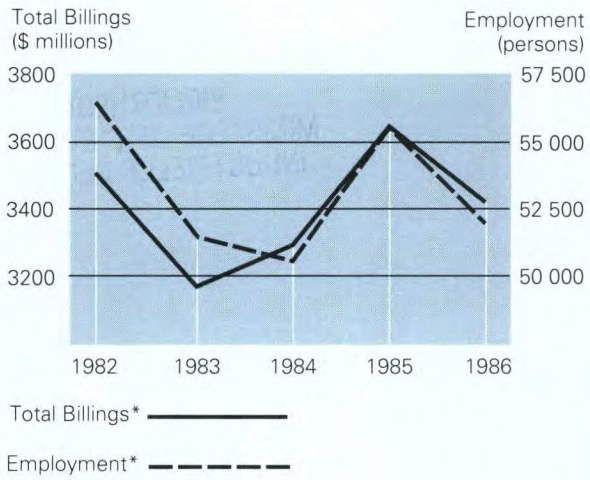


Total Billings and Employment

** These figures were computed from Statistics Canada Labour Survey covering engineering and scientific services and an estimate made for the consulting engineering components.*

The regional distribution of firms, and their employment and economic impact, reflects fairly closely the location of Canada's resources, industry and population. A major consulting engineering base has developed in the Ontario-Quebec industrial heartland, and accounts for about 60 percent of the industry's fee income. In Quebec, the industry's development can be traced to the strong contracting out policies of government agencies and Crown corporations, such as Hydro-Québec. As a result, a number of Quebec firms have developed a strong, internationally recognized capability in hydro-electric power generation and transmission.

Canada has a positive balance of trade in consulting engineering services. Canadian consulting engineers are active in the international field with more than 150 firms working in most regions of the world. The leading markets are Africa, Asia and the United States. While all sizes of firms serve the export market, the larger ones account for the greater share of Canadian foreign billings.

Consulting engineering companies do not perform all of the engineering services in demand in Canada — they account for roughly one-half of the country's requirement. The other half is performed in-house, that is, through an organization's own engineering staff in government departments, public utilities, Crown corporations and private-sector companies.

The industry is linked to other sectors in important ways. The skills it provides for the rationalization, design and management of facilities expansion and development have an impact on the efficiency of the client sectors it serves. By writing the specifications for materials and equipment, the industry also can have a direct effect on the manufacturing and supply industries. The impact can be significant for export projects where the engineering assignment often provides opportunities for "follow-on" sales. Also, consulting engineers are important repositories of technological and managerial know-how. This can facilitate the transfer of technology among government organizations, universities, research centres and the private sector.

During the recession of 1982-84, many firms had to rationalize and retrench their operations. Others, mainly larger companies, diversified and made acquisitions or mergers to the extent that a few large companies have emerged. Over this period, new operations were established by laid-off engineers, and branch offices of larger firms were established in response to provincial government policies, which favour locally based firms.

The client base of consulting engineers fluctuates, over time, with the general state of the economy, investor confidence and public-sector spending. The split between private-sector and public-sector work is approximately 50-50. The major share of public-sector work comes from provincial and municipal governments.

Interest and exchange rates have a bearing on the operating costs and, therefore, on the competitiveness of consulting engineering firms. More significant, however, is the effect that interest rates have on capital investment decisions which, in turn, influence the demand for consulting engineering services.

Performance

Consulting engineering activity is influenced by the level of capital investment; consequently, the industry's performance is cyclical.

Spurred by significant investment in Canadian industry, resource and energy development since the early 1950s, the consulting engineering industry has grown steadily. During the recession of 1982-84, it suffered a considerable reduction in fees and employment. The industry's real average annual growth rate between 1974 and 1982 was about eight percent. No real growth occurred between 1983 and 1986, but business picked up in 1987, with Ontario and Quebec firms enjoying a major share of the recovery.

Exports have also grown, increasing from $80 million in 1974 to about $400 million in 1982. However, since 1982, except for a modest upturn in 1986, there has been some decline in Canadian billings in foreign countries. The bulk of exports is accounted for by the larger firms.

The main asset of a consulting firm is its people. Consulting engineering is labour-intensive, and labour costs, which have increased at a faster rate than other expenses, form the bulk of a consulting operation's expenses. Profits have fallen steadily since the mid-1970s, with the lowest profit margins realized by the largest firms. This situation has been conducive to company takeovers and mergers.

While downsizing since the 1982-84 recession has made companies more efficient and productive, profit margins continue to be low, largely because of strong competitive forces. In comparison, the U.S. consulting engineering industry is believed to enjoy higher profit margins because of its fee structure. In addition, it would appear that U.S. firms are adopting computer technology more rapidly, thereby improving their productivity.

Technological change in the Canadian consulting engineering industry is by no means uniform. Several firms have adopted sophisticated computer-based technologies such as computer-aided design and drafting (CADD), but others have not. Some with sophisticated CADD systems had difficulty sustaining them during the recession. Since then, others have adopted a more cautious approach and are moving to simpler and less expensive systems which have been emerging in the market lately.

2. Strengths and Weaknesses

Structural Factors

The key factors affecting competitiveness are:

- technical, managerial and marketing skills;
- strong domestic base;
- technology;
- ability to combine strengths through consortia;
- government export support.

The Canadian consulting engineering industry is highly competitive in providing design and project management services in the international capital project market. The international market (the market obtained by foreign firms in other countries) is approximately $5 billion for design firms and $100 billion for contractors, including design-build contractors. Although Canadian consulting engineers have not competed significantly in the design-build market, they regularly obtain about eight percent of the international design market. This is about the same market share obtained by firms of France and the Federal Republic of Germany, and is only lower than that for American and British firms. The competitiveness of the Canadian industry is reflected by the fact that, in 1985, Canada had a positive balance of trade in "consulting and other professional services" (made up mainly of consulting engineering) of $734 million — a figure more than four times the 1981 surplus.

The effect of Canada's relatively successful consulting engineering industry internationally is that access to export markets is also provided to other Canadian industries. By undertaking feasibility studies and detailed designs, consulting engineers are a lead-in to capital projects. In the typical capital project, 10 percent of the cost is for engineering and 90 percent is for construction and equipment. Consequently, consulting engineers, by being effective technology exporters, create opportunities for exports of Canadian goods and other services.

The industry's specific export strengths are in electric power, mining, forestry, transportation and municipal services. Canadian capabilities in developing capital projects at remote, environmentally hostile sites are probably unparalleled in the world. The industry's key strength, however, is its reputation for offering independent professional advice, together with North American technology and project management services. Quebec firms also have a natural advantage in Francophone countries. All of these factors help Canadians obtain work in third-world countries, from which 80 percent of their exports is derived.

Weaknesses are found in the industry's capabilities in some areas of manufacturing and process plants, robotics and other advanced manufacturing technologies. Improvements in these areas would allow the industry to compete more effectively in markets of developed countries, as well as to offset future import competition.

The Canadian consulting engineering industry accounts for about 15 percent of all the professional engineers in the work force. The normal demand for engineers can be met through Canadian supply. However, when unusual demand arises, tapping of international engineering personnel is necessary.

The industry's domestic and export activities are mutually supportive. A strong domestic practice provides the base from which to export, and a strong export practice provides the additional experience and employment that will strengthen the domestic base.

Consulting engineers mainly apply existing technologies to meet the needs of their clients. But the actual technology of a consulting engineering firm is based, not only on the methods used in operating a consulting practice, but also on the qualifications of its people, the techniques used, the extent of its knowledge and the know-how accrued through previous experience.

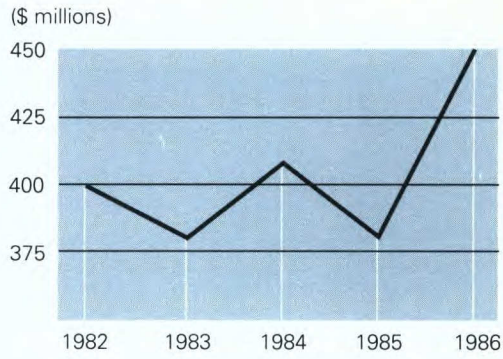
In today's diversified market, many projects require a variety of skills and experience which are difficult to find in a single organization. This means that firms must group together in joint ventures or consortia to provide the required services. An added factor, particularly in the case of multi-industry consortia formation, is sharing the contractual risks, even though this, and the stacking of contingency costs, may adversely affect competitiveness. Nevertheless, this need to form consortia remains particularly important in Canada because of the lack of integrated firms. Moreover, on international projects, consortia are also an attractive way of sharing the export financing.

Government support to match the aid provided to foreign competitors has helped Canadian firms secure contracts abroad. Front-end marketing support through the Program for Export Market Development (PEMD), and project identification through the Canadian International Development Agency's (CIDA) Canadian Project Preparation Fund (CPPF), have been beneficial to Canadian firms in securing overseas contracts. Project financing through the Export Development Corporation (EDC) has significantly helped consulting engineers develop capital projects abroad.

In the international capital project market, Canadians must compete with the foreign integrated firms. These offer engineer-procure-construct (EPC) services on a turnkey construction basis for a total price, fixed in advance and bearing the risk of cost overruns. In the industrial plant field, some foreign firms have their own proprietary process technologies which are used in the plants they build. Canadian firms do not have the same capability and financial resources as integrated U.S. and European-owned firms.

Canadian consulting engineers offer an alternative approach, that is, EPC services on a consulting/project management fee basis, but without guaranteeing the actual cost of project construction. When Canadian firms do compete directly on contracts with foreign turnkey construction contractors, they have to form consortia with contractors and equipment suppliers. To date, however, ventures of this type have been limited.

While Canadian firms are weaker in turnkey construction projects, it should be recognized that their demonstrated strength has been in providing impartial services to clients through consulting/ project management. These are services provided without direct links to manufacturers, contractors and suppliers. Through a competitive bidding process, they assist clients in the selection of contractors and suppliers for the various components of the capital project.



Canadian Billings in Foreign Countries

Trade-related Factors

Although there are no barriers to trade in consulting engineering services, a number of irritants exist which can detract significantly from efficient operations. These include discriminatory taxation, requirements to employ local nationals, the need to form a joint-venture arrangement locally, currency restrictions, professional licensing restrictions and countertrade.

In addition, when competing for projects in developing countries, Canadians face stiff competition from companies in developed countries which receive significant government aid.

In developed countries, because of the mature nature of local consulting industries and client preferences, the normal practice for foreign companies is to either establish or acquire a local company, or to enter into a joint venture with a local firm on a project-by-project basis.

Canada is the largest exporter of consulting engineering services to the United States. In this market, the trade irritants most frequently cited are temporary entry permits, accreditation of professionals, and local preferences (mostly in relation to government contracts).

Under the Canada-U.S. Free Trade Agreement (FTA), initiatives are being taken by both governments to facilitate temporary cross-border access for professional and business persons. Tariffs on drawings and plans will also be removed on January 1, 1989. In addition, the FTA will encourage professional licensing bodies in each country to work towards harmonization and reciprocity of their licensing requirements.

Technological Factors

Consulting engineers basically convert available technology, or knowledge, into practical solutions to problems through the use of innovative engineering. The industry also performs some research and development (R&D).

Consulting engineers perform both contract R&D and "own-account" R&D. Nonetheless, because of the nature of their business, they are constrained, in the case of the latter, by funding limitations. While most "own-account" R&D is directed to the management and efficiency of the consulting practice itself — management information systems and computerization — the research work can also include improved designs, processes and systems.

Contract R&D is mostly project-specific research to find solutions to a client's particular problem. This is an important area for consulting engineers because, by applying their technical and management skills to new and emerging technologies, their competitiveness is enhanced. Furthermore, as facilitators of technology transfer, consulting engineers also bring together the different technologies of engineering design, industrial processes, construction and manufacturing required in capital projects. As such, they also contribute a technical synergism.

Consulting engineering involves a spectrum of technologies. In general, Canadian firms match the capabilities of U.S.-owned and European-owned firms, but are weaker in certain areas of manufacturing and processing, including robotics and other advanced manufacturing technologies.

Other Factors

Agencies at the three levels of government in Canada regularly decide whether to contract out for the engineering services they require or, alternatively, to provide the services in-house with government employees. The latter decision can mean lost opportunities to develop private-sector capabilities and export potential. Over the years, Quebec has contracted out for most of its highway work as well as for the development of its hydro-electric sites, which has contributed to the competitive strength of Quebec-based engineering firms. Headquarters of Canada's three largest, most successful, export consulting engineering firms are in Quebec. There would appear to be scope, nationally and particularly at the provincial and municipal levels, to make further gains in industrial development through more contracting out of engineering services.

The Canadian industry has expressed concern regarding the practice of federal government departments in requesting a price as part of engineering proposals, because this inhibits innovative solutions to engineering problems. In the United States, the practice of the federal government and more than one-half of the state governments is to require that contracts be negotiated on the basis of demonstrated competence and qualifications to perform the services required. Subsequently, fees are negotiated with the firm having the best technical proposal. This practice strengthens the capacities of U.S. firms by permitting them to realize their capabilities fully.

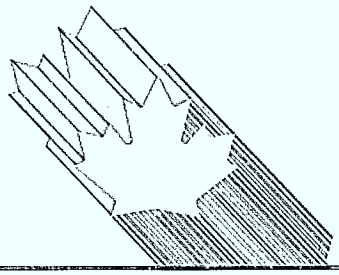
Another concern of the industry is the existence of barriers to interprovincial trade, particularly local preferences. Removal of these barriers would permit work to be carried out more efficiently and to enable Canadian firms to build a "critical mass" of staff in one location in order to compete better with foreign firms.

3. Evolving Environment

The industry is in transition, requiring that firms adapt their operations to new technologies and to the expectations of clients. In the future, three types of consultancy operations are expected to predominate in order to meet market requirements:

- the large multidisciplinary consulting practice capable of initiating major project proposals and offering a complete range of services, such as financial services (including taking equity as part of compensation), project construction management and operational management;
- the small, traditional firms which essentially service the domestic market, particularly the public sector; and
- the specialized firm concentrating in particular fields and sometimes involved as part of joint ventures or consortia.

Internationally, the market for conventional consulting engineering services is diminishing because of the increasing capability of developing countries to handle these services themselves. However, specialized and project management skills will still be in demand. In addition, turnkey construction projects and those requiring equity participation are expected to offer increasing opportunities. The larger Canadian firms are moving in this direction, positioning themselves to handle these high-risk projects.



At the same time, however, market opportunities to sell technical expertise in global market niches — either on their own or in consortia — should not be underestimated for small or medium-sized firms with specialized world-class capabilities. To be successful, these small firms will have to make a commitment on a long-term basis to export their services, and will have to devote the necessary resources to market their capabilities.

While the international megaproject business is generally down, there is a growing trend, particularly in countries with debt problems, to invite project proposals on the basis of build-operate-transfer (BOT). This is where the project bidder agrees to finance, build, own and operate the facility for a number of years until the project cost is recovered, at which time the facility is transferred to the host country. These are potentially high-profit, high-risk operations and only a few Canadian firms or consortia are currently in a position to consider them.

The record of Canadian consulting engineers on World Bank and other international lending agency projects is good. Canadian firms are strong competitors for such projects, but indications are that these agencies are now shifting from loans for large infrastructure projects to "structural adjustment" loans. These loans may be for one or more sectors, containing a number of projects, with the projects being smaller and not advertised internationally, as is the case for specific project loans. The implications are that more intensive marketing by Canadian firms will be required in the host country to identify opportunities.

The impact of the FTA is expected to be modest as Canada-U.S. trade in engineering services is already relatively unimpeded. Currently, Canada is the largest exporter of design engineering services to the U.S. market. What limited impact the agreement does have may work to Canada's advantage, as easier access to the U.S. market will enable more Canadian firms to gain experience in what is considered a highly competitive market. While easier access into the Canadian market will also apply to U.S. firms, the much larger size of the U.S. market may be more tempting for Canadian firms. However, competitiveness, marketing skills and an adequate marketing budget will still be paramount for successful penetration of that market. These benefits may be offset to some extent by U.S. companies successful in winning contracts for large projects in Canada, particularly those where the client is U.S.-owned.

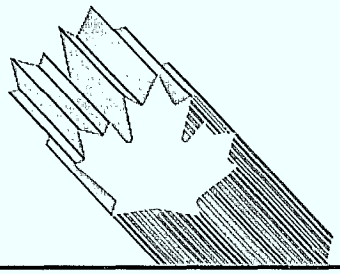
The rapid growth in consulting engineering work of the 1960s and 1970s, driven by development of the Canadian economy and major projects, has declined in recent years. Although a number of energy-related megaprojects have recently been announced, future domestic public-sector emphasis will tend to be on smaller projects and upgrading of existing infrastructure. In the private sector, there will be generally less emphasis on expansion of capacity, and more concentration on upgrading existing facilities and on improving production methods. Also, no significant growth can be expected from reductions in in-house engineering services. It is assumed that post-recession clients have now reached a reasonable balance between the use of in-house and contracted-out services. There may be additional scope for more contracting out from government departments and agencies, particularly at the provincial and municipal levels.

The degree of success in the domestic market will depend largely on the willingness and flexibility of the industry to adjust its operations — from the traditional area of design of capital projects (which has been diminishing) to new opportunities in upgrading existing facilities, maintenance and improving production methods. Also, with the development of new services, it is probable that CADD and other computer technologies that combine graphics and information processing will have a positive effect on long-term employment in the industry.

4. Competitiveness Assessment

In proportion to the size of its economy, Canada probably exports more consulting engineering services than any other country in the world. Consulting engineering is an example of a world-class Canadian service industry.

Canadian firms are competitive in most fields. While Canada exports to many countries around the world, the United States is its largest single market. By comparison, U.S. consulting engineering firms are much less active in Canada, although integrated U.S. engineering construction firms do operate here. Trade between the two countries in engineering services has been mostly to service private-sector clients. Adoption of the FTA is expected to provide some stimulus to Canadian export receipts, principally in relation to private-sector contracts. At the same time, greater competition can be expected from U.S. integrated firms, particularly on projects generated by investment by American-owned firms.



The likelihood of the industry successfully adapting to the more difficult and competitive international environment is rated high. Leaner operating methods and downsizing induced by the 1982-84 recession, plus movement toward leading edge production methods, augur well for improved competitiveness. The industry's flexibility is such that Canadian firms are well positioned to capture a share of emerging international opportunities. Diversification of larger consulting engineering firms has improved their financial strength, and should also permit them to pursue future higher-risk projects in the turnkey construction or BOT fields.

Future success of the industry will depend, in large part, upon closer attention to computerization, marketing, consortia formation, domestic and international joint ventures with local firms, including training of local engineers, as well as the ability to arrange innovative project financing.

In conclusion, the industry has a record of strong and proven performance in domestic and international markets. Its capacity for flexibility, competitiveness and innovation is such that it is anticipated that the new challenges of the future, both at home and abroad, will be successfully met.

For further information concerning the subject matter contained in this profile, contact:

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Industry, Science and Technology Canada
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235 Queen Street
Ottawa, Ontario
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(613) 954-2945

PRINCIPAL STATISTICS

SIC(s) COVERED: 775 (1980)

	1974[2]	1982	1983	1984	1985	1986
Establishments[1]	1 591	3 200	N/A	N/A	N/A	3 500[e]
Employment[1]	36 926	56 300	51 600	50 400	55 500	52 000
Payroll ($ millions)[1]	458	1 861	1 656	1 719	1 912	1 782
Total Billings ($ millions)[1]	984	3 568	3 174	3 294	3 664	3 425

TRADE STATISTICS

	1974[2]	1982	1983	1984	1985	1986
Canadian billings in foreign countries ($ millions)	80	400[e]	380[e]	410[e]	380[e]	450[e]
Domestic billings ($ millions)	904	3 168	2 794	2 884	3 284	2 975
Foreign billings in Canada ($ millions)	N/A	N/A	30[e]	30[e]	30[e]	25[e]
Canadian market ($ millions)	N/A	N/A	2 824	2 914	3 314	3 000
Canadian billings in foreign countries as % of total billings	8	11	12	12	10	13
Foreign billings in Canada as % of Canadian market	N/A	N/A	1	1	1	1
Canadian share of international market (% of billings)	N/A	8	7	8	7	9

Destination of exports (% of total value)		U.S.	Middle East	Asia	Africa	Latin America	Europe
(By Canadian firms making ENR's* top 200 list)	1982	27	18	15	21	14	5
	1983	20	18	17	28	12	5
	1984	26	9	26	26	8	6
	1985	25	6	27	30	11	1
	1986[e]	26	2	21	28	12	11

(continued)

REGIONAL DISTRIBUTION — 1982[2]

	Atlantic	Quebec	Ontario	Prairies	B.C.
Establishments – % of total	6	14	34	28	18
Employment – % of total	4	23	37	20	16
Billings – % of total	3	24	34	22	17

MAJOR FIRMS

Name	Ownership	Location of Head Offices
Acres International Limited	Canadian	Toronto, Ontario
Kilborn Limited	Canadian	Toronto, Ontario
Lavalin Inc.	Canadian	Montréal, Quebec
Monenco Consultants Limited	Canadian	Montréal, Quebec
Sandwell Swan Wooster Inc.	Canadian	Vancouver, British Columbia
H.A. Simons & Associates Ltd.	Canadian	Vancouver, British Columbia
The SNC Group	Canadian	Montréal, Quebec
UMA Group Ltd.	Canadian	Vancouver, British Columbia

e ISTC estimate
* ENR is McGraw Hill's weekly publication *Engineering News Record* — Survey results taken from top 200 design firms.
N/A Not available

Notes: 1 These figures were computed from Statistics Canada Labour Survey covering engineering and scientific services and an estimate made for the consulting engineering component.
2 From Statistics Canada Quadrennial Survey.

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