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I N D U S T R Y
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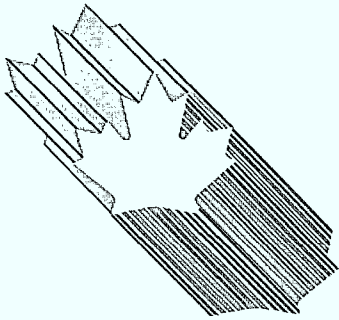


Industry, Science and
Technology Canada

Industrie, Sciences et
Technologie Canada

**Machine Tools
and Tooling**

Canada



INDUSTRY PROFILE

MACHINE TOOLS AND TOOLING

1988

FOREWORD

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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.

Minister

Canada

1. Structure and Performance

Structure

The machine tools and tooling sector comprises establishments engaged in building machinery used by metalworking industries to produce a wide range of consumer and industrial products such as automobiles, appliances and other machines. The sector encompasses two distinct but related sub-sectors, the machines themselves, known as *machine tools*, and the *tooling and dies* for the machines which shape the parts being manufactured.

Machine tools includes metal-cutting machines which shape metal by cutting (e.g., boring, drilling, milling, and grinding machines, lathes, planing machines, machining centres and custom-transfer machining lines). Also included are metal-forming machines which shape metal by pressing, shearing or rolling (e.g., presses, forging, punching and shearing machines, and bending machines). Either group can be manually controlled or computer-numerically controlled (CNC). The sub-sector further includes machine-tool-based systemization of manufacturing technology, in which CNC machine tools, materials handling equipment, robots and other computer-controlled machines are combined into flexible manufacturing systems (FMS) or computer-integrated manufacturing (CIM) systems.

Tooling and dies includes custom-designed tools and dies, standard cutting tools and machine accessories. Tool and die shops manufacture an extensive variety of tooling used with machine tools (e.g., tools and dies, jigs and fixtures, and gauges). Unlike tools and dies, cutting tools such as drill bits and machine accessories are produced as standard items by specialized manufacturers.

The *machine tools* sub-sector in Canada is composed of some 75 establishments employing approximately 2500 persons, with estimated shipments in 1986 of \$277 million. Exports, primarily of custom machines, were \$218 million, of which 78 percent went to the United States. Imports, largely of standard (as opposed to custom-designed) machines, were \$687 million, approximately 50 percent coming from the United States. The seven largest firms in Canada each employ between 100 to 250 persons. These firms, which are largely manufacturers of custom-built machinery for the automotive industry, account for an estimated 60 percent of machine tool shipments. The majority of Canadian machine tool manufacturers (90 percent) are small and specialized, with a staff of 15 to 25 and annual sales of less than \$5 million. Two of the 10 largest Canadian machine tool firms are subsidiaries of U.S. companies. The industry is located mainly in southern Ontario, with a number of firms in the Montréal and Vancouver areas.

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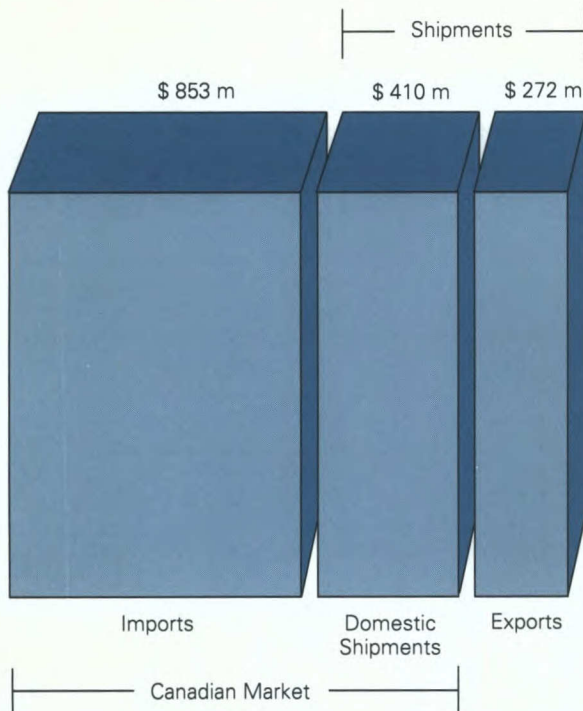
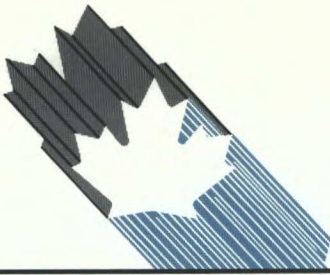
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**Imports, Exports and Domestic Shipments
1986**

A 1986 survey by *American Machinist* magazine ranked Canada 21st in terms of world production, 16th in terms of exports and 6th in terms of imports. International production of machine tools amounted to an estimated US\$29 billion in 1986, with trade accounting for approximately US\$25 billion. The market is dominated by Japan with 24 percent of world production, the Federal Republic of Germany (F.R.G.) with 16 percent, the United States with 10 percent and Italy with five percent. These four countries also account for more than 50 percent of world trade in machine tools. A growing portion of world production is being accounted for by larger corporations such as Cincinnati Milacron and Litton Industrial Automation (formerly Lamb Technicon) of the United States and Toshiba, Toyota and Yamazaki of Japan.

World restructuring of the machine tool operations accelerated in the 1980s, with Japan overtaking the United States as the leading producer and exporter in 1982 because of lower costs and better technology. Similarly, the F.R.G. also displaced the United States to become the world's second-largest producer and exporter in 1983. In addition, production of conventional machine tools is increasingly shifting from North America to lower-cost European and Asian countries.

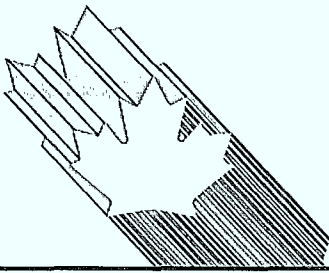
Production of precision metal-cutting machine tools in Canada is increasingly limited to selected types of equipment, usually in a narrow range of sizes. In fact, the most significant and competitive machine tool production capability is limited to the manufacture of specialized or custom-built systems to perform multiple-machining operations on engines and transmissions (transfer machining lines) for the automotive industry. Production of metal-forming machine tools in Canada, on the other hand, is fairly complete although gaps exist for some equipment sizes and specialty functions. Canadian capabilities cover production lines for the shearing, slitting and roll-forming of metal. There is also good capability in most sizes of hydraulic and mechanical presses, press brakes and shears.

The *tooling and dies* sub-sector in Canada comprises an estimated 300 to 350 establishments employing approximately 5000 persons. In 1986, shipments were estimated at \$405 million and exports at \$54 million, of which 90 percent went to the United States. Imports in 1986 were \$166 million, with 67 percent being supplied by the United States. Tools and dies produced by some manufacturers for their own internal use are not included, as statistics are not available and they are normally not considered part of the market.

Tool and die shops in Canada and abroad tend to be small, owner-manager operations specializing in the production of tooling for custom markets. In Canada, they are concentrated in southern Ontario close to their major markets. Tool and die shops are mainly independent and Canadian-owned, whereas standard cutting-tool producers are mainly subsidiaries of U.S. firms. *Tooling and dies* employs highly skilled craftspeople capable of operating modern machines to produce tools to precise, accurate tolerances. These skills are acquired over many years through apprenticeship training programs.

Performance

Growth in machine tool shipments accelerated rapidly during the 1979-81 period (from \$208 million to \$354 million or 18 percent in real terms) before experiencing a sharp cyclical decline during the 1983-84 period. Since 1984, however, Canadian machine tool shipments have again been increasing strongly, reaching an estimated \$277 million in 1986. Overall, the generally good performance since the late 1970s has been attributable to the massive modernization programs undertaken by the North American automotive industry. Demand for machine tools is highly cyclical and because of the one-year design and build time frame, the business cycle of machine tool builders generally lags behind that of its customers.



Exports, averaging approximately 80 to 90 percent to the United States, have remained strong and have generally increased as a percentage of shipments, from \$89 million in 1979 to \$217 million in 1986. While the export orientation of the *machine tools* sub-sector has fluctuated considerably (from 32 percent to 79 percent), exports averaged 57 percent of industry shipments between 1982 and 1986. Even during the 1983-84 slowdown, the sub-sector continued to experience a relatively strong export performance. This was due, at least in part, to arrangements by several U.S.-based manufacturers to share existing orders for the U.S. automotive industry with their Canadian subsidiaries, which had excess capacity. Although the United States accounts for 80 percent of Canadian exports of machine tools, Canada's share of U.S. imports is less than five percent, ranking approximately sixth in terms of country suppliers.

Imports of machine tools in the Canadian market are substantial and have been increasing in recent years as the sub-sector has experienced a narrowing of its production base due, to a large extent, to global restructuring of the industry. On average since 1980, imports have taken 78 percent of the Canadian market. For the most part, these imports represent manual and CNC standard configuration machine tools and sophisticated machining centres which are not produced in Canada. Imports to Canada from the United States have accounted for upwards of 70 percent of total imports. However, in 1986, the U.S. share of Canadian imports dropped to 50 percent, while the European Community (E.C.) and Japan increased their shares to 27 percent and 18 percent respectively. This reduction in the share of the Canadian market held by the United States reflects a decline in the competitiveness of the U.S. machine tool industry relative to Japan and the F.R.G.. In this regard, the number of U.S. producing plants has declined by about one-third in the past five years. In Canada, five producers ceased production during the same period, including two large U.S. subsidiaries and one major Canadian-owned producer.

Shipments of tooling by Canadian manufacturers have increased more gradually to an estimated \$405 million in 1986, from a level of approximately \$200 million in the mid-1970s. Shipments are largely to the automotive sector and to a lesser extent to aerospace and defence-related markets. The *tooling and dies* sub-sector is much more domestically oriented than the *machine tools* sub-sector in that both the export orientation and the import penetration are much lower. Tooling demand is not subject to as severe cyclical fluctuations as machine tools. Exports have averaged only about 10 percent of shipments during the past 10 years, but with an increasing trend during the last three years to about 13 to 15 percent. Imports of tooling into Canada have also been fairly constant, averaging nearly 30 percent of the domestic market during the eighties. Recently, standard cutting tools (as opposed to custom tooling) have encountered strong price competition from countries such as Brazil and Taiwan, which benefit from a General Preferential Tariff (GPT).

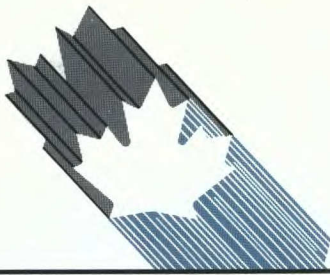
2. Strengths and Weaknesses

Structural Factors

For the *machine tools* sub-sector, important factors determining competitiveness include a demonstrated technological capability to develop and design products and systems, a reputation for performance, reliability and quality, and, for the builders of custom-machining systems, the financial resources to participate in large-scale projects. Price, which is, in part, influenced by scale of operation, is also important for standard machine builders. Price is not as significant a factor for custom machines.

In general, Canadian industry cost structures appear to be well in line with those in the United States; nevertheless, they are facing increased competition from Japanese and European producers. Canada and the United States, and to a lesser extent European countries, are finding Asian labour costs one of the major hurdles to remaining competitive in the world market.

The world machine tool industry is now mature and is dominated by a number of firms from the F.R.G., the United States and Japan. Several producers have experienced relatively low profits and high capital costs in servicing a cyclical market. This situation has made the purchase of new equipment and production processes difficult, as the financial community frequently views the industry as being in the high-risk category. These circumstances are aggravated by the pressure in recent years of imports from low-cost producers in Asia. This situation is not unique to Canada; all North American producers are facing cost and technological pressures from Asian, European and particularly Japanese suppliers.



The current difficulties of the U.S. machine tool industry (imports increased from 35 percent of U.S. consumption in 1984 to 45 percent in 1986) illustrate the problems of competing against lower-cost and increasingly technically sophisticated southeast Asian producers. The Canadian industry is also not well positioned to enter the world markets in the face of this competition. Canada is competitive in special-purpose transfer-line equipment and special tooling for the North American automotive industry, owing to its reputation for high quality and reliability. However, Canadian firms have limited capability in strong growth areas such as CNC machine tools and larger-capacity, higher-speed presses. In addition, there is no capability in Canada in computerized-machine controls, or in general-purpose robots, which are being increasingly integrated with machine tools into production systems.

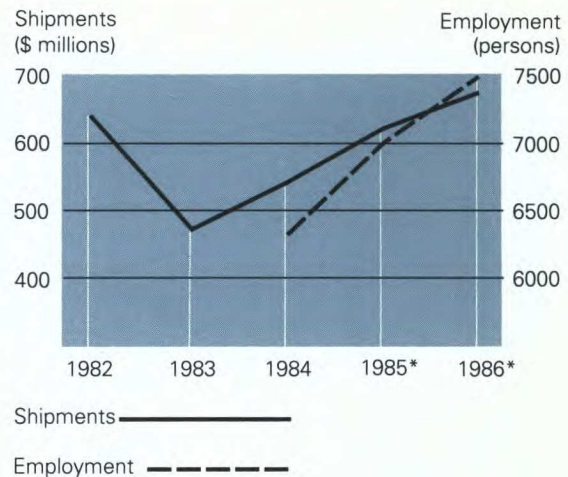
Factors which determine the competitiveness of the *tooling and dies* sub-sector include a demonstrated capability to design and build high-quality, custom tools, modern production facilities and a skilled work force. Other considerations are time of delivery and price.

With a recognized reputation for high quality, Canadian tool and die producers have a strong position in a wide range of custom-designed tools and dies, jigs and fixtures, and gauges. There is limited capability in standard cutting tools and only selected capability in machine-tool accessories. An increasing number of tool and die producers are adopting computer-aided design and manufacturing technology that has a capability to enhance the design function and shorten delivery time. This modernization is higher among larger firms with the capital to acquire expensive equipment, and lower among smaller firms with limited resources. While there are no studies specifically on the *tooling and dies* sub-sector, it is believed that it is adopting new process technology at a satisfactory rate.

The growth of *tooling and dies* over the past decade has created a shortage of skilled toolmakers. In addition, the expanded use of computer-controlled machines and systems has resulted in a shortage of computer-based skills. These skill shortages represent a constraint on growth, and are a major concern to the industry.

Trade-related Factors

Machine tools, parts of machine tools and tooling imported into Canada enter with a Most Favoured Nation (MFN) duty ranging from zero to 9.2 percent and a GPT of 2.5 percent. However, under the Machinery Program, the duty otherwise payable on imports may be remitted if the machinery is not available from Canadian production. In addition, significant imports of such items as machining centres and grinding machines enjoy statutory, duty-free entry. An estimated two-thirds of machine tool imports into Canada are not subject to duty.



Total Shipments and Employment

* *ISTC estimate*

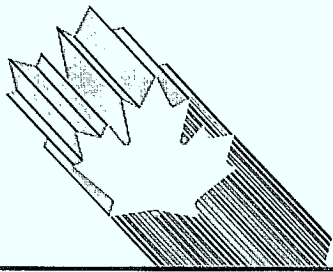
Duties applicable to imports of machine tools into the United States currently range from 4.2 percent to 5.8 percent. U.S. rates of duty applicable to these tools are generally higher than tariffs levied on other machinery items because machine tool production is viewed as strategically important in terms of national defence. Duties applicable to imports of machine tools into Japan currently range from zero to 5.4 percent, and into the E.C., from 2.2 to 5.8 percent.

There are no major non-tariff barriers (NTBs) which affect Canadian trade in machine tool products with the United States, Japan or the E.C. However, the machine tool industry in the United States, concerned with the sharp import penetration of the U.S. market during the 1980s, filed a petition in March 1983 requesting U.S. authorities to restrict imports under the *1962 Trade Expansion Act* relating to national security. Effective January 1, 1987, the United States negotiated voluntary restraint agreements with Japan, Taiwan and the F.R.G. limiting machine tool exports. These arrangements have not had any impact on the Canadian industry.

Under the terms of the Canada-U.S. Free Trade Agreement (FTA), all duties are to be eliminated over a five-year period beginning January 1, 1989. The agreement also facilitates cross-border mobility for service personnel, which has been a problem at times for Canadian exporters attempting to service their machines in the United States.

Technological Factors

A 1985 study of 51 machine tool builders in seven countries, including Japan, conducted by Sciberras and Payne, a British consulting firm, found that formal research and development does not play a major role in the industry. Product development activities and improvements to machine performance are the main thrusts of development.



The world machine tool industry is facing radical changes as a result of micro-electronics technology. Initiatives to improve productivity and reduce costs across all manufacturing industries are significantly increasing the demand for automated machine tools, while the demand for conventional products is decreasing. Product development in the machine tool industry is increasingly moving from the development of single, independent CNC machine tools to the design of automated production systems incorporating several CNC machines, industrial robots and automated parts handling. However, while there is considerable product development being undertaken in Europe and Japan with significant government incentives, the level and scope of such work under way in Canada is quite limited. The relative small size of the industry and the limited resources of Canadian producers restrict their ability to engage in substantial product development.

Tool and die producers generally design and build tools to customer part designs. As their customers increasingly use computerized design to develop and manufacture new products, the tool manufacturer must be able to build tools from these designs. While many Canadian tool and die shops have CNC machine tools, they will require substantial capital outlays to update their computer systems and controls to handle new demands and provide shorter delivery. Growth in this sub-sector will also be affected by the continuing trend to substitute moulded plastic in place of formed metal parts.

3. Evolving Environment

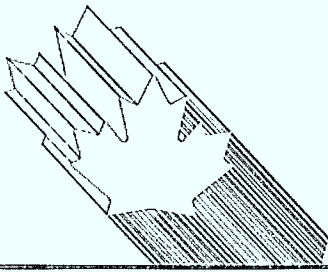
For Canada's specialized *machine tools and tooling* sector, change is likely to continue to be dictated by the North American automotive industry. New North American assembly plants established by foreign-owned auto producers, increasing offshore automotive parts sourcing and normal cyclical fluctuations in automotive industry investment after 1990 are expected to limit demand in the next few years for the metal-cutting transfer lines produced by Canadian companies.

Canadian manufacturers of machine tools, especially transfer line equipment, are increasingly being required to respond to greater specialization of machining lines. In particular, there is a need to design more flexible manufacturing systems capable of machining a variety of different part sizes and shapes without the need for tooling changeovers. This trend to computer-based systems is bringing world equipment firms into closer collaboration with electronic-based control suppliers as well as software systems specialists. While demand will increase for all types of computer-based machine tool products, the extent to which the relatively small Canadian firms will be able to participate in these emerging markets is uncertain because of high entry costs and significant scale requirements. Japan now has a dominant market lead in electronic controls. The large market share obtained by the Japanese for CNC machine tools has allowed them to build highly efficient, automated production facilities for specific types of machines such as lathes and machining centres.

Canadian manufacturers of custom tools and dies will increasingly be required to produce tooling from computer designs. The North American automotive industry will insist that tool and die producers be equipped with state-of-the-art computerized technology.

The recent establishment of Asian-owned automotive producers in North America presents a longer-term new business opportunity for Canadian manufacturers. However, to date most tools and dies have been sourced from the traditional Asian suppliers of these producers.

The assured market access provided by the FTA, particularly in the servicing of machinery, should prove beneficial to most Canadian machine tool and tooling manufacturers. As a result, exports are expected to increase marginally. Nevertheless, gains are not expected to be significant because of the selective nature of Canadian capability, the relatively low level of existing U.S. tariffs and the absence of NTBs.



4. Competitiveness Assessment

International market forces have already reduced the range of metal-cutting machines available from Canadian production and several Canadian manufacturers have ceased production of standard machine tool products. Canadian strength now remains primarily in the design and manufacture of custom-built systems for the North American automotive industry and the largest firms are well integrated into this market. Canadian metal-forming equipment firms remain competitive within their particular areas of product capability. However, a number of these firms are more domestically oriented and are facing increasing offshore competition in the Canadian market.

Canadian tool and die firms are continuing to operate in a fairly stable market and are oriented towards serving the North American automotive industry. This sub-sector is currently more domestically oriented than the machine tool sub-sector; trade does not play such a major role as it does with machine tools. A number of the larger firms have adopted computerized design and process technology in order to remain competitive and to secure new business in the North American market. The majority of the firms in the sub-sector, however, are small, owner-managed operations, whose future will depend on adopting computerized design and production technology.

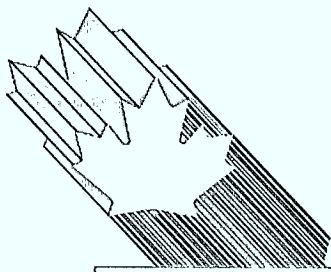
The impact of the FTA is expected to be positive.

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

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Bill Keith.



PRINCIPAL STATISTICS

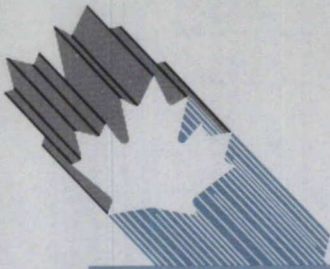
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	1973	1980	1981	1982	1983	1984	1985 ^e	1986 ^e
Establishments	N/A	N/A	N/A	N/A	N/A	N/A	400	400
Employment	N/A	N/A	N/A	N/A	N/A	6 300	7 000	7 500
Shipments (\$ millions)	220	679	654	639	472	531	617	682

TRADE STATISTICS

	1973	1980	1981	1982	1983	1984	1985	1986
Exports (\$ millions)	34	140	157	218	99	200	197	272
Domestic shipments (\$ millions)	186	539	497	421	373	331	420	410
Imports (\$ millions)	190	725	929	492	409	561	720	853
Canadian market (\$ millions)	376	1 264	1 426	913	782	892	1 140	1 263
Exports as % of shipments	15	21	24	34	21	38	32	40
Imports as % of domestic market	51	57	65	54	53	63	63	68
Source of imports (% of total value)					U.S.	E.C.	Asia	Others
			1981	74	13	7	6	
			1982	71	17	5	7	
			1983	71	15	8	6	
			1984	70	15	8	7	
			1985	64	18	10	8	
			1986	50	27	18	5	
Destination of exports (% of total value)					U.S.	E.C.	Asia	Others
			1981	82	5	3	10	
			1982	71	12	1	16	
			1983	88	3	1	8	
			1984	90	2	2	6	
			1985	90	3	1	6	
			1986	78	14	1	7	

(continued)



REGIONAL DISTRIBUTION — Average over the last 3 years

	Atlantic	Quebec	Ontario	Prairies	B.C.
Establishments – % of total	—	10	80	5	5
Employment – % of total	N/A	N/A	N/A	N/A	N/A
Shipments – % of total	N/A	N/A	N/A	N/A	N/A

MAJOR FIRMS

Name	Ownership	Location of Major Plants
Machine Tools		
F. Jos. Lamb Company Limited	American	Windsor, Ontario
Kingsbury Machine Tool Canada Limited	American	Burlington, Ontario
Tri-Way Machine Ltd.	Canadian	Windsor, Ontario
Eagle Precision Technologies Inc.	Canadian	Brantford, Ontario
Brown Boggs Foundry & Machine Co. Limited	Canadian	Hamilton, Ontario
Tooling		
Valiant Machine & Tool Inc.	Canadian	Windsor, Ontario
Butterfield Division, Litton Canada Inc.	American	Smiths Falls, Ontario
Valenite-Modco Limited	American	Windsor, Ontario
International Cutting Tools Inc.	Canadian	Montréal, Quebec
Cochrane Tool & Design Limited	Canadian	Toronto, Ontario

e ISTC estimate
N/A Not available.

Note: Statistics Canada data have been used in the preparation of this profile.

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