Foreword

Most Canadians recognize the importance of Canada's minerals and metals industry to the Canadian economy. Few, however, are aware that Canada's suppliers of mining related goods and services also make an important contribution to jobs and incomes.

Canadian suppliers offer a wide range of goods and services to mining companies operating in Canada and abroad. These products are used in mineral exploration, mine construction, the production of mineral commodities, and mine-site reclamation. Canada's domestic mining industry has been a catalyst for the development of a large number of companies that provide these types of goods and services. In turn, these suppliers have helped Canadian mining companies maintain their competitive edge internationally.

Natural Resources Canada, with the full support of the Canadian Association of Mining Equipment and Services for Export (CAMESE), the national voice of Canada's exporters of mining equipment and services, has examined the economic links between Canada's minerals and metals industry and Canadian suppliers of mining goods and services.

This ground-breaking study provides considerable insight into the interdependencies of these two key resource-related components of Canada's economy. It also shows how their mutual growth represents benefits to Canadians in urban and remote communities.

Ralph Goodale
Minister of Natural Resources Canada

Jon Baird
Managing Director
Canadian Association of Mining Equipment
and Services for Export

Preface

There are strong economic links between Canadian mining companies operating in Canada and abroad and many industrial and commercial industries based in Canada.

The need for information on the links between Canadian mining companies and their domestic suppliers has become increasingly important because of the rapid globalization that has occurred in mining since the early 1990s.

Canadian companies are involved in thousands of mineral exploration, deposit appraisal, mine development or production projects in over 100 countries around the globe. This enormous amount of Canadian activity is creating opportunities for well-paying jobs for Canadians and for the sale of a wide range of goods and services of Canadian origin.

There have been a number of reports in the press and elsewhere of success stories with respect to the export of goods and services in conjunction with Canadian mining projects abroad. However, statistical data collection and classification in Canada has not evolved sufficiently to enable researchers to effectively assess the impact of globalization of the mining industry, estimate its economic potential, and provide policy advice to governments on how best to translate it into jobs and growth for Canadians.

Although there can be no certainty that business opportunities will translate into sales, Canadians need to understand more fully the role that domestic mining companies play globally in creating potential outlets for domestic expertise, goods and services. This study is an initial attempt at assessing the impact of Canadian mining companies on their main supporting sectors.

This study was financed in part by a contribution from the Canada-Quebec Subsidiary Agreement on Mineral Development. Many individuals were instrumental in its preparation. Foremost, we would like to thank those in the more than 600 companies who took time to respond to our survey of suppliers of mining goods and services. As well, Dallas Davis of Dalmin Corporation and Jon Baird and Spencer Ramshaw of the Canadian Association of Mining Equipment and Services for Export provided valuable advice and assistance in the development of the survey questionnaire, and Gerry Armstrong, Louise Baird, Sylvie Mongeot, Bill Penner and Betty Richardson of the Business Register Division of Statistics Canada were indispensable in the arduous task of assigning industrial codes to our compilation of suppliers. Finally, this report would not have been possible without the sustained efforts of numerous individuals in the Minerals and Metals Sector of Natural Resources Canada. To them also we express our appreciation.

Readers of this report are encouraged to provide feedback to:

André Lemieux
Principal Researcher
Telephone: (613) 992-2709
Facsimile: (613) 943-8453
E-mail: alemieux@nrcan.gc.ca

Table of Contents

LIST OF FIGURES

LIST OF TABLES

APPENDICES

Executive Summary

Mines have a finite life and, as a result, there is a constant need to develop new ones. The demand for goods to keep the world's mines in operation is estimated at over US$200 billion per year. The demand for goods and services for the construction of new mines currently planned around the world is well in excess of US$50 billion. The market for goods and services required for mineral exploration is currently depressed but, nonetheless, worth US$3 billion annually.

There are more mining companies based in Canada than in any other country. Beginning in the early 1990s, Canadian mining companies expanded their operations to over 100 countries around the globe. In the process, they acquired mineral properties at all stages of development. They became the largest players in mineral exploration, accounting for one third of the activity around the globe. As a result, Canadian operations have created unprecedented opportunities for the export of mining expertise, goods and services of Canadian origin.

Mining companies consume two main types of products: "specialized products," which are mostly scientific or technical in nature, and "other products." The statistical classifications used in Canada do not readily differentiate supplier transactions with mining companies from those with other areas of the economy. Nonetheless, the available data provide considerable insight.

SECTOR SIZE

- Analysis based on Canada's input-output tables shows that, in 1992, Canadian mining companies and producers of primary metals generated more than $20 billion in sales and contributed over 180 000 jobs in their supporting sectors.

Based on research in this study, it is estimated that:

- Revenues from the sale of specialized goods and services to mining companies increased by 15% from 1996 to 1997.

- Goods account for 55% of revenues from sales of specialized products to mining companies, while services account for the remaining 45%.

- Sales to mining companies account for roughly 25% of the total revenues of all suppliers of specialized mining goods and services.

- Sales to mining companies account for roughly 25% of the jobs provided by suppliers of specialized goods and services.

SUPPLIERS OF SPECIALIZED GOODS AND SERVICES

- There are at least 2200 firms of all sizes based in Canada that advertise specialized mining goods and services; hundreds of others are known to use marketing tools other than advertising to acquire and retain clients.

- Almost three quarters of Canadian suppliers of specialized mining products are based in Ontario, British Columbia and Quebec.

- Both urban and remote centres benefit from supplying mining companies.

- Half of all suppliers depend on sales to mining companies for 50% or more of their total revenues.

- Small companies account for most of the suppliers of specialized mining products, but large firms account for most of the revenues and jobs.

- Small suppliers derive a substantially larger proportion of their total revenues from mining companies than the larger ones do.

- Canadian firms supply thousands of specialized mining products, but have considerable depth in products related to underground mining, the environment, exploration, feasibility studies, mineral processing and mine automation.

- The manufacturing sector, the professional, scientific and technical services sector, the wholesale trade sector, and the mineral resource extraction sector (contract drilling and contract mining) account for 80% of the firms, and 90% of the sales revenues, of suppliers of specialized mining products.

- Almost one quarter of suppliers of specialized mining products are engineers, geologists, geophysicists, geochemists or members of related disciplines.

Globalization and Trade

- The United States, the United Kingdom, Germany, Canada and Australia appear to be the leading suppliers of specialized mining goods and services.

- National associations in at least 12 countries, including Canada, facilitate the export of specialized mining goods and services.

- Canadian suppliers of specialized mining products sell in all the major mining markets. In 1994, they sold in 179 countries and planned to penetrate markets in an additional 20 countries.

- Exports account for 30-50% of the revenues from the sale of specialized mining goods and services.

- Revenues from exports of specialized goods and services to mining companies increased by roughly 25% from 1996 to 1997.

- Employment related to the export of specialized goods and services to mining companies increased by over 10% from 1996 to 1997.

- There is a close correlation between the countries that Canadian suppliers of specialized mining products have targeted and the countries where Canadian mining companies are the most active.

SUPPLIERS OF OTHER GOODS AND SERVICES

In addition to strong ties with suppliers of specialized products, Canadian mining companies also have strong links to suppliers of other products:

- Mineral commodities account for 60% of the rail tonnage and for more than half of the marine tonnage handled in Canada.

- Canadian mining operations around the world create a disproportionately large demand in Canada for the services of mining analysts, underwriters, lawyers and auditors with respect to institutional and retail investing, financing of exploration and mine development, and due diligence in connection with foreign mining transactions.

- In 1998, 60% of the $3.8 billion in equity capital raised for mining around the world was raised by Canadian financial institutions, compared to 48% of the $10.1 billion raised in 1997.

- More than 200 firms in Canada have been active over the past four to five years in raising capital for Canadian mining companies, more than 70 Canadian law firms have a recognized mining practice, and more than 100 investment analysts follow Canadian mining companies closely.

CONCLUSION

Supplying expertise, goods and services to mining companies provides good jobs for Canadians, both at home and abroad. The volume of business on the books around the world suggests that there is considerable opportunity to derive further benefits from supplying the mining industry.

1. Introduction

This report looks at the supply and demand for mining goods and services to identify the main links between Canadian mining companies operating in Canada and abroad and various sectors of the Canadian economy. It also looks at how well Canadian suppliers have responded to the unprecedented opportunities created by the recent globalization of the mining industry.

Mining companies use products from all sectors of the economy. However, it is not possible to quantify many of the transactions that occur between mining companies and their suppliers with the industrial classifications used in Canada. As a result, these classifications represent but a fraction of the links between them. Because data on suppliers to mining companies cannot be captured readily with existing statistics, alternate approaches are used here to address the problem.

1.1 DEFINITIONS

For purposes of this report, "Canadian mining companies" are defined as firms based in Canada that conduct mineral exploration programs, assess the technical and economic viability of mineral deposits, or produce ores, concentrates, industrial minerals, aggregates or coal in this country or elsewhere around the world. "Mining products" are defined as inputs of goods or services consumed by mining companies in their various activities. Goods include consumable as well as capital items. Mining products are subdivided here into two major categories: specialized products and other products.

"Specialized products" are those mainly of a scientific or technical nature. One notable characteristic of these products is that many of their suppliers advertise in mining trade publications. "Other products," such as financial services, transportation services and energy, are essentially non-technical in nature. Suppliers of these products generally do not advertise to mining companies. Furthermore, applications of these products in mining are often little different from applications in other areas of the economy.

1.2 METHODOLOGY

This report examines the demand for mining products based on studies previously prepared by the Minerals and Metals Sector of Natural Resources Canada and on material available in mining literature. It examines the supply of specialized mining products based mainly on advertising appearing in trade publications over the period 1991-99 and on the results of a survey of suppliers for the 1996 and 1997 calendar years carried out by the Minerals and Metals Sector of Natural Resources Canada. Links of Canadian mining companies to domestic suppliers are established by assigning North American Industry Classification System codes to individual suppliers.

2. Nature of Mining Goods and Services

There is a wide assortment of industrial, commercial and consumer products consumed by mining companies in their various operations. Goods and services from more than 400 firms (**Table 1**) contributed to the development of the Ekati mine, Canada's first diamond operation, which started production in late 1998 in the Northwest Territories.

It would be impractical to deal in an exhaustive way with all of the goods and services consumed by mining companies. Therefore, this study focuses mainly on specialized products and on some of the more important other products that they consume.

2.1 SPECIALIZED MINING PRODUCTS

Most of the goods and services consumed by mining companies are specialized products. These products are largely technical or scientific in nature. Some of them are used only in mining, but many are also used in various other industrial applications. Many of the specialized mining products (**Appendix I**) are advertised in trade publications or equivalent media.

Mining industry trade publications differ considerably in the number of products that they list (**Table 2**). To some extent, the number of products listed is arbitrary, reflecting the nature of the companies that choose to pay to advertise. As the mix of advertisers changes, products or product categories may be added or deleted.

The *Mining Magazine*,[1] published in London, England, is the most frugal international source in terms of product classification. It lists only 222 goods and services subdivided into 72 product categories and 7 product groups. The *Canadian Mining Journa*l,[2] on the other hand, lists over 2100 goods and services subdivided into almost 550 product categories. Other directories use product classifications with levels of detail that fall somewhere in between.

Product classifications reflect a pragmatic level of detail. The assortment of mining goods and services offered to mining companies is considerably more complex than buyers' guides alone would suggest. Suppliers based in Canada and the United States offer 19 models of surface blasthole drills; 34 models of surface-exploration, environmental, construction or quarry drills; and 60 models of underground shaft-sinking, production, drifting, tunnelling, roof-bolting or exploration drills.[3] In addition, they offer 33 models of open-pit mining shovels and 27 models of open-pit mining trucks.[4] That level of detail does not appear in buyers' guides. In practice, buyers rely on even more detailed information, such as the specifications of individual products, to make purchase decisions.

2.2 OTHER PRODUCTS

Mining companies also consume large quantities of products in applications that are little or no different from those in other areas of the economy. Suppliers of such products include:
1) lawyers, auditors and underwriters who handle mergers, acquisitions or the raising of capital for exploration and other mining operations; 2) lawyers specializing in Canadian mining law

or occupying niche markets such as legal due diligence with respect to mining ventures abroad; 3) operators of helicopters supporting mineral exploration field work; operators of railways, vessels and trucks transporting ores and concentrates; or operators of port facilities loading coal, iron ore or other mineral commodities; and 4) suppliers of electrical power.

TABLE 1. SUPPLIERS AND COMMUNITY ORGANIZATIONS WHO PLAYED A ROLE IN CREATING THE EKATI MINE, CANADA'S FIRST DIAMOND OPERATION

#1 Yellowknife Airport
953677 NWT Ltd.
A&A Advertising
A&A Technical
Aboriginal Multi Media Society
Aboriginal Peer Education
Above 60 Nurse Placement
Above & Below Sports
Above & Beyond
A.C.E. Enterprises
Acklands Ltd.
Adco North Limited
ADCO Power
Adlair Aviation Ltd.
Aida Ayalik-McWilliam
Agra Earth & Environment
Aids Yellowknife
Air Tindi Ltd.
Alexander, Holburn, Beaudin & Lang
All-West Glass YK Ltd.
Andrew Hammond
Arc-Tek Mobile Welding
Arctic Alarm
Arctic Appliance Services
Arctic Art Gallery
Arctic Camp Services
Arctic Canada Wholesale
Arctic College Corporation
Arctic Data Systems
Arctic Divers Ltd.
Arctic Family Medical House
Arctic Farmer Landscaping
Arctic Frontier Carriers
Arctic News
Arctic Islands Lodge
Arctic Spirits Sportswear
Arctic Sunwest
Arctic Wings
Arctic Winter Games
Around the Point (Kendi)
Artisan Press Ltd.
Attima Hadlai
Aurora College
Aurora Gallery
Aurora Traffic Consulting
Back Bay Welding
Bartie & Gibson Co. Ltd.
Bart Lutz and Cleo Prellwitz
Bayly Williams
Bearing Supply
Beaver Lumber
Bellanca Development
Best Western International
Birchwood Developments
Blatchford Lake Lodge
Bouwa Whee Catering Ltd.
Braden Burry Expediting
Brooks Consulting
Brown's Moving & Storage
Bryant Environmental
Buffalo Airways
Buffalo Parcel Courier
Bumper to Bumper
Buyers Transport
C.C. Portable Welding
Cable TV
Canada Post
Canadian Airlines
Canadian Broadcasting Corporation
Canadian Helicopters Limited
Canadian Imperial Bank of Commerce
Canadian Tire Corporation Limited
Canarctic Graphics
Caplan Holdings
Captain Ron's Bed & Breakfast
Care Alot Cleaning
Caribou Motor Inn
Carl's Steam Cleaning
Camos Holdings Ltd.
CasCom
Celine Football
Center Square Developments
Center Square Parking
Charles Corothers Building
Choice Video 90
City Cab
City Center Family Physicians
City Furniture & Appliances
City of Yellowknife
CJCD Radio Ltd.
CKLB - FM Radio Ltd.
Clark Builders
Clear Arctic Springs
Click It
CNIB
CNX Courier
Coldwell Banker
Colonial Foodsystems
Community Development Association
Connector Food Service
Coppermine Inn
Corner Mart
Creative Paper System
D&V Food Services
Danmax Communication
Dantel Communication
David Gon
Davis & Company
Dechi Laot'i Council
Denesoline Corp. Ltd.
Diamond Communication
Dillon Consulting
Discovery Inn
Dogrib Board of Education
Dogrib Community Services Board
Dogrib Rae Band
Dogrib Treaty 11 Council
Dr. M. Princ
Dr. O. Pelov
E B A Engineering
Echo Bay Mines Ltd.
Echo Bay Transport
Edgson's Produce Ltd.
Eecol Electric Ltd.
Electronic Countermeasures Inc.
Enokhok Inn
Eric Fuglsang
Eric Henderson
Everetts Upholstery
Eva Mingligak
Explosives Limited
Fabrics "N" Sew On
Ferguson Simek Clark
Finning Ltd.
First Air
Fitzgerald Carpeting
Flowers by Candelite
Flowers by Manuela
Flowers North
Force One
Forrest Drive Manor
Fort Smith Health Centre
Frame Lake Family Physicians
Frank Tremblay
Frontier Coachlines
Frontier Mining Ltd.
Furniture Land
Fyremaster Equipment
G.W. Business Machine
Gallery of Time Ltd.
Gameti Development Corporation
Gameti First Nation
Gameti Motel
General Electric Capital
Genesis Group Ltd.
Gibson Medical Clinic
Gord Beaulieu
Government of the Northwest Territories
Grandma Lee's
Great Slave Graphic
Great Slave Helicopter
Great Slave Medical House
Grimshaw Trucking
Grower Direct
GTM Photographics
Hak's Autobody Ltd.
Hamlet of Kugluktuk
Harvey's Office Products
Hay River Chamber of Commerce
Hay River Film Society
Hay River Mechanical
Henry's Photo
H.H. Williams Memorial Hospital
Holy Trinity Anglican Church
Home Electronics Ltd.
Hovat Construction
Hub Publications Ltd.
ICG Propane Inc.
Igloo Building Specialties
Igloo Building Supplies Group
Igloo Inn
Ikaluktutiak Co-operative
Ikon Office Solutions
Ile Holdings Ltd.
Imperial Aviation
Incorporated Hamlet of Lac La Martre
Incorporated Hamlet of Rae-Edzo
Independent Electrical
Independent Environmental Monitoring Agency
Inkit Ltd.
Inland Cement Limited
International Conference on Permafrost
Inuit Art Restoration
Inukshuk Safety Ventures
Inuvik Regional Health Board
J.A. Gilliland
J & K Industrial & Marine
J & R Mechanical Ltd.
JT Thomas Diamond Drilling
Jacobs Industries
Javaroma Gourmet Coffee
Jayda Mercredi
Jiri Hermann Photography
Jofran Enterprises Ltd.
Johnson's Building Supplies
Johnson, Gullberg, Weist
Just-Ann Alterations
Kam Lake Enterprises
Keelinik Translation Services
KHJ Photography Studio
Kilinik High School
Kingland Ford Mercury
Kingland Truck & Welding
Kingland Freightliner
Kingngait Language Consultants
Kitikmeot Health Board
Kitikmeot Inuit Association
Kopycat North
Krazy Eddie's
Kugluktuk Angoniatit Association
Lake Awry Cap and Crest Ltd.

TABLE 1 (cont'd)

Langlois Picture Framing
Life Works
Lutsel K 'e Dene Council
Mack Travel
Mackay & Partners
Mackenzie Media
Mackenzie Regional Health
Magic Touch Dry Cleaning
Mark's Work Warehouse
Mary Lane
MATCO
Matonabee Petroleum
Medical Arts Laboratory
Medical Surgical Supply
Meni Dene Co-operative
Metis Heritage Association
Microage Computer Stores
Midnight Sun Energy
Midtown Esso
Milestone Employment Services
MIL SPEC Northwest Territories
Mohr's Upholstery & Repair
Monkey Tree Restaurant
Mr. T's Shoe Repair
Mrs. Lillian Sarazin
MPL Communications
Multi-Imaging
Nahanni Construction Ltd.
NAPEGG
NETSOS
Nishi-Khon
NORPO Powerline Construction
North of Sixty Nurse
North Slave Metis Alliance
North-West Electric
Northern Communications
Northern Fancy Meats
Northern Frontier Carriers
Northern Images
Northern Interiors Ltd.
Northern Metallic Sales
Northern News Services
Northern Repro
Northern Snackfoods
Northernlites Motel
Northland Utilities
Northstar Resorts Ltd.
Northwest Cleaning Ltd.
Northwest Territorial Airways
Northwest Territories Power
Northwest Transport Ltd.
Northwestel Inc.
Northwestern Air Lease Ltd.
Northwind
Northwood Communications
Nova Construction
Nuna Logistics Ltd.
Nunavut Mining Symposium
Nurse to Go
NWT Air Limited
NWT Chamber of Commerce
NWT Chamber of Mines
NWT Community Mobilization
NWT Family Services
NWT Construction Association
NWT Crimestopper
NWT Marine Group
NWT Montessori Society
NWT Registered Nurse
NWT Rock Services Ltd.
Office Compliments Ltd.
Our Place
Outcrop Communications & Design
Overlander Sports
Paquin Entertainment Agency
Paul Bros. Welding Ltd.
Park Sanders Adam Viske
PCL Constructors Northern Inc.
Petro Canada
Philip Constant
Photoworks
Pido Production Ltd.
Pioneer Industrial Supply Ltd.
Plummer's Lodge
Polar Developments
Polar Explosives
Polar Painting
Polar Tech
Power Engineering Books Ltd.
Precision Business
Premier Northern Ltd.
Premium Homes
Prestinge Planning
Procon Tools
Prospects North
Ptarmigan Airways Ltd.
Ptarmigan Inn
Quality Fire Control Ltd.
Quality Furniture
Quantum Developments
Quickmail Plus
R. J. K. Mobile Mechanics
Radio Shack
Raven Crane Ltd.
Rae-Edzo Friendship Centre
Rae Lakes General Store
Raven Tours
Ray Pirker Plumbing
Receiver General for Canada
Recreation World
Rent-A-Relic
Rescan Environmental Services
Ron's Auto Service Ltd.
Rowes Construction Ltd.
Royal Canadian Legion
Royal Catering
RTL - Robinson Enterprises Ltd.
Ryfan Electric Ltd.
Sampson Consulting Services
Sears
Secure Check
Shell Yellowknife Agency
Shoppers Drug Mart
Snap-On Tools Canada
South Slave Medical Centre
Space Building Maintenance Ltd.
Sports Traders
SSI Micro
St. John Ambulance
St. Patrick's High School
Standard Electric
Stanton Yellowknife Hospital
Stewart, Weir, MacDonald
Stonewall Springs
Sub-Arctic Surveys Ltd.
Sub-Arctic Welding Ltd.
Subway Sandwiches
Sundberg, Mary Rose
Sunfree NWT
Sutherland's Drugs Ltd.
Tamarack Computers
Taylor Industrial Products Inc.
TC Oil Distributors
TC Propane
TRL Industries
Ta'gera Company Ltd.
Ted's U - Drive Ltd.
Territorial Catering Ltd.
Territorial Embroidery
Territorial News
Territorial Refrigeration
Territorial Rewind Ltd.
TGIT
The Arctic Answer
The Executive
The Explorer Hotel
The Final Touch
The Northern Document
The Prospector Bar
The Ptarmigan Inn
The Salvation Army
The Satellite Shop
The Sportsman
The Sweetgrass Cafe
The Yellowknife Inn
Tindee Interpreting
Tire North
Tli Cho Landtran Transport Ltd.
Top Forty
Top of the World
Town of Hay River
Trans Arctic Electric Ltd.
Treaty 11 Dogrib Council
Triple A Taxi
True North Trading Company
Try-Me Construction
Twilite Security
UAP / NAPA Distribution Centre
Uniglobe Yamozah Travel
United Group
Up Here Magazine
Urbco Inc.
Vera Morin
Video Conversions
Vista Engineering
Wal-Mart Canada Inc.
Water Pro
Weavor & Devore Trading Ltd.
Webster Galleries YK
Wekweti Development
Wesclean
Western Arctic Lock & Safe Co. Ltd.
Western Explosives Ltd.
Westown Tire Service
Wha Ti Charter Community
Wha Ti First Nation
White Bear Chrysler
Wolverine Sports Shop
Wolverine Welding
Woodland Interiors
Work World
Workers Compensation
Xerox Canada Ltd.
YZF Corporate Travel
Yati Translations
Yellowknife Book Cellar
Yellowknife Chamber of Commerce
Yellowknife Construction
Yellowknife Direct Charge Co-op
Yellowknife Foto Source
Yellowknife Hardware Ltd.
Yellowknife Motors Ltd.
Yellowknife Photo Centre
Yellowknives Dene First Nation
YK Plumbing & Heating Supplies Ltd.
Yousef A. Farah
YWCA of Yellowknife

Source: Natural Resources Canada, based on *BHP Diamonds Update*, November 1998, p. 8.

TABLE 2. COMPARISON OF SELECTED BUYERS' GUIDES TO MINING GOODS AND SERVICES

Source	Country of Publication	Number of Products Listed	Number of Product Categories	Number of Product Groups	Number of Advertisers	Number of Canadian Advertisers
"Buyers' Guide," *Canadian Mining Journal*, November 1999	Canada	2 104	547	–	403	355 (89%)
"Buyers' Guide 1998," *Engineering & Mining Journal*, November 1998	United States	853	411	–	2 475	145 (6%)
Robertson Info-Data Inc., Vancouver, British Columbia, www.infomine.com, October 1999	Canada	717	302	–	n.a.	n.a.
CAMESE COMPENDIUM of Canadian Mining Suppliers, 1999-2000, The Canadian Association of Mining Equipment and Services for Export, September 1999	Canada	631	244	8	255	255 (100%)
"Buyers' Guide 1999," *Rock Products*, November 1998	United States	338	21	–	951	24 (3%)
Directory of Canadian Exporters: Mining Equipment and Services, Department of Foreign Affairs and International Trade, 1994	Canada	326	110	8	293	293 (100%)
"Buyers' Guide 1999," *Aggregates and Roadbuilding*, November-December 1998	Canada	304	106	–	271	168 (62%)
"Buyers' Guide 1999," *Mining Magazine*, December 1998	United Kingdom	222	72	7	600	51 (9%)
"1999 Directory Issue," *Mining Review,* B.C. & Yukon Chamber of Mines, February 1999	Canada	190	–	–	213	210 (99%)

Source: Natural Resources Canada.
– Nil; n.a. Not applicable.

3. Demand for Mining Goods and Services

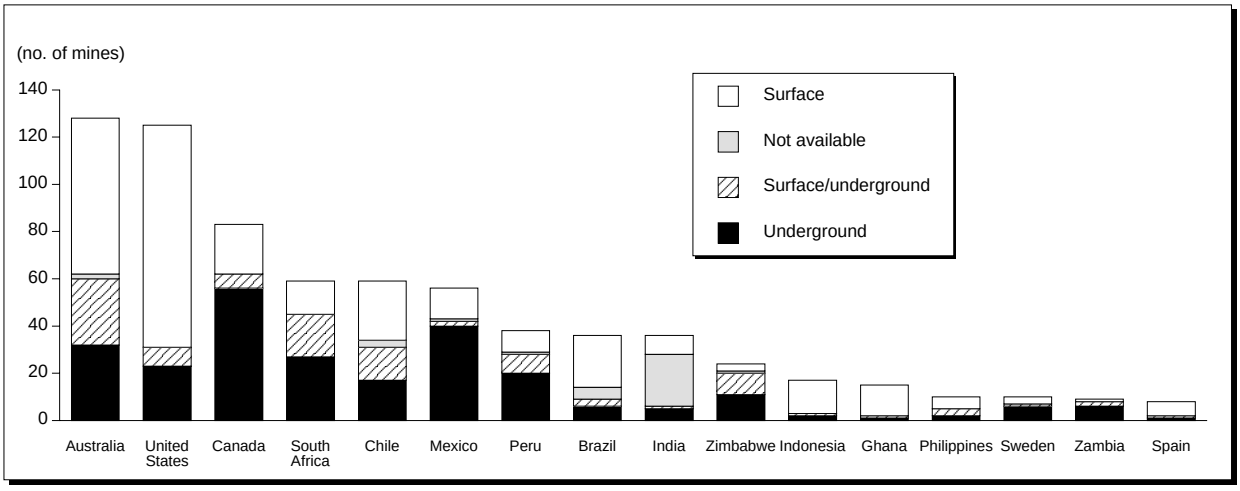
3.1 GLOBAL DEMAND

Mining has long been an international business. However, beginning in the early 1990s, many developing nations with known but undeveloped mineral potential made substantial changes to their trade and investment laws. These changes considerably reduced business risk for companies based in countries with strong mining industries. Many companies, especially those based in Canada, Australia, the United States and a number of European nations, seized the unprecedented opportunities presented by these changes. As a result, the mining industry of many developed countries, such as Canada, expanded rapidly abroad.

Mining has become truly global in scope. It contributes more than 5% to the world's Gross Domestic Product.[5] There are at least 3000 mines and 8000 mining companies worldwide.[6] Almost 150 countries produce metallic or nonmetallic minerals.[7] Large producers dominate production, but fewer than 20 countries account for more than 80% of the larger mines that produce metal-bearing ore in which Western World companies have an interest (**Figure 1**).

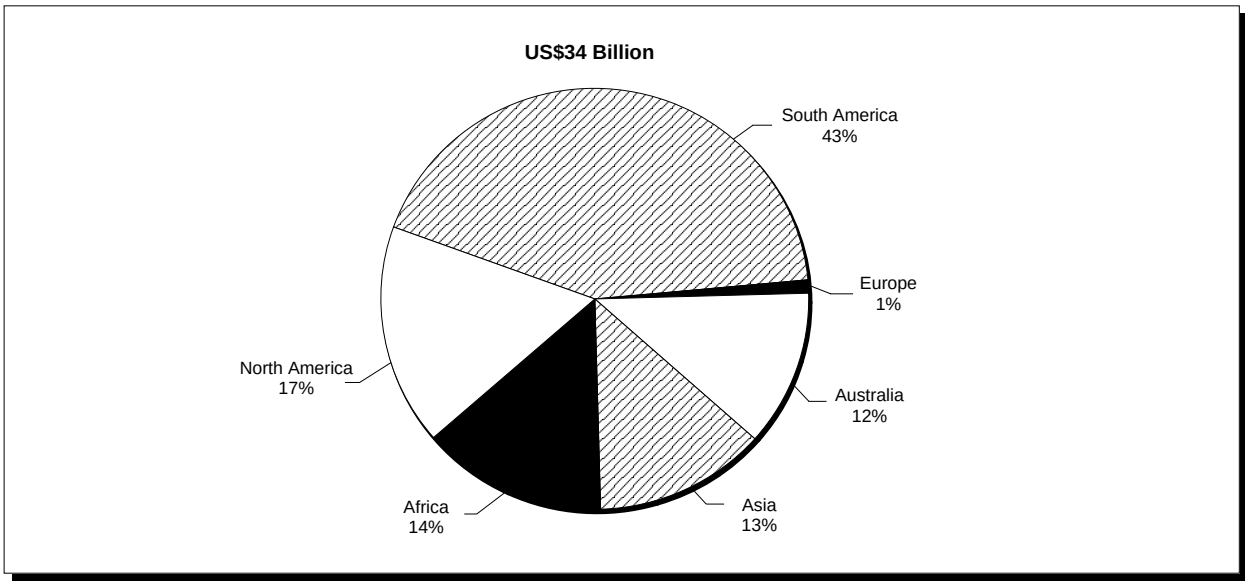
Mining is a cyclical business. Although metal prices over the period of the study were relatively low in response to recent economic difficulties in Asia, there is nonetheless a steady need for mineral materials. As a result, new mines are constantly being developed and others are being planned. In mid-1997, the *Mining Journal* reported that metalliferous mine construction projects requiring some US$34 billion in specialized goods and services were planned around

Figure 1
Countries Accounting for 80% of the World's Larger Mines
Operations in Which Western World Companies Hold Interests and Which Produce More Than 150 000 Tonnes of Metal-Bearing Ore Per Annum



Source: Natural Resources Canada, based on "Mining Activity Survey," *Mining Magazine*, January 1999, pp. 17-33.

Figure 2
Worldwide Metalliferous Mine Construction Projects Planned as at Mid-1997



Source: Natural Resources Canada, based on "Funding Hiatus," *Mining Journal*, August 1, 1997, p. 3.

the world (**Figure 2**). In early 2000, the *Engineering & Mining Journal* reported over US$50 billion,[8] which includes oil sands projects in Canada.

Exploration activity around the globe grew each year from 1991 to 1997. In 1998, mineral exploration programs were planned in over 100 countries. These programs were expected to require goods and services worth some $4.0 billion (**Figure 3**).

Once deposits are in production, ore must be developed on an ongoing basis in order to maintain production. The mining plant and infrastructure must be repaired or upgraded and, eventually, as ore is exhausted, mines must be closed. All of these mineral exploration, deposit appraisal, mine development, production and closure activities create a steady need for a wide variety of goods and services. The worldwide market for goods required to keep mines operating is estimated at over US$200 billion annually.[9]

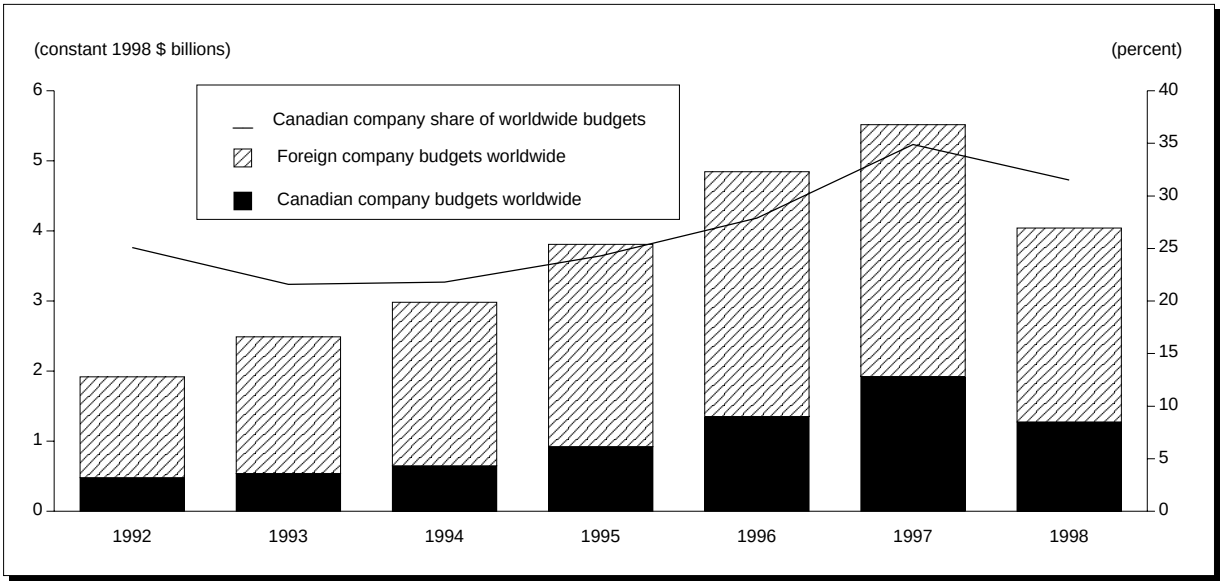
Few nations are self-sufficient or competitive in all lines of mining products. In mining, as in other industrial activities, purchase decisions are made largely on the basis of specifications and price. Further, mining companies purchase locally where possible. As a result, the large mix of products required in mining operations is derived from around the globe.

3.2 DEMAND FROM CANADIAN MINING COMPANIES

There are some 1500 public mining companies in Canada.[10] Many of these companies operate in both Canada and abroad. Mining activity in Canada has made it possible for many suppliers of specialized mining goods and services to prosper. The activities of Canadian mining companies abroad create opportunities for, although not the certainty of, jobs for Canadians and the export of goods and services of Canadian origin.

The demand for mining goods and services comes from four main groups of Canadian mining firms: 1) integrated producers, 2) producers, 3) exploration companies, and 4) prospectors and small-scale operators (**Table 3**).

Figure 3
Exploration Budgets of the World's Larger Companies, by Origin, 1992-98
Companies with Worldwide Budgets of at Least $4 Million (US$3 Million)
for Precious-Metal, Base-Metal or Diamond Exploration



Source: Natural Resources Canada, based on *Corporate Exploration Strategies: A Worldwide Analysis*, Metals Economics Group, Halifax, Nova Scotia.
Notes: The worldwide exploration budgets of companies that intended to spend less than $4 million (US$3 million) annually are excluded. The worldwide exploration budgets for other commodities such as uranium or industrial minerals are also excluded.

TABLE 3. GENERALIZED MODEL OF CANADIAN SUPPLY AND DEMAND FOR MINING GOODS AND SERVICES

Demand Mining Companies	Supply Suppliers to Mining Companies
INTEGRATED PRODUCERS • Produce ores, concentrates and metals • Explore for minerals in Canada and abroad	SUPPLIERS OF SPECIALIZED PRODUCTS • Manufacturers • Wholesalers and distributors • Professional, scientific and technical services • Mineral resource extraction (contract mining and drilling) • Other services (repairs and associations)
PRODUCERS • Produce ores and concentrates • Explore for minerals in Canada and abroad	
EXPLORATION COMPANIES • Explore for minerals in Canada and abroad	SUPPLIERS OF OTHER PRODUCTS • Financing • Transportation • Power • All others
PROSPECTORS AND SMALL-SCALE OPERATORS • Produce metals such as placer gold • Explore for minerals in Canada	

Source: Natural Resources Canada.

Figure 4
Generalized Model of the Mineral Development and Mining Process

PHASES	MINERAL RESOURCE ASSESSMENT	MINERAL EXPLORATION					MINERAL DEPOSIT APPRAISAL				MINE COMPLEX DEVELOPMENT	MINERAL PRODUCTION	ENVIRON-MENTAL RESTORATION
	MRA	EX-1	EX-2	EX-3	EX-4	EX-5	DA-1	DA-2	DA-3	DA-4	MCD	MP	ER
STAGES	Surveys, research, synthesis.	Exploration planning.	Regional reconnaissance and surveys.	Prospecting and ground survey of anomalies.	Verification of anomalies and showings.	Discovery and delimitation.	Deposit definition.	Project engineering.	Project economics.	Feasibility study, production decision.	Construction of plant and infra-structure, mine preparation.	Production, marketing.	Mine closure, site reclamation and restoration.
OBJECTIVES	Supply informa-tion and tools required to develop the mineral potential of the nation for economic bene-fit, in the perspective of sustainable development.	Select target commodities. Establish exploration objectives and strategies. Select target areas.	Find regional and more local-ized anomalies. Select significant targets.	Acquire proper-ties. Confirm presence, exact location and characteristics of anomalies.	Acquire additional properties as required. Investigate anomalies. Find mineral showings.	Discover, delimit a mineral deposit of potential economic interest. Appraise current technical and economic data to justify a deposit appraisal program.	Define the limits, internal grade distribution and controls, mineralogy and mineral processing character of the deposit. Acquire data for engineering planning.	Establish technical feasibility. Obtain realistic plans, schedules, investment costs and operating cost estimates for all aspects of the project.	Obtain all the parameters required and carry out economic, financial and social-political evaluation of the project.	Ensure the validity of project data, assumptions and evaluation results to achieve objectives. Decide whether or not to undertake the project. Obtain the required permits.	Complete mine development and construction on schedule and within budget. Ensure efficient and timely mine and con centrator start-up according to schedule, forecasts and specifications.	Achieve planned rate and speci-fications of commercial production on schedule and within budget. Achieve mine profitability, company survival and sustainable development.	Restore mine site to an environmentally acceptable condition.
EVALUATION METHODS	Geoscientific, mineral and economic sur-veys, research, compilations and synthesis by governments, research institutes and universities.	Mineral and metal market research. Review of geological and ore deposit information for various areas. Review of legal and political context.	Remote sensing, aerial photography and airborne geophysics. Prospecting, geology and geochemistry. Appraisal, rating and selection of anomalies.	Ground-based geological, geo-chemical and geophysical prospecting and surveys. Review and selection of significant anomalies.	Geological mapping and other surveys. Trenching and sampling. Review of results and selection of targets.	Stripping, trench-ing, detailed mapping, sampl-ing, drilling and down-hole geo-physics. Prelimi-nary deposit inventory and evaluation. Environmental characterization and site surveys.	Detailed map-ping, sampling and drilling on surface or from underground. Systematic mineral processing tests. Detailed environ-mental and site surveys.	Pilot tests and engineering studies. Design, cost estimation for mining, processing, infrastructure, environmental protection and restoration.	Market, price, cost and other financial studies. Technical, environmental, economic, financial, social and political risk analysis.	Exhaustive due diligence review of the geological, engineering, environmental, economic, legal and site data. Evaluation of the profitability, risks and up-side factors.	Project and quality manage-ment methods. Training program for personnel and detailed start-up plan.	Production management using continuous quality improve-ment methods. Exploration, appraisal and development of new ore zones, both at the mine site and off-property.	Mine closure and decommission-ing. Environ-mental restora-tion and monitoring.
RESULTS	Geoscientific, mineral and economic data-bases, maps and models.	Exploration projects.	Regional anomalies.	Local anomalies.	Mineral showings.	Mineral deposit.	Deposit appraisal project.			Mining project.	Mining Complex.	Mineral production.	Restored site.
FEASIBILITY STUDIES						Expected margin of error of estimates at the 90% confidence level:							
						± 100%	± 60%	± 40%	± 20%	± 10%		± 5%	Full compliance
INVESTMENT	Low to moderate	Low but increasing.					Much larger and increasing.				Large to very large.		
RISK LEVEL	Moderate	Very high, but decreasing risk of failure and financial loss.					High, but decreasing risk of failure.				Low to moderate industrial risk.		
MINERAL INVENTORY	Undelimited mineral resources					Inferred	Delimited mineral resources				Ore reserves		
	Speculative	Hypothetical				Inferred	Indicated and measured				Proven and probable		

Sources: Modified by D.A. Cranstone, A. Lemieux and M. Vallée, February 25, 1994, from M. Vallée, 1992, *Guide to the Evaluation of Gold Deposits*, CIM Special Volume 45, p. 4, and *SOQUEM Annual Report*, 1976-77, pp. 4 and 5. Revised June 2000.

Although there are relatively few integrated producers in Canada, these companies are involved in the largest number of mining activities. They conduct exploration in Canada and abroad, produce ores and concentrates, and smelt and refine metals. Some are also involved in fabrication, the recycling of metals, and other downstream businesses. As a result, integrated producers purchase the largest assortment of goods and services. Of the 25 largest mining companies in the world, 6 are based in Canada; Noranda Inc. alone controls an estimated 1.6% of global non-fuel mineral production.[11]

Producers conduct exploration in Canada and abroad. There are about 150 that produce ores and concentrates in Canada, and more than 2000 that produce other products such as sand and gravel. Others operate only abroad.

Exploration companies search for mineral deposits in Canada and abroad. There are more than 1000 such companies based in Canada. Unlike producers and integrated producers, exploration companies do not generally generate sufficient cash flow from operations to finance their activities. As a result, they rely on the stock market and on providers of financial and related services for capital to conduct their exploration programs.

Prospectors and small-scale operators, such as placer gold miners, tend to be small firms, often composed of only a few individuals. Nonetheless, there are thousands of such firms in Canada, many of which operate seasonally. This group consumes the smallest assortment of mining goods and services.

Demand in Canada

Canada ranks second, after Mexico, in terms of underground operations as a proportion of all mining operations; it ranks third, behind Australia and the United States, in terms of the number of large mining operations (**Figure 1**). In 1996, Canada ranked sixth in the world in terms of the value of its domestic mineral production.[12]

In early 1997, there were more than 4700 active mineral properties in Canada, of which more than 170 were at advanced stages of evaluation.[13] That year, mineral resource development (**Figure 4**) in Canada consumed $5.7 billion in goods and services. Of that amount, $2.3 billion (40%) was spent on the construction of new mining facilities or expanding existing ones; $1.8 billion (31%) was spent on scientific, technical, engineering, environmental, feasibility or related goods and services for exploration, deposit appraisal and mine development, and $1.6 billion (29%) was spent repairing existing production capacity.[14]

In 2000, 14 mines are likely to open in Canada, and a further 18 in 2001.[15] A sample of 37 Canadian mining companies that responded to a recent survey[16] reported plans to spend over $1.6 billion in 2000 on goods and services at new or existing mining operations in Canada.

These projects represent only some of the opportunities in Canada for suppliers of mining products. Some of these projects, deep mining projects in particular, will require innovative solutions to address problems such as ground control.

Demand From Canadian Operations Abroad

Although Canadian mining companies have operated significant projects abroad since at least the 1940s, the industry has taken on truly global proportions since the early 1990s. Canadian mining companies have expanded their operations to over 100 countries around the globe. This activity is creating export opportunities for Canadian suppliers.

Companies based in Canada conduct more mineral exploration in Canada and elsewhere around the world than those of any other country.[17] In 1998, Canadian-based companies planned to spend $1.3 billion on mineral exploration in Canada and elsewhere around the

world, or more than 30% of all global activity expected during that year (**Figure 3**). They were expected to undertake the largest share of the exploration programs in Canada, the United States, Mexico, South America, Central America, Europe, and the Former Soviet Union.

As a result of recent globalization, Canadian mining companies are involved in some 6800 projects in Canada and around the world. Several hundred of these projects are at the production or advanced stages of development outside of Canada (**Table 4**).

TABLE 4. SELECTED PRODUCTION AND ADVANCED MINERAL DEVELOPMENT PROJECTS ABROAD IN WHICH COMPANIES BASED IN CANADA HAVE AN INTEREST

Country	Project	Canadian Participants	Products	Status
Angola	Camafuca	SouthernEra Resources Limited	Diamonds	Feasibility
	Luo	DiamondWorks Ltd.	Diamonds	Production
	Yetwene	DiamondWorks Ltd.	Diamonds	Suspended
Argentina	Alumbrera, Bajo de la	Rio Algom Limited	Copper, gold	Production
	El Pachón	Cambior Inc.	Copper	Feasibility
	Veladero	Barrick Gold Corporation	Gold, silver	Feasibility
Armenia	Ararat	First Dynasty Mines Ltd.	Gold	Production
	Meghradzor	First Dynasty Mines Ltd.	Gold	Suspended
	Zod	First Dynasty Mines Ltd.	Gold	Suspended
Australia	Bounty	Viceroy Resource Corporation	Gold	Production
	Ely	Alcan Aluminium Limited	Aluminum	Feasibility
	Emily Ann	LionOre Mining International Ltd.	Nickel	Feasibility
	Gladstone (refinery)	Alcan Aluminium Limited	Aluminum	Production
	Granny Smith	Placer Dome Inc.	Gold	Production
	Kidston	Placer Dome Inc.	Gold, silver	Production
	Osborne	Placer Dome Inc.	Gold, copper	Production
	Rustler's Roost	William Resources Inc.	Gold	Suspended
	Tarmoola	Teck Corporation	Gold	Production
Bolivia	Amayapampa	Vista Gold Corp.	Gold	Feasibility
Botswana	Phoenix (Tati)	LionOre Mining International Ltd.	Nickel, copper	Production
	Selkirk (Tati)	LionOre Mining International Ltd.	Nickel, copper	Production
Brazil	Alumar (refinery)	Alcan Aluminium Limited	Aluminum	Production
	Aratu (smelter)	Alcan Aluminium Limited	Aluminum	Production
	Brasília	TVX Gold Inc.	Gold	Production
	Crixás	TVX Gold Inc.	Gold	Production
	Jacobina	William Resources Inc.	Gold	Suspended
	Ouro Preto (refinery)	Alcan Aluminium Limited	Aluminum	Production
	Ouro Preto (smelter)	Alcan Aluminium Limited	Aluminum	Production
	São Bento	Eldorado Gold Corporation	Gold	Production
	Trombetas	Alcan Aluminium Limited	Aluminum	Production
Chile	Altonorte (smelter)	Noranda Inc.	Copper	Production
	Andacollo Copper	Aur Resources Inc.	Copper, gold	Production
	Andacollo Gold	Dayton Mining Corporation	Gold	Production
	Cerro Casale (Aldebaran)	Placer Dome Inc., Bema Gold Corporation, Arizona Star Resource Corp.	Gold, copper, silver	Feasibility
	Cerro Colorado	Rio Algom Limited	Copper	Production
	Collahuasi	Falconbridge Limited	Copper	Production
	El Indio	Barrick Gold Corporation	Copper, gold, silver	Production
	El Toqui	Breakwater Resources Ltd.	Zinc, gold, silver	Production
	Guanaco	Kinross Gold Corporation	Gold, silver	Production
	La Coipa	TVX Gold Inc., Placer Dome Inc.	Gold, silver	Production
	Lobo-Marte	Teck Corporation	Gold	Feasibility
	Lomas Bayas	Boliden Limited	Copper	Production
	Pascua-Lama	Barrick Gold Corporation	Gold, silver	Feasibility
	Quebrada Blanca	Cominco Ltd., Teck Corporation	Copper	Production
	Refugio	Bema Gold Corporation, Kinross Gold Corporation	Gold, silver	Production
	Spence	Rio Algom Limited	Copper	Feasibility
	Zaldívar	Placer Dome Inc.	Copper	Production
China	Crimson Hills	Goldpark China Limited	Gold	Production
	Fortune Mountain	Goldpark China Limited	Gold	Production
	Hucun	Global-Pacific Minerals Inc.	Copper, gold	Production
	Kunshun (refinery)	Inco Limited	Nickel	Production
	Magushan	Copper Mountain Mines Ltd.	Copper	Production
	Qian Chang	Global-Pacific Minerals Inc.	Gold, copper, iron	Production
	Xuanzhou	Copper Mountain Mines Ltd.	Copper	Production

TABLE 4 (cont'd)

Country	Project	Canadian Participants	Products	Status
Costa Rica	Bellavista	Wheaton River Minerals Ltd.	Gold	Feasibility
	El Recio (Palo Negro)	Ariel Resources Ltd.	Gold	Production
	Tres Hermanos	Ariel Resources Ltd.	Gold	Suspended
Cuba	Mantua	Northern Orion Explorations Ltd.	Copper	Feasibility
	Moa Bay	Sherritt International Corporation	Nickel, cobalt	Production
Democratic Republic of the Congo	Tenke Fungurume	Tenke Mining Corp.	Copper, cobalt	Feasibility
Dominican Republic	Cerro de Maimon	Falconbridge Limited	Copper	Exploration
	Falcondo	Falconbridge Limited	Nickel	Production
Ghana	Bonte	Akrokeri-Ashanti Gold Mines Inc.	Gold	Production
	GBC	Alcan Aluminium Limited	Aluminum	Production
	Tarkwa	Repadre Capital Corporation	Gold	Production
Greece	Olympias	TVX Gold Inc.	Gold, zinc, lead, silver	Construction
	Skouries	TVX Gold Inc.	Gold, copper	Feasibility
	Stratoni	TVX Gold Inc.	Lead, zinc, silver	Production
Guinea	Aredor	Trivalence Mining Corporation	Diamonds	Production
	Halco	Alcan Aluminium Limited	Aluminum	Production
Guyana	Omai	Cambior Inc.	Gold	Production
Honduras	El Mochito	Breakwater Resources Ltd.	Zinc, lead, silver	Production
	Vueltas del Rio	Geomaque Explorations Ltd.	Gold	Construction
India	Alupuram (smelter)	Alcan Aluminium Limited	Aluminum	Production
	Belgaum (refinery)	Alcan Aluminium Limited	Aluminum	Production
	Chandgad	Alcan Aluminium Limited	Aluminum	Production
	Hirakud (smelter)	Alcan Aluminium Limited	Aluminum	Production
	Lohardaga	Alcan Aluminium Limited	Aluminum	Production
	Muri (refinery)	Alcan Aluminium Limited	Aluminum	Production
	Uktal	Alcan Aluminium Limited	Aluminum	Feasibility
	Uktal (refinery)	Alcan Aluminium Limited	Aluminum	Feasibility
Indonesia	Cikidang	International Antam Resources Ltd.	Gold, silver	Production
	Halmahera	Weda Bay Minerals Inc.	Nickel, cobalt	Feasibility
	Soroako	Inco Limited	Nickel	Production
Jamaica	Ewarton (refinery)	Alcan Aluminium Limited	Aluminum	Production
	Jamaica	Alcan Aluminium Limited	Aluminum	Production
	Kirkvine (refinery)	Alcan Aluminium Limited	Aluminum	Production
Japan	Tokyo (refinery)	Inco Limited	Nickel	Production
Kazakstan	Central Mukur	Eurasia Gold Corp.	Gold	Production
	Inkai	Cameco Corporation	Uranium	Feasibility
	Myaly	Eurasia Gold Corp.	Gold	Production
Kenya	Kwale	Tiomin Resources Inc.	Titanium sands	Feasibility
Kyrgyzstan	Kumtor	Cameco Corporation	Gold	Production
Mali	Sadiola	IAMGOLD Corporation	Gold	Production
	Yatela	IAMGOLD Corporation	Gold	Feasibility
Mexico	Avino	Avino Silver & Gold Mines Ltd.	Silver, gold, copper	Production
	Cerro San Pedro	Metallica Resources Inc., Cambior Inc.	Gold, silver	Feasibility
	La Colorada	Eldorado Gold Corporation	Gold	Production
	La Colorada	Pan American Silver Corp.	Silver	Feasibility
	Magistral	Queenstake Resources Ltd.	Gold	Feasibility
	Morris	Manhattan Minerals Corp.	Gold	Suspended
	Mulatos	Placer Dome Inc.	Gold	Feasibility
	NYCO	Canadian Pacific Limited	Wollastonite	Production
	Paredones Amarillos	Viceroy Resource Corporation	Gold	Feasibility
	Piedras Verdes	Azco Mining Inc.	Copper	Feasibility
	San Francisco	Geomaque Explorations Ltd.	Gold	Production
	Santa Gertrudis	Campbell Resources Inc.	Gold	Production
	San Martin	First Silver Reserve Inc.	Silver	Production
	San Nicholas	Teck Corporation, Western Copper Holdings Ltd.	Zinc, copper, gold, silver	Feasibility
Myanmar	Letpadaung	Ivanhoe Mines Ltd.	Copper	Feasibility
	Monywa (S&K)	Ivanhoe Mines Ltd.	Copper	Production
New Caledonia	Goro	Inco Limited	Nickel, cobalt	Feasibility
Nicaragua	El Limon	Black Hawk Mining Inc.	Gold	Production
Norway	Nikkelverk (refinery)	Falconbridge Limited	Copper, nickel	Production
	Norzinc (smelter and refinery)	Boliden Limited	Zinc, aluminum	Production
Panama	Cerro Colorado	Tiomin Resources Inc.	Copper, gold	Feasibility
	Cerro Quema	Campbell Resources Inc.	Gold	Construction
	Petaquilla	Inmet Mining Corporation, Teck Corporation, Adrian Resources Ltd.	Copper, gold	Feasibility
Papua New Guinea	Misima	Placer Dome Inc.	Gold, silver	Production
	Ok Tedi	Inmet Mining Corporation	Copper, gold	Production
	Porgera	Placer Dome Inc.	Gold, silver	Production
Peru	Acari	Dynacor Mines Inc.	Gold	Production
	Antamina	Noranda Inc., Rio Algom Limited, Teck Corporation	Copper, zinc, silver, molybdenum	Construction
	Cajamarquilla (refinery)	Cominco Ltd.	Zinc, sulphuric acid	Production
	El Brocal	Cominco Ltd.	Zinc, lead, silver	Production
	Nueva Condor	Oroperu Resources Inc.	Gold	Suspended
	Pierina	Barrick Gold Corporation	Gold, silver	Production
	Quiruvilca	Pan American Silver Corp.	Silver, zinc, lead, copper	Production

TABLE 4 (cont'd)

Country	Project	Canadian Participants	Products	Status
Philippines	Bulawan	Philex Gold Inc.	Gold	Production
	Sibutad	Philex Gold Inc.	Gold	Suspended
Portugal	Aljustrel	EuroZinc Mining Corporation	Zinc, lead, copper, silver	Feasibility
Russia	Dukat	Pan American Silver Corp.	Silver, gold	Feasibility
	Julietta	Bema Gold Corporation	Gold, silver	Construction
	Kubaka	Kinross Gold Corporation	Gold, silver	Production
South Africa	Klipspringer	SouthernEra Resources Limited	Diamonds	Feasibility
	Maranda	Crew Development Corporation	Zinc, copper	Production
	Marsfontein	SouthernEra Resources Limited	Diamonds	Production
	Messina	SouthernEra Resources Limited	Platinum group metals, copper, nickel	Feasibility
	Murchison	Crew Development Corporation	Gold, antimony	Production
	Nabakeep (smelter)	Crew Development Corporation	Copper	Production
	Nigramoep	Crew Development Corporation	Copper	Production
	Palmietgat	Trivalence Mining Corporation	Diamonds	Construction
	Ryedale	Crew Development Corporation	Manganese	Production
	South Deep	Placer Dome Inc.	Gold	Production
	Vergenoeg	Crew Development Corporation	Fluorite	Production
	Wakefield	Crew Development Corporation	Coal	Production
South Korea	Onsan (refinery)	Inco Limited	Nickel	Production
Spain	Carles	Rio Narcea Gold Mines Ltd.	Gold	Construction
	El Valle	Rio Narcea Gold Mines Ltd.	Gold	Production
	Los Frailes (Apirsa)	Boliden Limited	Zinc, copper, lead, silver	Production
Suriname	Gross Rosebel	Cambior Inc.	Gold	Feasibility
Sweden	Aitik	Boliden Limited	Copper, gold, silver	Production
	Åkerberg	Boliden Limited	Zinc, copper, lead, gold, silver	Production
	Garpenberg	Boliden Limited	Zinc, copper, lead, gold, silver	Production
	Kedträsk	Boliden Limited	Zinc, copper, lead, gold, silver	Production
	Kristineberg	Boliden Limited	Zinc, copper, lead, gold, silver	Production
	Laisvall	Boliden Limited	Lead, zinc, silver	Production
	Petiknäs	Boliden Limited	Zinc, copper, lead, gold, silver	Production
	Renström	Boliden Limited	Zinc, copper, lead, gold, silver	Production
	Rönnskär (smelter and refinery)	Boliden Limited	Copper, lead, zinc, gold, silver, platinum group metals, sulphuric acid	Production
Taiwan	Kaohsiung (refinery)	Inco Limited	Nickel	Production
Tajikistan	Aprelevka	Gulf International Minerals Ltd.	Gold	Construction
Tanzania	Bulyanhulu	Barrick Gold Corporation	Gold	Construction
	Kabanga/Kagera	Barrick Gold Corporation	Nickel, cobalt	Feasibility
Thailand	Somboon	Asia Pacific Resources Ltd.	Potash	Feasibility
Tunisia	Bougrine	Breakwater Resources Ltd.	Zinc, lead	Production
Turkey	Agi Dagi	Cominco Ltd.	Gold	Exploration
	Çayeli	Inmet Mining Corporation	Copper, zinc, gold, silver	Production
	Cerattepe	Cominco Ltd.	Copper, gold, silver	Feasibility
	Kaymaz	Eldorado Gold Corporation	Gold	Feasibility
	Kücükdere	Eldorado Gold Corporation	Gold	Feasibility
United Kingdom	Acton (refinery)	Inco Limited	Platinum group metals	Production
	Burntisland (refinery)	Alcan Aluminium Limited	Aluminum	Production
	Clydach (refinery)	Inco Limited	Nickel, cobalt	Production
	Kinlochleven (smelter)	Alcan Aluminium Limited	Aluminum	Production
	Lochaber (smelter)	Alcan Aluminium Limited	Aluminum	Production
	Lynemouth (smelter)	Alcan Aluminium Limited	Aluminum	Production
United States	Bald Mountain	Placer Dome Inc.	Gold	Production
	Betze-Post (Goldstrike)	Barrick Gold Corporation	Gold	Production
	Carlota	Cambior Inc.	Copper	Construction
	Castle Mountain	Viceroy Resource Corporation	Gold	Production
	Copper Creek	AMT International Mining Corporation	Copper, molybdenum	Feasibility
	Cortez (Pipeline)	Placer Dome Inc.	Gold, silver	Production
	Crow Butte	Cameco Corporation	Uranium	Production
	DeLamar	Kinross Gold Corporation	Gold, silver	Suspended
	Denton-Rawhide	Kinross Gold Corporation, Dayton Mining Corporation	Gold, silver	Production
	Donlin Creek	Placer Dome Inc.	Gold	Exploration
	Eveleth	Stelco Inc.	Iron	Production
	Fort Knox	Kinross Gold Corporation	Gold	Production
	Gas Hills	Cameco Corporation	Uranium	Feasibility
	Getchell and Turquoise Ridge	Placer Dome Inc.	Gold	Feasibility
	Golden Sunlight	Placer Dome Inc.	Gold	Production
	Hayden Hill	Kinross Gold Corporation	Gold, silver	Production
	Hibbing	Stelco Inc.	Iron	Production
	Highland	Cameco Corporation	Uranium	Production
	Hycroft	Vista Gold Corp.	Gold, silver	Suspended
	Jamboree	Stelco Inc.	Coal	Production

TABLE 4 (cont'd)

Country	Project	Canadian Participants	Products	Status
	Ken Snyder	Franco-Nevada Mining Corporation Limited	Gold	Production
	Lisbon Valley	Summo Minerals Corporation	Copper	Feasibility
	Meikle (Goldstrike)	Barrick Gold Corporation	Gold	Production
	Montanore	Noranda Inc.	Copper, silver	Feasibility
	New Madrid (smelter)	Noranda Inc.	Aluminum	Production
	Nicolet (Crandon)	Rio Algom Limited	Zinc, copper	Permitting
	Pend Oreille	Cominco Ltd.	Zinc, lead	Feasibility
	Rasmussen Ridge	Agrium Inc.	Phosphate	Production
	Red Dog	Cominco Ltd.	Zinc, lead, silver	Production
	Rodeo (Goldstrike)	Barrick Gold Corporation	Gold	Construction
	Sebree (smelter)	Alcan Aluminium Limited	Aluminum	Production
	Smith Ranch	Rio Algom Limited	Uranium	Production
	Soledad Mountain	Golden Queen Mining Co. Ltd.	Gold, silver	Feasibility
	Tilden	Algoma Steel Inc., Stelco Inc.	Iron	Production
	Wharf	Goldcorp Inc.	Gold	Production
Uruguay	San Gregorio	Crystallex International Corporation	Gold	Production
Venezuela	Albino	Crystallex International Corporation	Gold	Suspended
	Las Cristinas	Placer Dome Inc.	Gold, copper	Construction
	Loma de Niquel	*i*Tech Capital Corp.	Nickel	Construction
	Tomi	Bolivar Goldfields Ltd.	Gold	Production
Zambia	Bwana Mkubwa	First Quantum Minerals Ltd.	Copper, sulphuric acid	Production
	Chibuluma West	Crew Development Corporation	Copper	Production
	Mufulira	First Quantum Minerals Ltd.	Copper	Production
	Nkana	First Quantum Minerals Ltd.	Copper, cobalt	Production
Zimbabwe	Blanket	Kinross Gold Corporation	Gold	Production
	Blue Rock	Conquest Resources Limited	Gold	Production
	Connemara	First Quantum Minerals Ltd.	Gold	Production
	Jena	Consolidated Trillion Resources Ltd.	Gold	Production
	Shamrock	Conquest Resources Limited	Gold	Production

Source: Natural Resources Canada, based on company reports available in early June 2000.
Note: Canadian companies have interests in hundreds of other projects around the globe, mainly at the exploration stage of the mineral development process.

4. Supply of Mining Goods and Services

4.1 GLOBAL SUPPLY

Much as the demand for mining products is global, so is its supply. There is considerable competition to supply products to mining companies. There are thousands of suppliers around the world that offer specialized products (**Table 2**). Many are exporters and most do not serve mining companies exclusively. Some suppliers provide products that are used in many aspects of mining, but most supply products for certain industries only. There is no single source of information on global suppliers to the mining industry. However, international buyers' guides that cater to one or more of the many facets of mining provide considerable insight into the relative strength of suppliers in various countries.

The *Engineering & Mining Journal*,[18] which is published in the United States and covers all major developments that affect mining around the world, has an average monthly distribution of some 27 000 copies. That journal publishes one of the most extensive buyers' guides to international suppliers of mining products. In November 1998, it listed almost 2500 suppliers based in 38 countries. The *Mining Magazine*,[19] which is published in the United Kingdom and which also covers global developments in mining, has an average monthly distribution of some 13 000 copies in 160 countries. In December 1998, its buyers' guide listed more than 600 suppliers based in 25 countries. *Rock Products*,[20] which is also published in the United States and which covers the production and distribution of sand, gravel, crushed stone, cement, lime, gypsum and other nonmetallic minerals, has an average monthly distribution of over 24 000. Its November 1998 buyers' guide listed more than 950 suppliers based in 22 countries.

Ten countries generally account for 90% of the world's suppliers of mining products, but in the case of the more specialized markets there may be as few as five (**Figures 5a, 5b and 5c**). The United States, with its large economy, is by far the leading supplier of mining products. Although rank varies somewhat depending on the specific market served, the United Kingdom, Germany, Canada and Australia are among the other leading suppliers of mining products. Canada appears to rank among the top three or four, depending on the market.

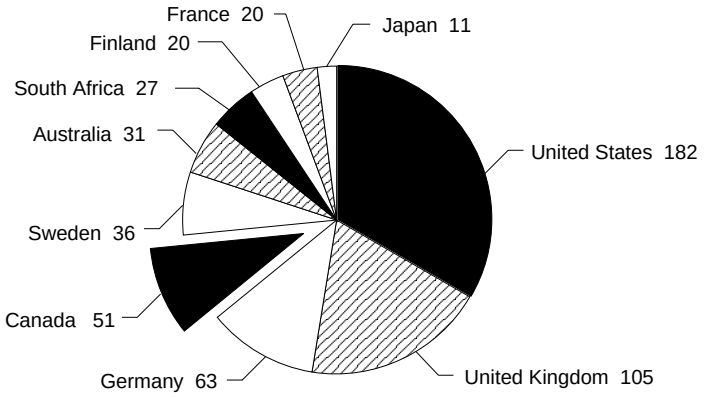
National associations in several countries facilitate the sale of specialized mining products.[21] Many of them are particularly active in the export of manufactured products. They exist in at least 12 countries: Australia, Belgium, Canada, Finland, France, Germany, Japan, the Netherlands, Spain, Sweden, the United Kingdom and the United States (**Table 5**).

Competition among international suppliers of mining products has increased since the mid-1990s, at least in the mining markets served by some trade publications (**Figure 6**). Competition seems to have increased considerably following the large amounts of capital raised for mining in 1996 and 1997. Since then, competition grew considerably from suppliers based in the United States, Australia, the United Kingdom, France, Germany, Sweden and South Africa.

Recently, Australian companies have made a concerted effort to penetrate export markets for mining products. In 1998, the 130 members of Australian Mine Equipment, Technology and Services (Austmine) exported mining goods and services valued at more than A$1 billion;[22] these suppliers expect to triple their export sales within five years.[23] Australian suppliers of

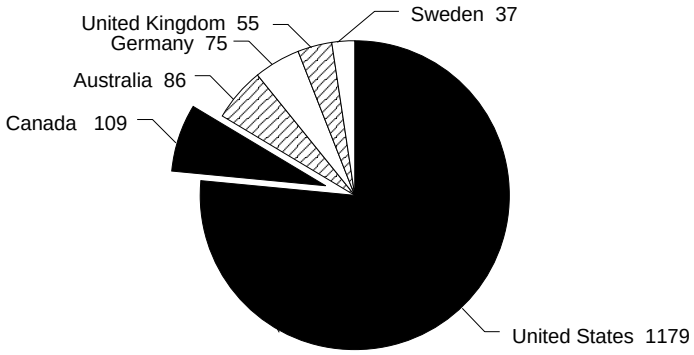
Figure 5
International Suppliers of Specialized Mining Goods and Services

5a. Leading Countries, Ranked by the Number of Advertisers in the *Mining Magazine* Buyers' Guide



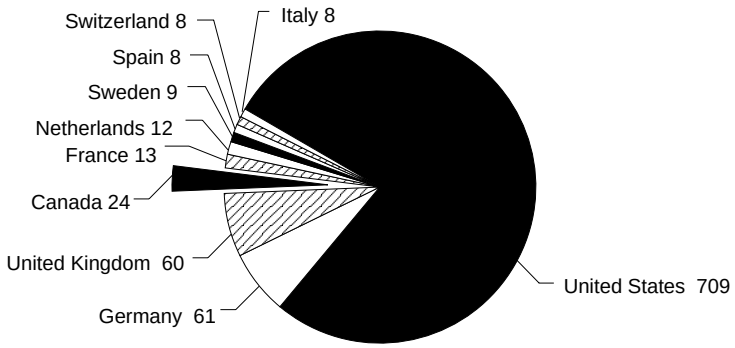
Source: Natural Resources Canada, based on "Buyers' Guide 1999," *Mining Magazine,* December 1998.

5b. Leading Countries, Ranked by the Number of Advertisers in the *Engineering & Mining Journal* Buyers' Guide



Source: Natural Resources Canada, based on "Buyers' Guide 1999," *Engineering & Mining Journal*, November 1999.

5c. Leading Countries, Ranked by the Number of Advertisers in *Rock Products* Buyers' Guide



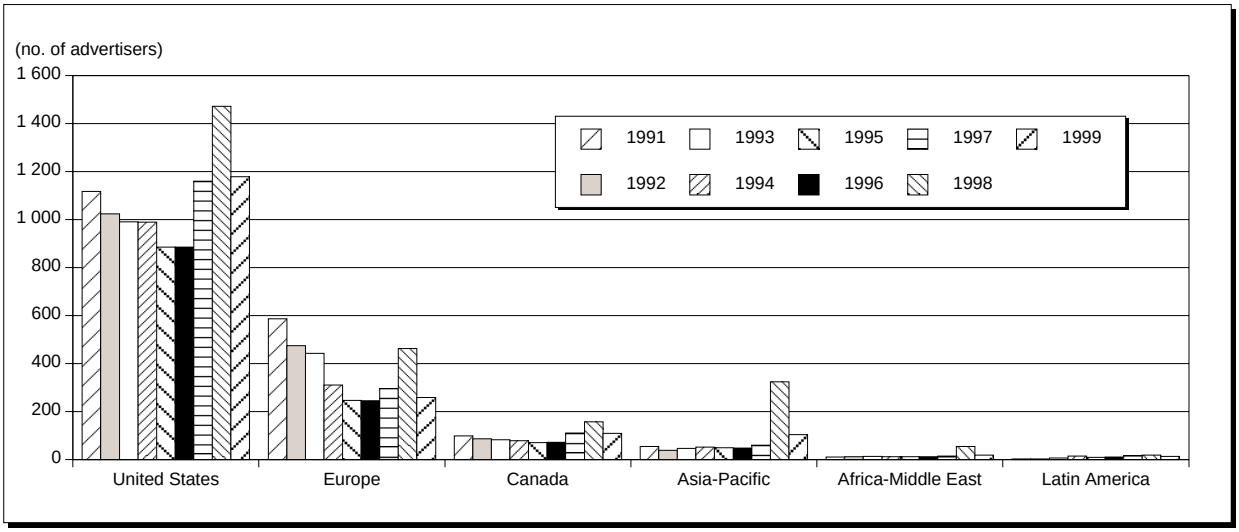
Source: Natural Resources Canada, based on "Buyers' Guide 1999," *Rock Products,* November 1998.

TABLE 5. SELECTED NATIONAL ASSOCIATIONS OF SUPPLIERS OF SPECIALIZED MINING GOODS AND SERVICES

Country	Association
Australia	Australian Mining Equipment Technology and Services (Austmine)
Belgium	Prochar
Canada	Canadian Association of Mining Equipment and Services for Export (CAMESE)
	Canadian Drilling Association (CDA)
	Canadian Mining Contractors Association
	Machinery and Equipment Manufacturers' Association of Canada (MEMAC)
Finland	Finnminers
France	Systramines
Germany	VDMA
Japan	J.S.I.M.
Spain	Spanish Association of Equipment Manufacturers for the Construction and Mining Industries (ANMOPyC)
Sweden	Swedish Mining Group
United Kingdom	Association of British Mining Equipment Companies (ABMEC)
United States	National Mining Association

Source: Natural Resources Canada, based on "Buyers' Guide 1999, " *Mining Magazine,* December 1998, p. B11; *Mining Magazine*, October 1999, pp. 238-252, and February 2000, p. 102; and membership directories.

Figure 6
International Suppliers of Specialized Mining Goods and Services
Regional Supply, Ranked by Number of Advertisers in the *Engineering & Mining Journal* in 1999



Sources: Natural Resources Canada, based on "Buyers' Guides," 1991-99, *Engineering & Mining Journal.*

mining products have been particularly active in training, software, underground mining systems or contract mining in Argentina, Bolivia, China, Peru, Poland, South Africa or Vietnam. Members of Austmine work closely with Australia's diplomatic posts abroad.

4.2 SUPPLY FROM FIRMS BASED IN CANADA

Products Available from Canadian Suppliers

Thousands of mining products are available from suppliers based in Canada.[24] The *Canadian Mining Journal* lists more than 2100 products, of which at least 1870 (89%) are available from at least 355 suppliers based in Canada.[25] *Aggregates and Roadbuilding*[26] lists 304 products, of which at least 295 are available from at least 168 Canadian suppliers,[27] and the B.C. & Yukon Chamber of Mines[28] lists 190 products, 189 of which are available from at least 210 Canadian suppliers.[29]

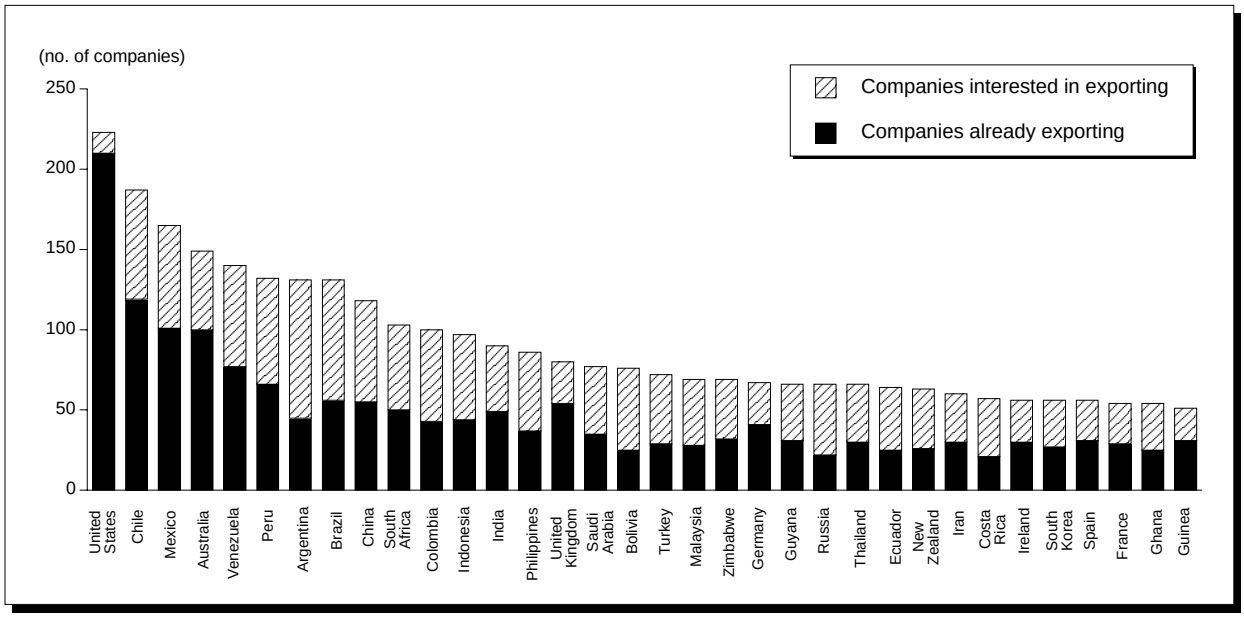
Foreign Markets for Canadian Mining Products

Canadian mining products are distributed widely around the world. Canadian suppliers sell in all of the major mining markets. In 1994, over 260 Canadian companies exported mining products to 179 countries. Most of these companies planned to continue to increase their export activities, including penetration of markets in an additional 20 countries (**Figure 7**). Of those companies, 137 (more than half) exported to six or more countries (**Figure 8**).

There is a close correlation between the countries where Canadian suppliers of mining products have focused their export efforts (**Figure 9)** and the countries where Canadian companies hold their largest numbers of mineral properties.[30] This close correlation also holds for specific regions of the world, notably for South America (**Figure 10**), Central America, the Caribbean, Eastern Europe and the Former Soviet Union. In addition, Canadian suppliers also export to other countries from which mining products may be re-exported.

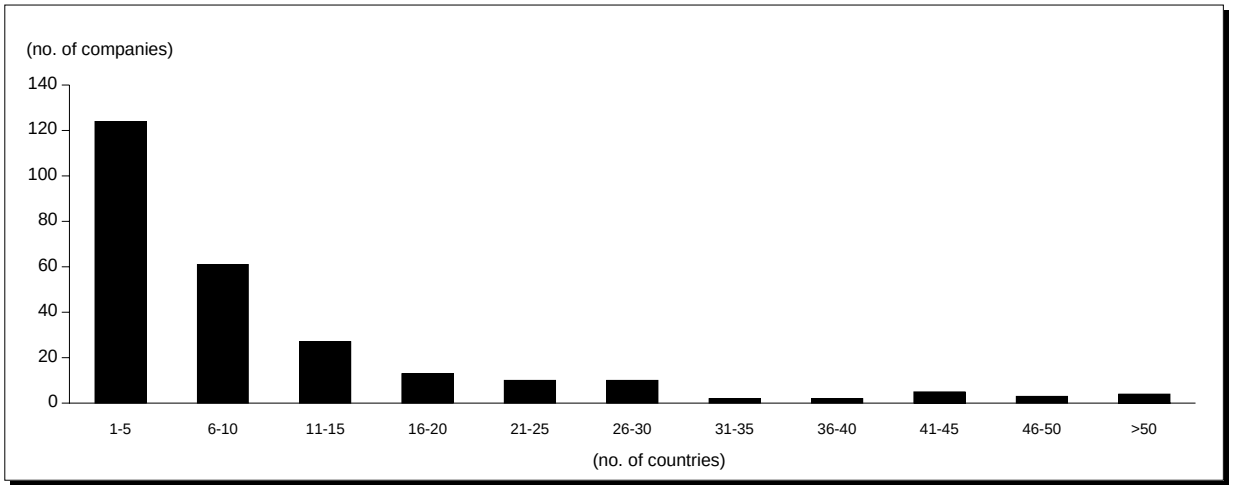
More than 250 companies are members of the Canadian Association of Mining Equipment and Services for Export (CAMESE). These companies offer more than 600 products in almost 250 product categories and 8 product groups to international mining markets. About one fifth of these products are available from five or more of these suppliers. Members of CAMESE offer considerable expertise in products related to underground mining (**Figure 11**), which is not surprising given the large number of underground mines in Canada. Products with a high knowledge content rank prominently among those that they offer to the international mining community. Services related to the environment, exploration, technical and economic feasibility, due diligence, mineral processing and mine automation are among their leading products (**Figure 12**).

Figure 7
Main Export Markets of Canadian Suppliers of Specialized Mining Goods and Services
Activities and Intentions of 293 Companies for 199 Countries



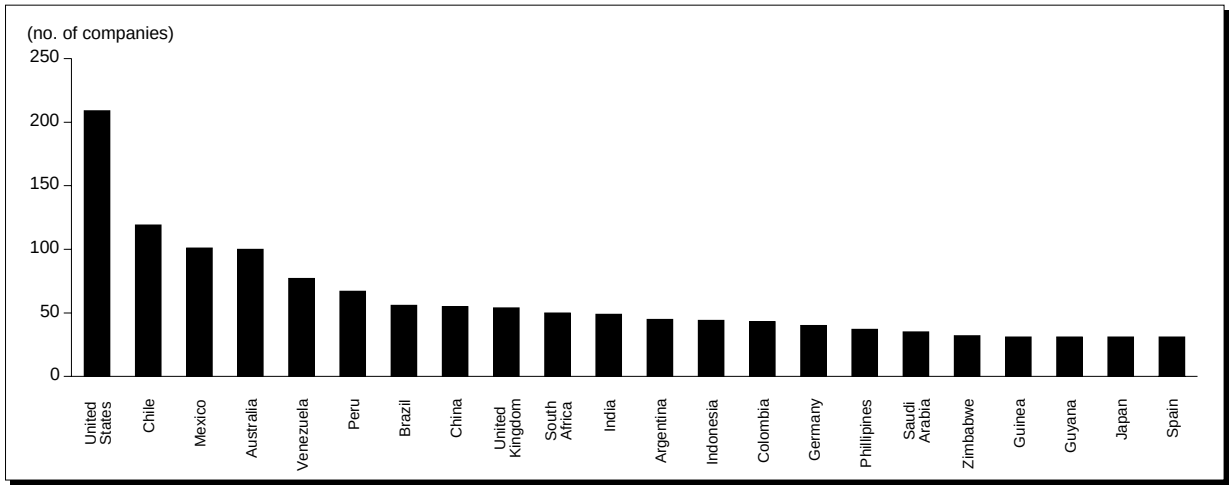
Source: Natural Resources Canada, based on *Directory of Canadian Exporters: Mining Equipment and Services*, Department of Foreign Affairs and International Trade, 1994.

Figure 8
Penetration of Export Markets by Canadian Suppliers of Specialized Mining Goods and Services
Number of Markets by Company



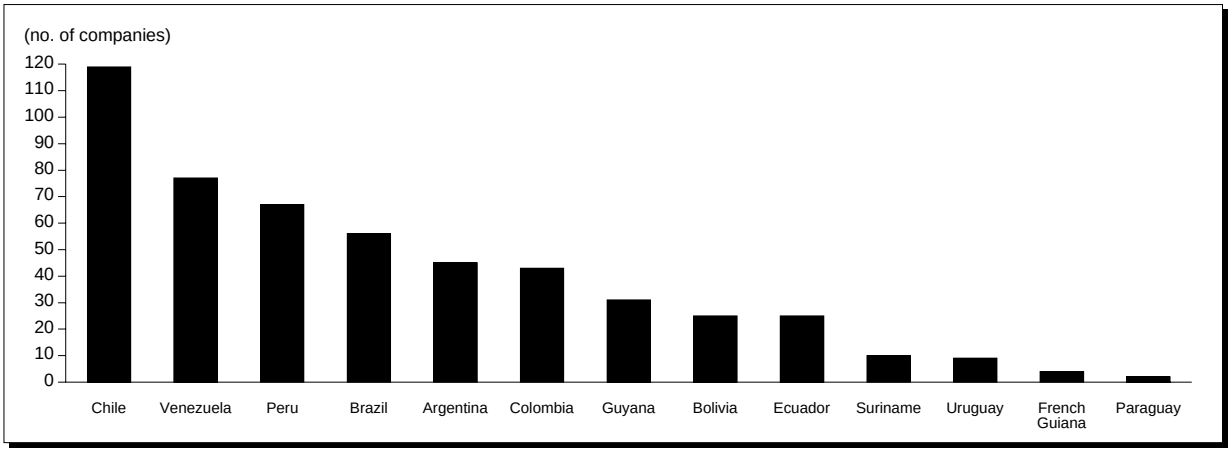
Source: Natural Resources Canada, based on *Directory of Canadian Exporters: Mining Equipment and Services*, Department of Foreign Affairs and International Trade, 1994.

Figure 9
Canadian Suppliers of Specialized Mining Goods and Services
Countries Accounting for Half of Export Presence



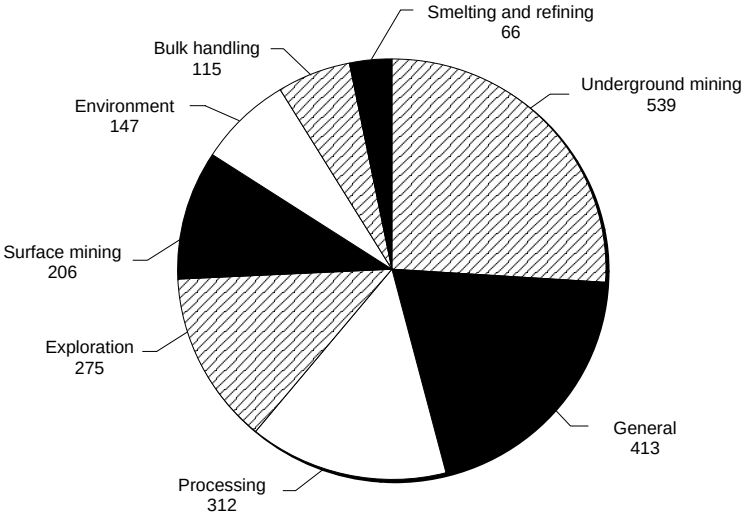
Source: Natural Resources Canada, based on *Directory of Canadian Exporters: Mining Equipment and Services*, Department of Foreign Affairs and International Trade, 1994.

Figure 10
Canadian Suppliers of Specialized Mining Goods and Services
Export Presence in South America, by Number of Companies



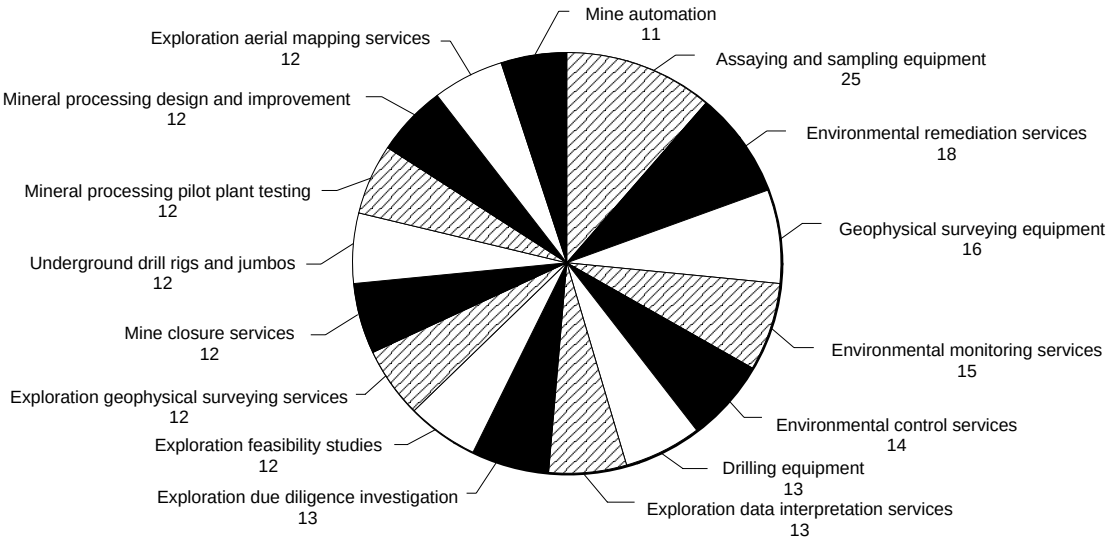
Source: Natural Resources Canada, based on *Directory of Canadian Exporters: Mining Equipment and Services*, Department of Foreign Affairs and International Trade, 1994.

Figure 11
Canadian Suppliers of Specialized Mining Goods and Services
Areas of Specialty, Ranked by Number of Product Offerings



Source: Natural Resources Canada, based on *CAMESE COMPENDIUM of Canadian Mining Suppliers, 1999-2000,* September 1999.
Note: Product offerings refer to the number of products weighted by the number of suppliers.

Figure 12
Canadian Suppliers of Specialized Mining Goods and Services
Leading Products Ranked by Number of Suppliers



Source: Natural Resources Canada, based on *CAMESE COMPENDIUM of Canadian Mining Suppliers, 1999-2000,* September 1999.
Note: Numbers refer to the number of companies offering a given product.

5. Links Between Canadian Mining Companies and Selected Sectors of the Canadian Economy

5.1 LINKS TO SUPPLIERS OF SPECIALIZED MINING PRODUCTS

An examination of over 30 Canadian or international trade journals or equivalent sources (**Table 6**) has identified almost 2200 companies with addresses in Canada that consider mining a sufficiently large market to warrant advertising their products to mining companies. About 40% of these suppliers advertise in more than one trade publication or its equivalent (**Figure 13**).

The compilation from trade publications has not identified all of the significant Canadian suppliers of mining products. Some of the larger suppliers of specialized products, as well as many of the smaller ones, rely on marketing tools other than advertising to attract and retain customers. As well, for many other suppliers, mining companies are unlikely to be significantly different from their other customers to warrant advertising in mining trade publications.

In 1993/94, 20% of suppliers to mining companies in Australia are likely to have made over 80% of the sales.[31] Although counting suppliers advertising in trade publications may ignore significant numbers of them, it likely identifies many of the more important ones.

Main Regional Links

Head offices of Canadian suppliers of specialized mining products are located mainly in Ontario, British Columbia and Quebec. These provinces are also the ones with the largest mining economies. They account for about 70% of Canadian suppliers of specialized mining products. Ontario alone accounts for almost half of the suppliers identified from advertising appearing in trade publications (**Figure 14**). Canadian exporters of mining products are even more concentrated in these provinces; more than 85% of them are located there.[32]

Canadian mining companies purchase a large quantity of goods and services relative to sales. In 1997, mining companies in Ontario purchased goods and services for production purposes valued at $1.1 billion, equivalent to 30% of the $3.8 billion that they made in sales during that year.[33] More than 77% of the goods and services purchased by these companies were obtained from suppliers based in Ontario; some 40% of the purchases were made from suppliers located within 80 kilometres of mining operations. In Australia, mining companies spend, on average, about half of the value of their production on goods and services, 80% of which is obtained domestically.[34]

The supply of mining products creates benefits for both urban and remote areas alike. Northern Ontario (telephone area code 705) accounts for about 15% of suppliers of specialized mining products, about the same as in southern Ontario (area code 905). In 1996, more than 300 companies or individuals with mining expertise resided in Sudbury or neighbouring areas; more was estimated spent on underground hardrock mining products within a 500-km radius of Sudbury than anywhere else in Canada, the United States or Chile.[35] In the North Bay area, some 65 businesses generate at least 30% of their revenues from supplying mining companies; more than 1300 full-time direct jobs and almost 800 indirect jobs result from the activities of

TABLE 6. TRADE JOURNALS AND EQUIVALENT SOURCES OF INFORMATION FROM WHICH CANADIAN SUPPLIERS OF SPECIALIZED MINING GOODS AND SERVICES WERE COMPILED

Abitibi-Témiskamingue 48e Nord International, 1999

Aboriginal Supplier Inventory Web Site, Indian and Northern Affairs Canada

Aggregates and Roadbuilding, Vol. 12, 1998

"Buyers' Guide 1998," *Mining Magazine*, December 1997

"Buyers' Guide 1999," *Aggregates and Roadbuilding*, Nov.-Dec. 1998

"Buyers' Guide 1999," *Rock Products*, November 1998

CAMESE COMPENDIUM of Canadian Mining Suppliers, 1998/99, Canadian Association of Mining Equipment and Services for Export, September 1998

Canadian Mines Handbook, 1998-99, Southam Mining Publications Group, Toronto

CIM Bulletin, Vol. 91, 1998

CMJ, Vol. 119, 1998

Coal Directory, 1998, The Coal Association of Canada

Directory of Canadian Exporters: Mining Equipment and Services, Department of Foreign Affairs and International Trade, 1994

Exhibitors, Annual Convention and Trade Show, Canadian Institute of Mining, Metallurgy and Petroleum, Montréal, Quebec, May 1998

Exhibitors, Annual Convention and Trade Show, Prospectors and Developers Association of Canada, Toronto, Ontario, March 1998

E&MJ Bulletin, Vol. 199, 1998

Industrial Minerals, nos. 364-375, 1998

Membership Directory, Machinery and Equipment Manufacturers' Association of Canada

Membership Directory 1999, Canadian Drilling Association

Membership Directory 1999, Canadian Mining Contractors Association

Mining Magazine, Vol. 178, 1998

Mining Review, B.C. & Yukon Chamber of Mines, Vol. 18, 1998

"Mining Sourcebook," *Canadian Mining Journal*, 1998

Northern Miner (The), Vol. 84, 1998

Prospector (The), Vol. 10, 1999

Provincial Government Web Sites, 1999

Rock Products, Vol. 101, 1998

Stone Review, Vol. 14, 1998

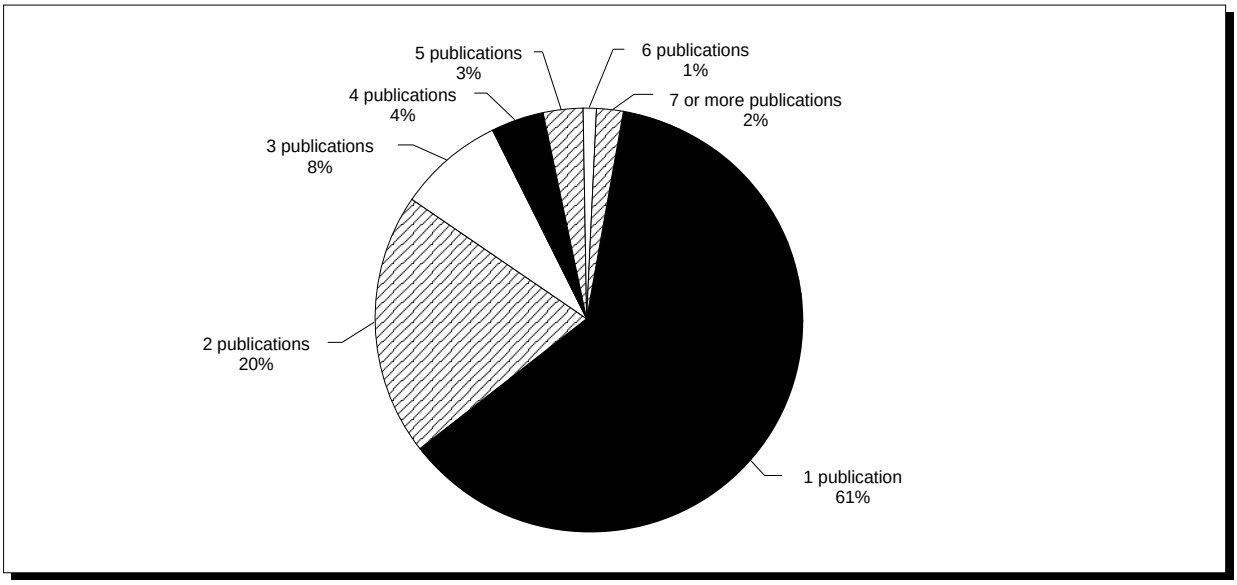
STRATEGIS, Canadian Capability Web Site, Industry Canada

Sudbury Region Mining and Environmental Directory, Sudbury Regional Development Corporation, 1996

Sulphur, no. 248-253, 1997

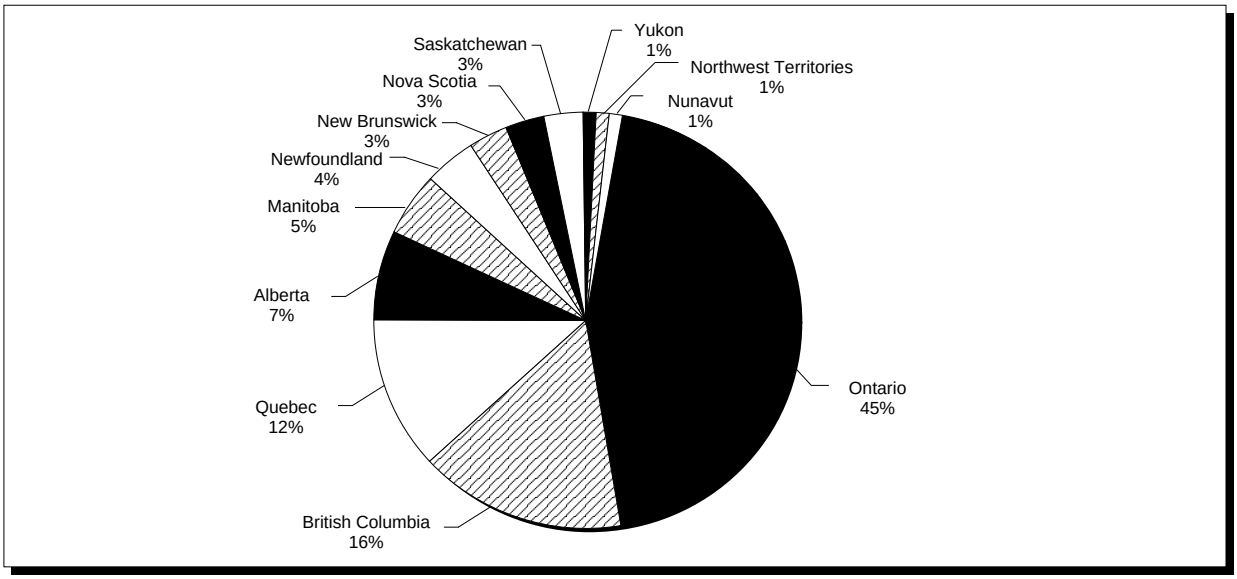
Source: Natural Resources Canada.

Figure 13
Canadian Suppliers of Specialized Mining Goods and Services
Propensity to Advertise



Source: Natural Resources Canada, based on advertising by 2195 companies compiled from trade publications.

Figure 14
Canadian Suppliers of Specialized Mining Goods and Services
Distribution of Head Offices in Canada, by Province and Territory



Source: Natural Resources Canada, based on advertising by 2195 companies compiled from trade publications.

these companies in supplying mining companies.[36] In Australia, in 1993/94, more than three quarters of payments from the sale of mining products were made to suppliers in urban areas.[37]

Suppliers of specialized mining goods and services exist in over 400 localities in Canada. Some 20 localities in various parts of the country account for 80% of the Canadian suppliers of specialized mining goods and services (**Figure 15**). The Toronto, Vancouver and Sudbury areas alone account for 45%. Some suppliers based in urban areas have branch offices in mining communities. Branch offices are not counted here and, as a result, the importance of remote communities as suppliers of mining products is to some extent underestimated. Some 28 towns, townships, cities, municipalities or regional municipalities belong to the Association of Mining Municipalities of Ontario.[38]

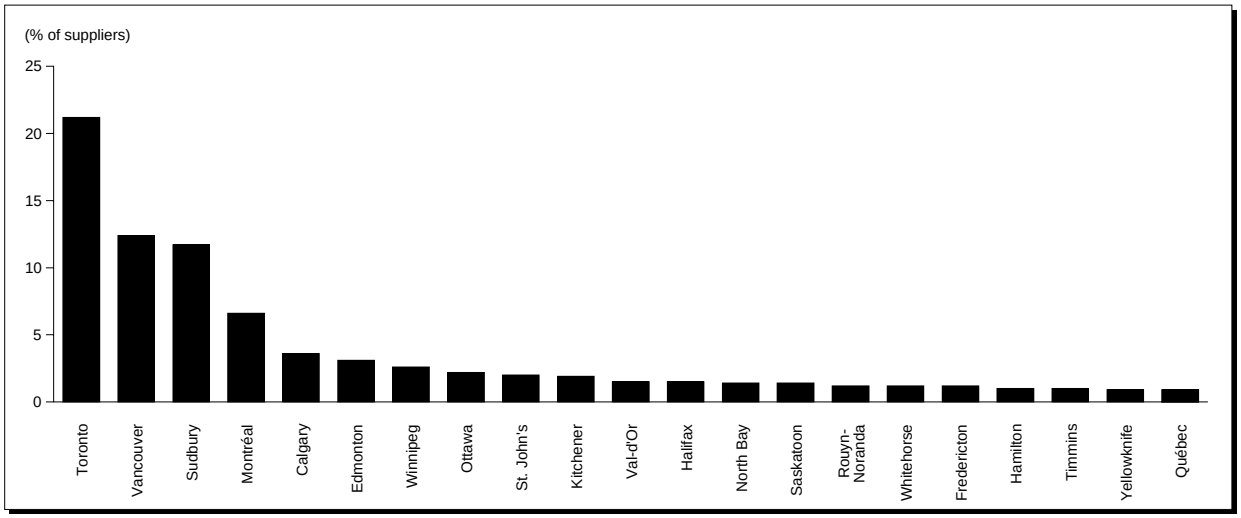
Main Sector Links

Although there are Canadian suppliers of mining goods and services in all 20 sectors of the Canadian economy,[39] the manufacturing sector, the professional, scientific and technical services sector, the wholesale trade sector and the mineral resource extraction sector (contract drilling and contract mining) account for 80% of the almost 2200 specialized Canadian suppliers identified from advertising appearing in trade publications (**Figure 16**).

Manufacturing Sector

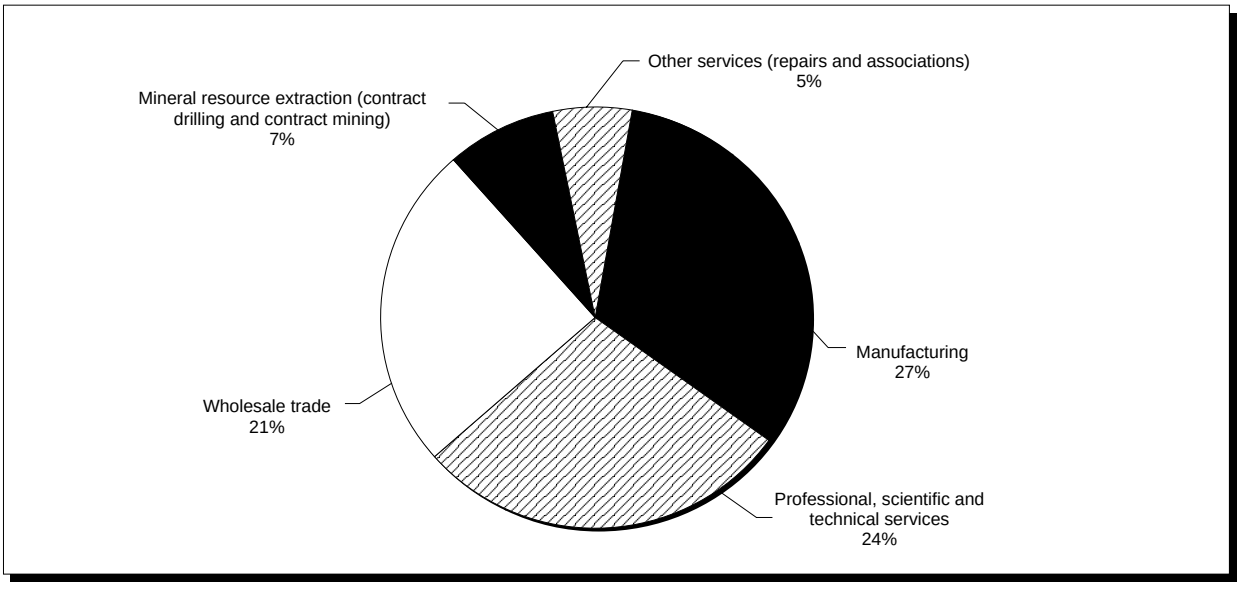
Almost 590 companies, or 27% of the suppliers identified from advertising, are manufacturers. Suppliers of various types of machinery and equipment account for more than 40% of these manufacturers (**Figure 17**). Since 1955, the Machinery and Equipment Manufacturers' Association of Canada[40] has promoted the development of an internationally competitive machinery and equipment sub-sector based in this country. The association has a mining equipment manufacturers' section.

Figure 15
Canadian Suppliers of Specialized Mining Goods and Services
Cities Accounting for 80% of Suppliers



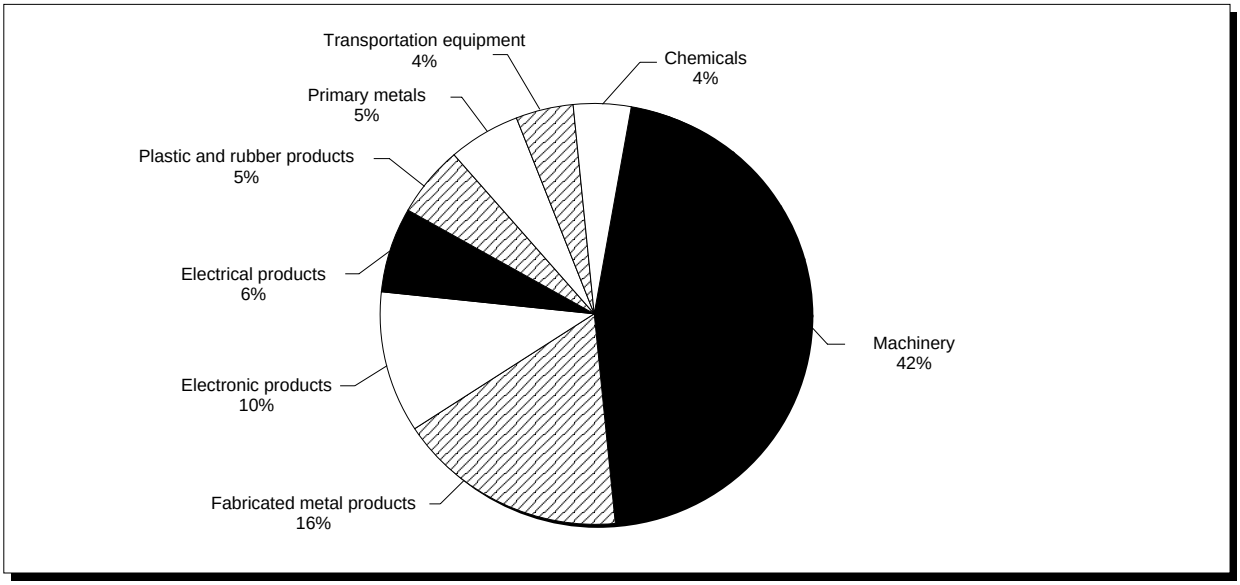
Source: Natural Resources Canada, based on advertising by 2195 companies compiled from trade publications.

Figure 16
Canadian Suppliers of Specialized Mining Goods and Services
Sectors of the Economy Accounting for 80% of Suppliers



Source: Natural Resources Canada, based on 2195 companies advertising in trade publications and on industry codes from Statistics Canada and Industry Canada.

Figure 17
Canadian Suppliers of Specialized Mining Goods and Services
Sub-Sectors of the Economy Accounting for 90% of Manufacturers



Source: Natural Resources Canada, based on 586 companies advertising in trade publications and on industry codes from Statistics Canada and Industry Canada.

Professional, Scientific and Technical Services Sector

Human capital is a substantial component of the specialized products consumed by mining companies. More than 530 companies, or 24%, of the suppliers identified from advertising provide professional, scientific or technical services. Engineers, as well as geologists, geophysicists, geochemists and other members of disciplines of the earth sciences, account for over 70% of these suppliers (**Figure 18**). At least 40 firms based in Canada provide geophysical services or supply geophysical equipment to domestic or export markets.[41,42]

The recruitment of personnel for mining companies has also become a global business. Leading recruiters from Australia, Canada, the United States, the United Kingdom and South Africa recently formed an alliance to staff mining and construction jobs around the world.[43]

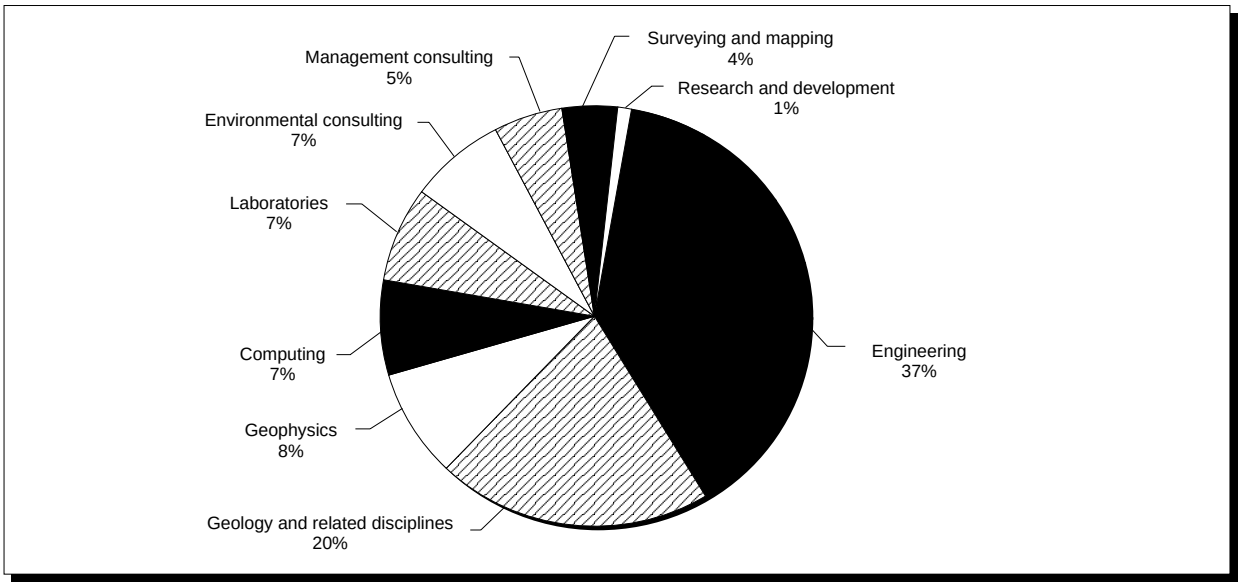
Wholesale Trade Sector

More than 460 companies, or 21%, of the specialized suppliers identified from advertising are wholesalers. Firms providing machinery, equipment and related products account for more than 70% of these wholesalers (**Figure 19**). In addition to new goods, these suppliers also sell machinery and equipment recycled from Canadian mines that have ceased production. Used goods are re-used in Canada or exported to mining operations abroad.

Mineral Resource Extraction Sector

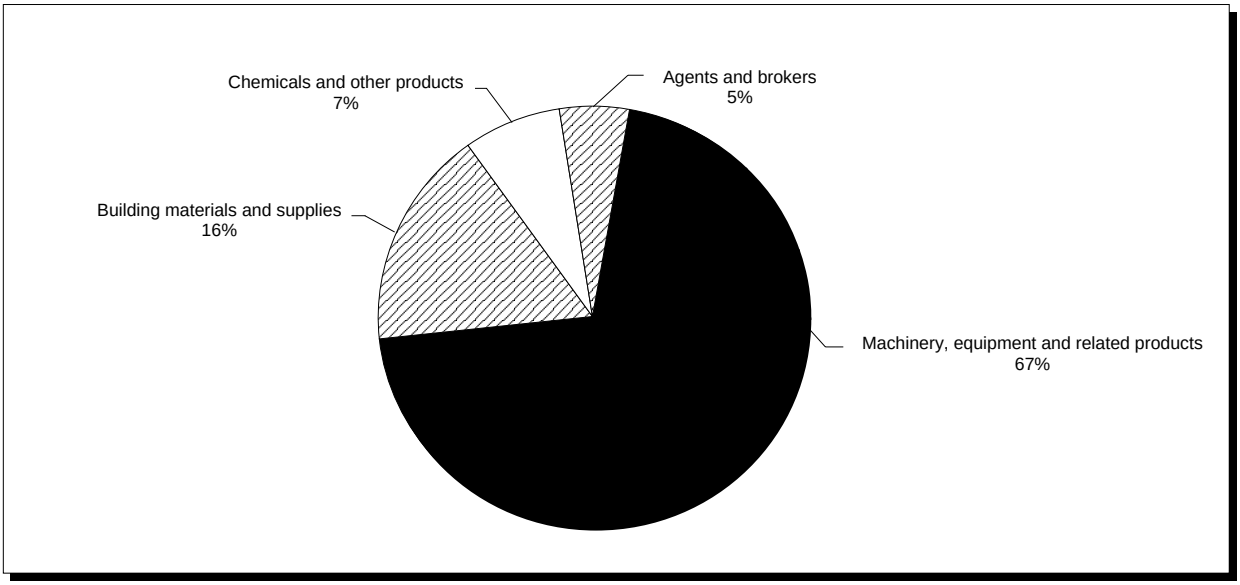
More than 150 firms, or 7%, of the specialized suppliers identified from advertising belong to the mineral resource extraction sector. Firms in this sector provide contract drilling, contract mining, and other exploration or production services to mining companies. Many of the contract drillers are members of the Canadian Drilling Association.[44] Many of the contract mining and development firms are members of the Canadian Mining Contractors Association.[45]

Figure 18
Canadian Suppliers of Specialized Mining Goods and Services
Industries Accounting for 95% of the Professional, Scientific and Technical Services Sector



Source: Natural Resources Canada, based on 536 companies advertising in trade publications and on industry codes from Statistics Canada and Industry Canada.

Figure 19
Canadian Suppliers of Specialized Mining Goods and Services
Sub-Sectors of the Economy Accounting for 95% of Wholesalers



Source: Natural Resources Canada, based on 461 companies advertising in trade publications and on industry codes from Statistics Canada and Industry Canada.

Other Services Sector (Repairs and Associations)

Some 110 firms, or 5%, of the specialized suppliers identified from advertising belong to the repairs and other services sector. In addition to firms that repair machinery and equipment used in mining operations, this sector also includes business and professional associations.

Numerous associations are related directly or indirectly to mining companies. There are at least 60 business associations in Canada that promote the development of markets for specific mineral commodities or that lobby on specific issues of common interest to their members (**Table 7**). Similarly, there are at least 40 professional associations with ties to mining (**Table 8**). Some of these associations regulate professions that supply services to mining companies. Most promote the development of their respective discipline and the transfer of knowledge and experience among their members.

Survey of Canadian Suppliers of Specialized Mining Products

There are no statistical data collected in Canada that can readily measure the revenues and employment derived by Canadian firms from supplying mining companies in Canada and abroad. Therefore, a survey was undertaken by the Minerals and Metals Sector of Natural Resources Canada to obtain data to help quantify the economic links between domestic mining companies and their suppliers. The main objective of the survey was to obtain quantitative data to assess: 1) the relative importance of the mining industry to suppliers in various sectors of the Canadian economy; 2) the connection between the activities of Canadian mining companies abroad and exports from Canada of mining goods and services; and 3) the jobs that supplying mining companies in Canada and abroad generate in Canada.

Methodology

The survey was conducted using a questionnaire and an accompanying letter (**Appendices II and III**). It consisted of 14 questions and focused on revenues from sales in Canada and abroad and on the resulting employment in Canada for the calendar years 1996 and 1997. These questions were the final result of testing, reformulation and re-testing of the questionnaire. This preliminary work was undertaken in the summer and fall of 1998 under the guidance of a consulting mining engineer with respect to a number of companies representing a wide cross-section of industries. Consultations on the questionnaire were held with a number of private and public organizations including the Canadian Association of Mining Equipment and Services for Export and Statistics Canada.

Testing indicated that the response rate was likely to be highest from suppliers of specialized mining products. It also indicated that responses from suppliers of other products would not likely be sufficient to provide meaningful results. Consequently, the questionnaire was directed almost exclusively at suppliers of specialized products while non-survey methods were used to examine the impact of mining companies on selected suppliers of other products (refer to **Section 5.2**).

A convenience sample of more than 1700 companies that provide mainly specialized mining products was surveyed from the fall of 1998 through the summer of 1999. This sample represents 78% of the suppliers identified from advertising appearing in trade publications. Companies were initially contacted by mail. A follow-up to companies that had yet to respond consisted of up to three telephone calls and faxes. An estimated 3000 telephone calls were made in order to increase the response rate.

TABLE 7. SELECTED CANADIAN BUSINESS ASSOCIATIONS RELATED TO MINING

Aggregate Producers' Association of Ontario
Alberta Chamber of Resources
Aluminium Association of Canada
Association canadienne de la pierre naturelle
Association de l'industrie de l'aluminium du Québec
Association des mines d'amiante du Québec
Association des producteurs de tourbe du Québec
Association des prospecteurs amateurs Haute Côte-Nord
Association des prospecteurs de la Côte-Nord
Association des prospecteurs de la Manicouagan
Association des prospecteurs de l'Estrie-Beauce-Appalaches
Association des prospecteurs du Bas-Saint-Laurent
Association des prospecteurs du Nord-Ouest québécois
Association des prospecteurs du Québec
Association des prospecteurs du Saguenay-Lac-St-Jean
Association des prospecteurs gaspésiens
Association minière du Québec
Association of Mining Municipalities of Ontario
B.C. & Yukon Chamber of Mines
Canadian Aboriginal Minerals Association
Canadian Association of Mining Equipment and Services for Export
Canadian Construction Association
Canadian Copper & Brass Development Association
Canadian Drilling Association
Canadian Foundry Association
Canadian Lime Institute
Canadian Mining Contractors Association
Canadian Mining Industry Research Organization
Canadian Nuclear Association
Canadian Portland Cement Association
Canadian Steel Producers Association
Chamber of Mineral Resources of Nova Scotia
Chamber of Mines of Eastern British Columbia
Coal Association of Canada, The
Environmental Mining Council of British Columbia
International Council on Metals and the Environment
Klondike Placer Miners' Association
Machinery & Equipment Manufacturers' Association of Canada
Manitoba Prospectors and Developers Association Inc.
Manitoba-Saskatchewan Prospectors and Developers Association
Mining Association of British Columbia
Mining Association of Canada, The
Mining Association of Manitoba Inc.
Mining Association of Newfoundland and Labrador
Mining Society of Nova Scotia
Mining Suppliers, Contractors & Consultants Association of B.C.
New Brunswick Mining Association
New Brunswick Prospectors & Developers Association
Newfoundland & Labrador Explorationists
Newfoundland & Labrador Chamber of Mineral Resources Inc.
Nickel Development Institute
Northwest Territories Chamber of Mines
Ontario Mining Association
Ontario Prospectors Association
Potash & Phosphate Institute of Canada
Prospectors and Developers Association of Canada
Saskatchewan Mining Association
Saskatchewan Potash Producers Association Inc.
Small Explorers and Producers Association of Canada
Yukon Chamber of Mines
Yukon Prospectors Association

Source: Natural Resources Canada, based on *The Directory of Associations in Canada 1998/99, Canadian Mines Handbook* and association publications.

TABLE 8. SELECTED CANADIAN PROFESSIONAL ASSOCIATIONS RELATED TO MINING

Association of Consulting Engineers of Canada
Association of Consulting Engineers of Manitoba Inc.
Association of Exploration Geochemists
Association of Geoscientists of Ontario
Association of Profesional Geologists of New Brunswick Inc.
Association of Professional Engineers & Geoscientists of British Columbia
Association of Professional Engineers & Geoscientists of Newfoundland
Association of Professional Engineers & Geoscientists of Saskatchewan
Association of Professional Engineers and Geoscientists of the Province of Manitoba
Association of Professional Engineers of New Brunswick
Association of Professional Engineers of Nova Scotia
Association of Professional Engineers of Prince Edward Island
Association of Professional Engineers of Yukon
Association of Professional Engineers, Geologists & Geophysicists of Alberta
Association of Professional Engineers, Geologists and Geophysicists of the Northwest Territories
Association of Professional Geoscientists of Nova Scotia
Association professionelle des géologues et des géophysiciens du Québec
British Columbia Geophysical Society
Canadian Council of Professional Engineers
Canadian Council of Professional Geoscientists
Canadian Exploration Geophysical Society
Canadian Geoscience Council
Canadian Geotechnical Society
Canadian Institute of Geomatics
Canadian Institute of Mining, Metallurgy & Petroleum
Canadian Institute of Resources Law
Canadian Mineral Analysts
Canadian Nuclear Society
Consulting Engineers of British Columbia
Geological Association of Canada
Mineralogical Association of Canada
Mines Accident Prevention Association of Manitoba
Mines Accident Prevention Association of Ontario
Mines and Aggregates Safety and Health Association
Mining Industry Safety Association
Ordre des ingénieurs du Québec
Professional Engineers Ontario
Vancouver Geotechnical Society

Source: Natural Resources Canada, based on *The Directory of Associations in Canada 1998/99, Canadian Mines Handbook* and association publications.

Survey Results

Altogether, 629 companies returned a questionnaire with at least one item of useable data for at least one of the two years sought (**Appendix IV**). This is equivalent to an overall sample response rate of almost 37% and a target population response rate of 29%. Not all companies that returned a questionnaire completed all relevant questions. Some 574 companies provided data for both years; 56 companies provided data for only one of the years sought. As a result, caution is advised in interpreting differences between the two years as trends based solely on the survey data.

REVENUES FROM SALES

The 629 suppliers that responded to the survey questionnaire reported total revenues from sales to mining companies and to all other clients in Canada and abroad of $13.0 billion in 1996 and $13.9 billion in 1997. Their total revenues from sales of goods to clients in all industries were $7.5 billion in 1996 and $7.9 billion in 1997. Total revenues from sales of services to clients in all industries were $5.5 billion in 1996 and $6.0 billion in 1997. In both 1996 and 1997, more than 60% of suppliers reported selling goods and more than 50% reported selling services. In both years, the sale of goods to clients in all industries accounted for roughly 57% of total revenues, while the sale of services accounted for the remaining 43%. Average annual company sales of goods and services to clients in all industries were $22 million in 1996 and $23 million in 1997. Average annual company sales of goods to clients in all industries were $20 million in 1996 and $21 million in 1997; average annual company sales of services were $18 million in 1996 and $19 million in 1997.

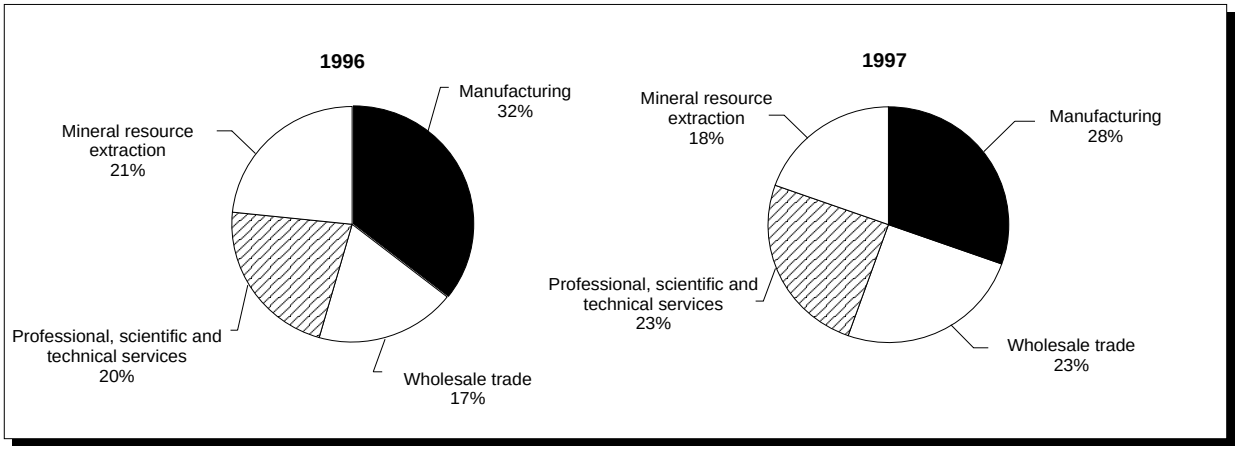
Respondents to the survey questionnaire reported total revenues from sales to mining companies in Canada and abroad of $4.0 billion in 1996 and $4.6 billion in 1997, an increase of 15%. Because the total number of suppliers to mining companies is unknown and because suppliers consist of a very heterogeneous mix of industries, it is not possible to estimate from survey responses the total value of the market served by Canadian suppliers of mining products. However, the impact of Canadian mining companies on their suppliers through production and investment has been estimated elsewhere using input-output methodology (**Appendix V**). Input-output analysis shows that, in 1992, mining companies and producers of primary metals generated more than $20 billion in sales and contributed over 180 000 jobs in their supporting sectors.[46] However, these estimates are not directly comparable to the survey results presented here.

Five sectors of the economy account for most of the suppliers of specialized mining products (**Appendix VI**). They also account for almost 99% of the aggregate revenues that respondents to the survey questionnaire reported from the sale of mining goods and services. In both 1996 and 1997, the manufacturing sector accounted for 30% of the total revenues derived from the sale of mining products. The professional, scientific and technical services sector, the wholesale trade sector and the mineral resource extraction sector (contract drilling and contract mining) each accounted for about 20% (**Figure 20**).

Many of the companies that provided data on their sales to mining companies in 1996 and 1997 did not provide data on their total sales to all types of clients. Nonetheless, based on returns from companies that supplied both items of data, sales to mining companies account for about 25% of the total revenues from all clients of companies that supply specialized mining goods and services. Half of all suppliers depend on sales to mining companies for 50% or more of their total revenues. However, small suppliers derive a substantially larger proportion of their total revenues from mining companies than the larger ones do. Sales to mining companies account for about 90% of the total sales of suppliers in the mineral resource extraction sector (contract drilling and contract mining), 35% of those in the professional, scientific and technical services sector, 25% in the manufacturing sector, and 15% in the wholesale trade sector.

Respondents to the survey questionnaire reported total revenues derived from the sale of goods to mining companies of $2.2 billion in 1996 and $2.4 billion in 1997, an increase of 9%. Their total revenues derived from the sale of services were $1.8 billion in 1996 and $2.1 billion in

Figure 20
Canadian Suppliers of Specialized Mining Goods and Services
Sectors of the Economy Accounting for 90% of Sales Revenues from Mining Companies, 1996 and 1997



Source: Natural Resources Canada, based on 629 replies to its *Survey of Businesses Based in Canada Providing Goods and Services to the Mining Industry Worldwide*.

1997. In both 1996 and 1997, revenues from the sale of goods accounted for roughly 55% of all revenues derived from sales to mining companies, while those of services accounted for the remaining 45%. Average annual supplier sales of goods to mining companies were $3.7 million in 1996 and $4.0 million in 1997; average annual supplier sales of services were $3.0 million in 1996 and $3.5 million in 1997.

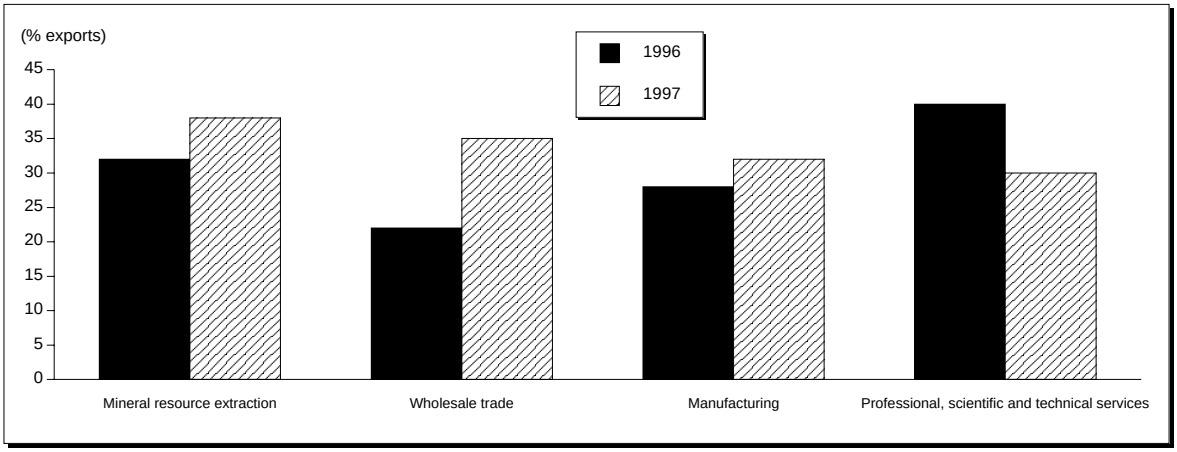
Engineering firms are an important component of the professional, scientific and technical services sector serving mining companies. These firms derive a significant proportion of their revenues from mining companies. In 1998, mining companies were the source of an estimated 9% of engineering revenues.[47] By coincidence, of the 217 specializations listed by the Association of Consulting Engineers of Canada, almost 20, or 9%, are directly related to mining. However, mining companies also utilize many other engineering specialties not specifically related to mining.

Respondents to the survey questionnaire reported total revenues derived from exports to mining companies of $1.2 billion in 1996 and $1.5 billion in 1997, an increase of 25%. Total revenues from sales of goods to mining companies abroad were $0.7 billion in 1996 and $0.9 billion in 1997, an increase of 29%. Total revenues from sales of services to mining companies abroad were $0.5 billion in 1996 and $0.6 billion in 1997, an increase of 20%. Average annual supplier sales of goods to mining companies abroad were $3.3 million in 1996 and $4.3 million in 1997; average annual supplier sales of services abroad were $3.9 million in 1996 and $4.2 million in 1997.

Suppliers of specialized mining products derived 30% of their revenues from mining companies from the sale of goods and services abroad in 1996 and 32% in 1997. The professional, scientific and technical services sector and the mineral resource extraction sector each derived, on average, 35% of their revenues from the sale of mining products from exports in 1996-97; the manufacturing sector and the wholesale trade sector each derived 30% (**Figure 21**). The overall proportion of revenues from the sale of mining products abroad estimated here is considerably lower than estimates made elsewhere. The proportion of exports of mining products to total sales of mining products may be as high as 50%.[48]

Suppliers of specialized mining products reported making most of their sales to mining companies in Canada and abroad without going through intermediaries. They reported revenues of $3.7 billion from direct sales to mining companies in Canada and abroad in 1996 and $4.0 billion

Figure 21
Canadian Suppliers of Specialized Mining Goods and Services
Exports of Dominant Sectors as a Proportion of All Sales to Mining Companies, 1996 and 1997

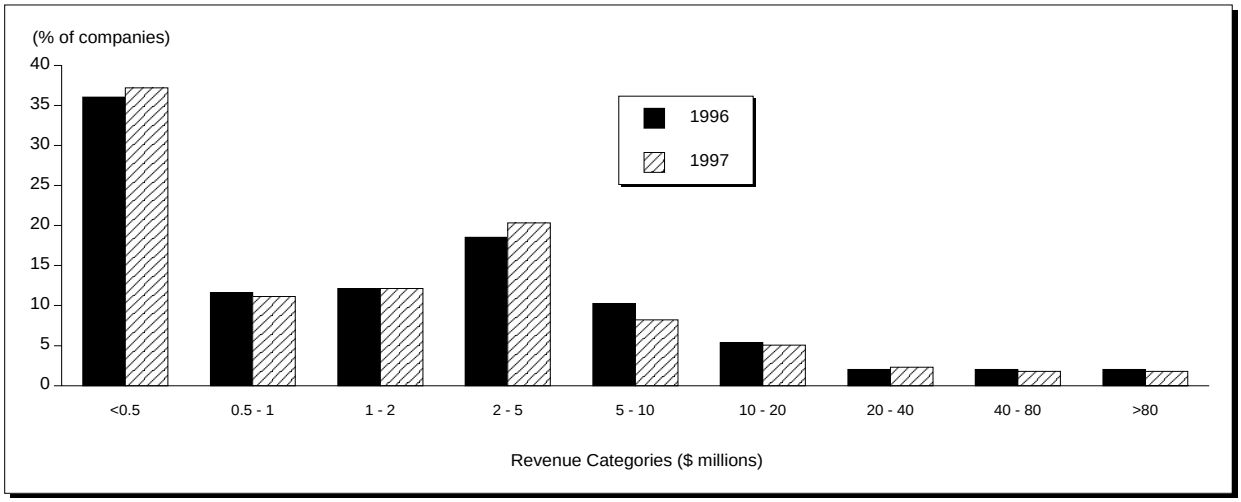


Source: Natural Resources Canada, based on 629 responses to its *Survey of Businesses Based in Canada Providing Goods and Services to the Mining Industry Worldwide.*

in 1997. Suppliers reported revenues from indirect sales to mining companies in Canada and abroad through contractors, wholesalers or other resellers of $0.3 billion in 1996 and $0.6 billion in 1997. Suppliers reported deriving about 8% of their total revenues from the sale of mining products through intermediaries in 1996 and 12% in 1997.

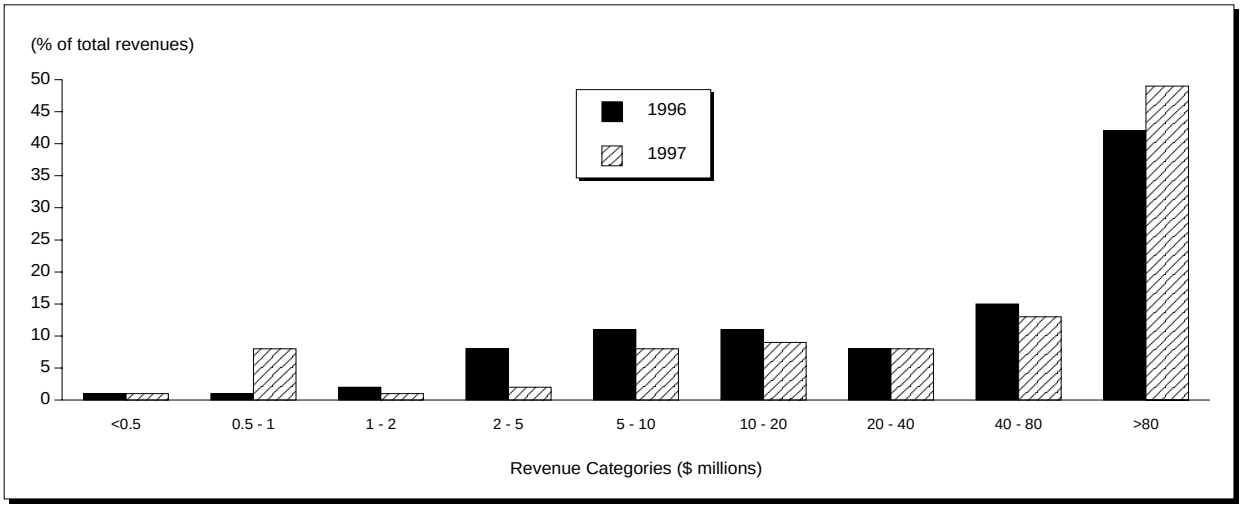
Revenues from the sale of specialized mining products are not distributed evenly with respect to company size. Companies with sales of mining products of less than $5 million account for about 80% of suppliers to mining companies (**Figure 22**). However, their revenues account for less than 20% of total sales of products to mining companies (**Figure 23**).

Figure 22
Canadian Suppliers of Specialized Mining Goods and Services
Distribution of Suppliers by Mining Revenue Category



Source: Natural Resources Canada, based on 629 responses to its *Survey of Businesses Based in Canada Providing Goods and Services to the Mining Industry Worldwide.*

Figure 23
Canadian Suppliers of Specialized Mining Goods and Services
Distribution of Total Mining Revenues by Revenue Category



Source: Natural Resources Canada, based on 629 responses to its *Survey of Businesses Based in Canada Providing Goods and Services to the Mining Industry Worldwide.*

EMPLOYMENT

Total employment also shows that a considerable proportion of Canadian suppliers of specialized mining products are relatively small firms. Although respondents to the survey questionnaire employed more than 55 000 people to serve mining and all of their other clients in Canada and abroad in 1996 and more than 56 000 in 1997, over 70% of them employed fewer than 50 people. The manufacturing sector accounted for almost 40% of employees serving mining and all other clients; the wholesale trade sector and the professional, scientific and technical services sector each accounted for almost 20%, while the construction sector and the mineral resource extraction sector each accounted for roughly 10%.

Employment related specifically to providing specialized products to mining companies also reflects the relatively small size of suppliers. Respondents to the survey questionnaire employed almost 13 000 people to serve mining companies in each of 1996 and 1997. Roughly 25% of the jobs at firms supplying specialized mining products are related to serving mining companies. A number of suppliers reported that their employees do not serve mining companies exclusively. Others reported that their estimate of jobs related to mining is based on revenues from sales to mining companies as a proportion of revenues from sales to all clients.

More than 40% of suppliers reported employing five or fewer people to serve mining companies; almost 90% reported employing fewer than 100; only about 5% reported employing 500 or more (**Figure 24**). Although suppliers of specialized mining products are predominantly relatively small companies, the larger companies nonetheless provide most of the jobs (**Figure 25**). About 30% of all such jobs are in companies with 500 or more employees while 60% are in companies with 100 or more.

Companies in the mineral resource extraction sector (contract drilling and contract mining), which is the most closely related to mining operations, accounted for more than 30% of all employees serving mining companies (**Figure 26**). The number of employees serving mining companies as a proportion of total supplier employment differs considerably between industries. In 1996, more than 80% of suppliers in the mineral resource extraction sector reported

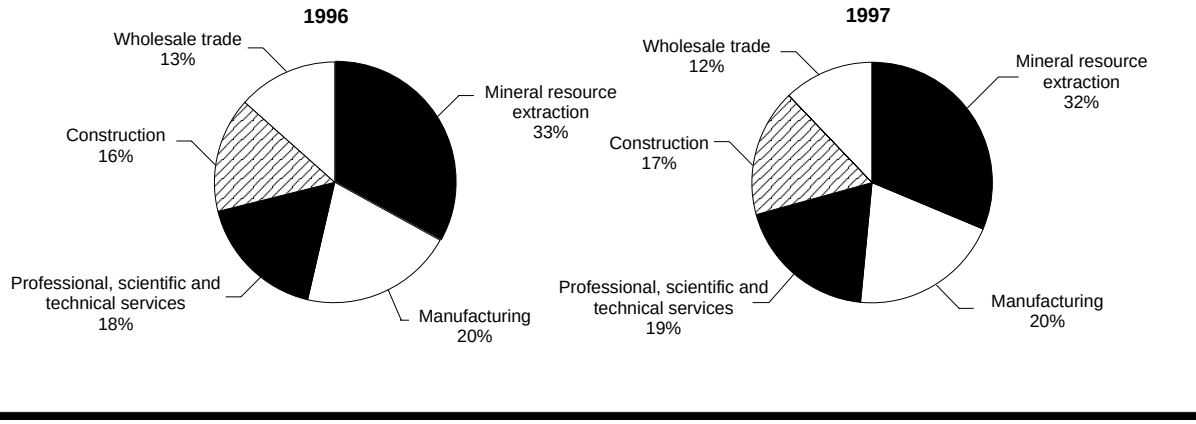
Figure 24
Canadian Suppliers of Specialized Mining Goods and Services
Distribution of Suppliers by the Number of Employees Serving Mining Companies in Canada and Abroad

Source: Natural Resources Canada, based on 629 responses to its *Survey of Businesses Based in Canada Providing Goods and Services to the Mining Industry Worldwide.*

Figure 25
Canadian Suppliers of Specialized Mining Goods and Services
Distribution of Employees Serving Mining Companies in Canada and Abroad, by Employment Category

Source: Natural Resources Canada, based on 629 responses to its *Survey of Businesses Based in Canada Providing Goods and Services to the Mining Industry Worldwide.*

Figure 26
Canadian Suppliers of Specialized Mining Goods and Services
Distribution of Employees Serving Mining Companies in Canada and Abroad, by Sector of the Economy



Source: Natural Resources Canada, based on 629 replies to its *Survey of Businesses Based in Canada Providing Goods and Services to the Mining Industry Worldwide.*

that half or more of their employees served mining companies; that proportion was about 60% for the professional, scientific and technical services sector, 50% for the manufacturing sector, and 40% for the wholesale trade sector.

Suppliers of specialized mining products reported almost 1900 employees based in Canada serving mining companies operating abroad in 1996 and more than 2100 in 1997, an increase of 11%. The number of employees serving mining companies operating abroad as a proportion of all employees serving mining companies everywhere also differs considerably between industries. For 1997, almost 40% of the professional, scientific and technical services sector reported that half or more of their employees served mining companies operating abroad. That proportion was about 30% for both the manufacturing sector and the mineral resource extraction sector; for the wholesale trade sector, it was less than 15%. In general, the fewer employees serving mining, the larger the proportion of those employees serving mining abroad. For example, 40% of companies with five or fewer employees serving mining reported that half or more of them served mining companies operating abroad.

Cross-Sector Markets

Demand by mining companies in Canada and abroad for technologies and management services to comply with existing or expected environmental regulations is expected to grow at a rate of 5-10% per annum over the next three years.[49] This is a very competitive market. The supply of environmental protection products to mining companies originates from several sectors of the economy, but mainly from the professional, scientific and technical services sector, the manufacturing sector and the wholesale trade sector.

Canadian firms currently sell to mining companies some $570 million of products related to the control of air pollution and the management of solid or liquid wastes each year, about 40% of which is exported.[50] More than 70% of the suppliers of environmental products have fewer than 50 employees and sales of less than $5 million. Nonetheless, almost 40% of these companies either have offices or some other form of representation abroad. These firms, like many other suppliers to mining companies, also serve a diversity of clients involved in oil, gas, hydro, civil engineering and other projects.

In 1996, mining companies reported spending over $320 million in Canada on environmental protection,[51] an amount comparable to the above estimates.

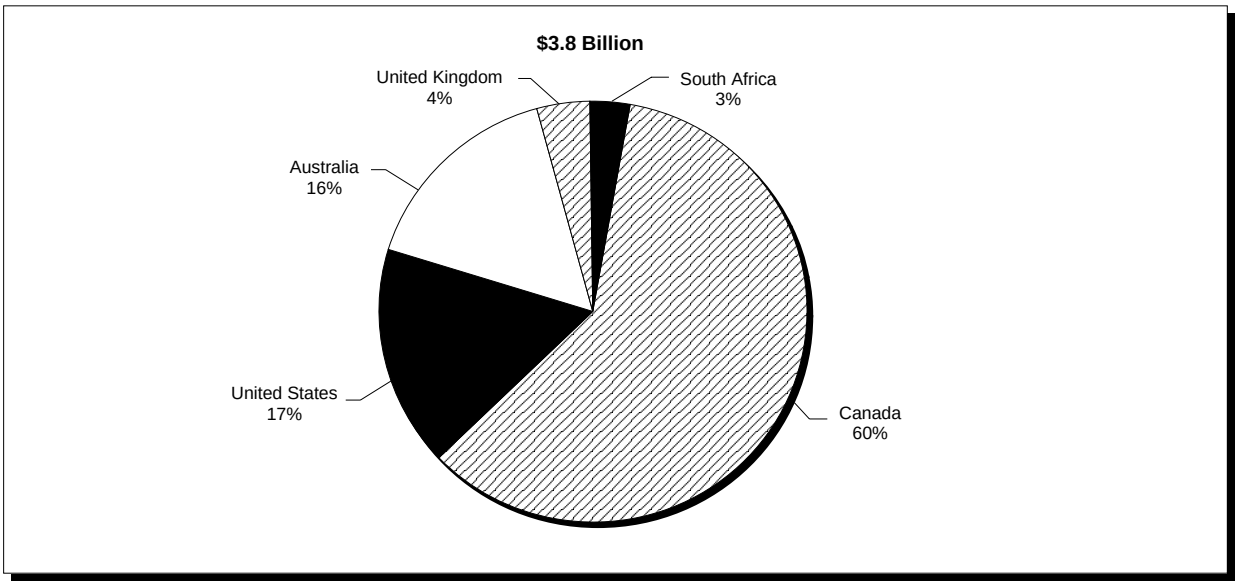
5.2 LINKS TO SELECTED SUPPLIERS OF OTHER PRODUCTS

Industries where there are few firms supplying mining companies, or where only a minority of potential suppliers advertise to mining companies, are categorized in this report as suppliers of "other products." Although they do not advertise much, many of the firms in these industries are nonetheless significant suppliers to mining companies.

Financing and Related Activities

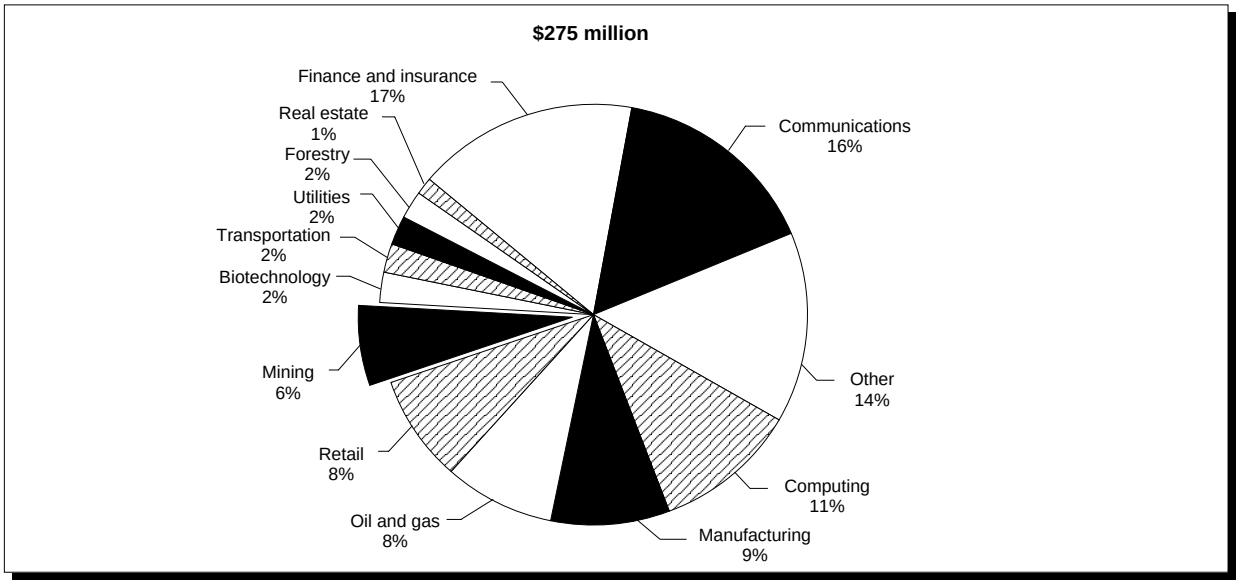
Mining in Canada accounts for a substantial segment of the economy. In 1998, it accounted for 3.7% of the country's Gross Domestic Product.[52] In January 2000, mining companies accounted for roughly 20% of the total market capitalization of companies listed on Canadian stock exchanges.[53] They accounted for more than a third of the capitalization of the Montréal Exchange, 16% of the Canadian Venture Exchange (CDNX), 7% of the Canadian Dealing Network (CDN), and 5% of the Toronto Stock Exchange. In contrast, mining companies accounted for 15% of the capitalization of the Johannesburg Stock Exchange (JSE), but for less than 2% of the American Stock Exchange (ASE) and less than 1% of the London Stock Exchange (LSE).

Figure 27
Sources of Equity Financing for the World's Mining Companies, 1998



Source: Natural Resources Canada, based on Toronto Stock Exchange, Securities Data Company, Financial Post DATAGROUP and Gamah International.

Figure 28
Equity Research Budgets of Institutional Investors, by Sector, 1999



Source: Natural Resources Canada, based on *The Globe and Mail*, January 14, 2000, p. B16, after Brendan Wood International.
Note: "Other" includes research on the economy, small companies and portfolio strategy.

In 1998, companies based in Canada accounted for about one quarter of the capitalization of the world's mining indices, about the same as companies based in Australia and South Africa. Those in the United States accounted for about 20%.[54] Three quarters of the world's mining companies are listed in Canada. In January 2000, 1447 companies were listed on Canadian exchanges. In contrast, only 342 were listed on the Australian Stock Exchange (ASX), 66 on the JSE, 38 on the LSE, and 35 on the New York Stock Exchange (NYSE). However, only three companies, Anglo American Corporation of South Africa Ltd., Billiton Plc and Rio Tinto Limited accounted for over 90% of the mining market capitalization on the LSE; a single company, The Broken Hill Proprietary Company Limited (BHP), which also has oil and gas interests, accounted for almost 50% of that on the ASX; Alcoa Inc. accounted for almost half on the NYSE; and a small number of companies accounted for about half on the JSE. As a result of its concentration of mining companies, Canada has more head offices of mining companies, the largest number of mining analysts and the largest number of firms specializing in mining legal due diligence than anywhere else in the world. Canadian law firms, through their work with mining companies in over 100 countries, have developed a unique diversity of expertise in dealing with the differences and complexities in legal systems around the globe.

Because of their numbers and worldwide activities, Canadian mining companies require considerable amounts of capital to carry out mineral exploration programs, develop mines and expand existing operations. Much of this capital is raised by members of Canadian stock exchanges. As a result, the financing of mining companies gives rise to substantial revenues from professional fees or commissions for underwriters, auditors and lawyers involved in raising these funds. Almost 200 such firms in Canada have been active in the past four to five years in raising capital for mineral projects.[55] These firms also act for the various parties involved in mergers and acquisitions of mining companies. In addition, some Canadian banks maintain departments that finance mine construction projects.

More than 70 Canadian lawyers are counted in the most frequently recommended, repeatedly recommended, and consistently recommended categories of practitioners for the mining industry.[56] The large amount of mineral activity carried out by Canadian companies creates a substantial demand for advice and opinion with respect to titles to foreign mining properties and other international business transactions. A number of law firms in Canada specialize in legal due diligence and other matters related to foreign mining operations.[57]

In 1996, at the apogee of the current mining cycle, a record $8.8 billion in equity and debt capital was raised in this country for companies involved in developing minerals in Canada and around the world. Except for the financial sector, more capital was raised for mining companies based in Canada that year than for any other sector of the Canadian economy. Levels of capital raised around the world have fallen substantially since 1996. Nonetheless, in 1998, 60% of the $3.8 billion in equity capital for mining around the world was raised in Canada (**Figure 27**).

Institutional investors rely on considerable amounts of research to guide their investment in the various sectors of the Canadian economy. In 1999, they allocated an estimated 6% of their $275 million equity research budgets for the assessment of mining company stocks (**Figure 28**); in 1995, just prior to the peak of the mining cycle, they had allocated an estimated 11%, almost twice the proportion as in 1999.[58] Some 100 investment analysts in Canada follow closely the activities of Canadian mining companies.

Transportation Services

Mining companies create a large demand for freight transportation services in Canada. In 1991, transportation accounted for 30% of the selling price of nonmetallic minerals.[59]

In 1996, more than 57 000 people were employed in railway and marine transportation services in Canada. Transportation of mineral products accounted for over 40% of the tonnage carried

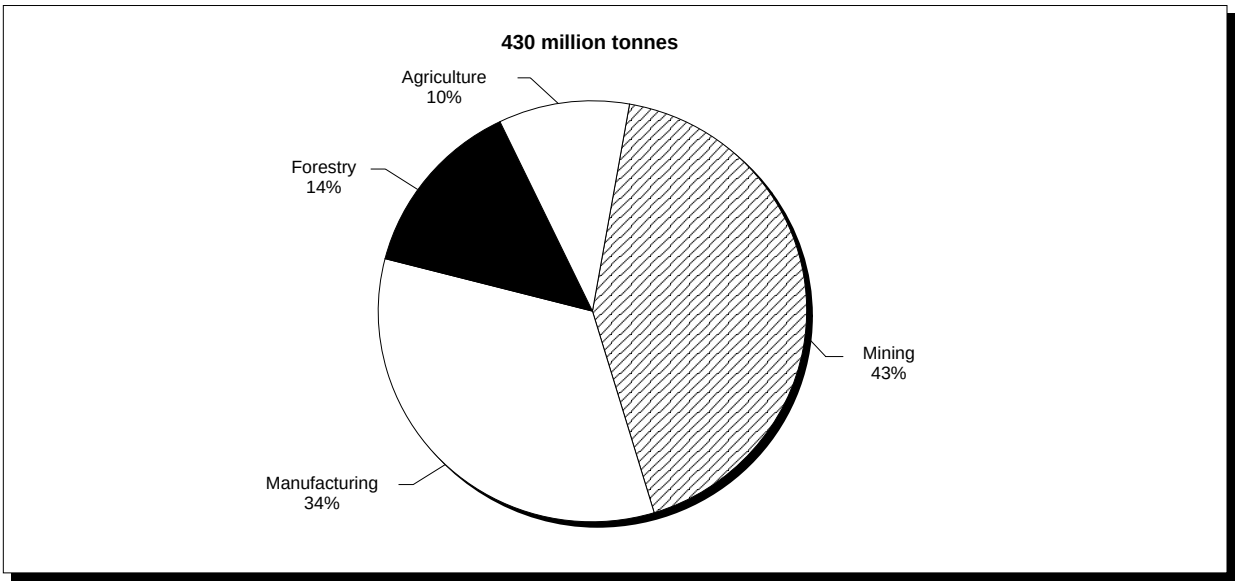
that year in this country (**Figure 29**).[60] Mineral commodities accounted for almost 60% of the railway tonnage (**Figure 30**) and for more than half of the marine tonnage (**Figure 31**). Iron ore and coal are the leading mineral commodities handled by railway and marine transportation (**Figure 32**) in Canada.

Mining companies are also large users of chartered fixed-wing aircraft and helicopter services, particularly in mineral exploration for the transportation of personnel and equipment in and out of remote locations in Canada and abroad.

Energy

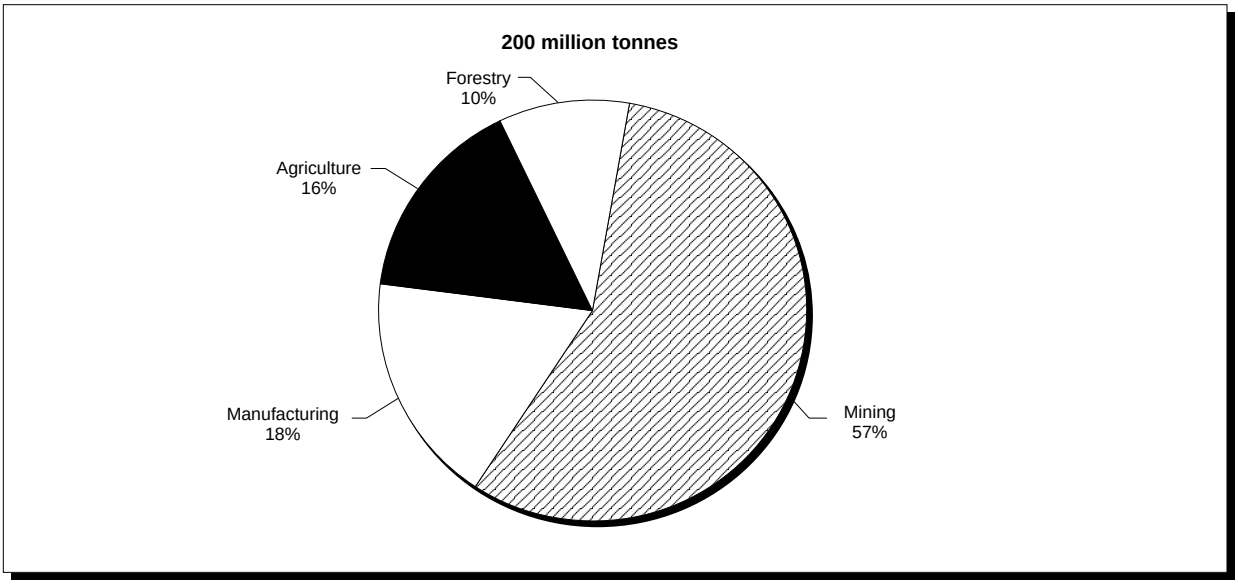
Mineral production, smelting and refining consumes a considerable amount of power. In 1997 these operations accounted for about 40% of the industrial demand in Canada.[61] In Ontario, mining companies spent $265 million on natural gas and electricity, equivalent to over 6% of their operating costs. Electricity alone accounted for $218 million, or 82% of their total energy purchases.[62]

Figure 29
Transportation in Canada, by Commodity, 1996



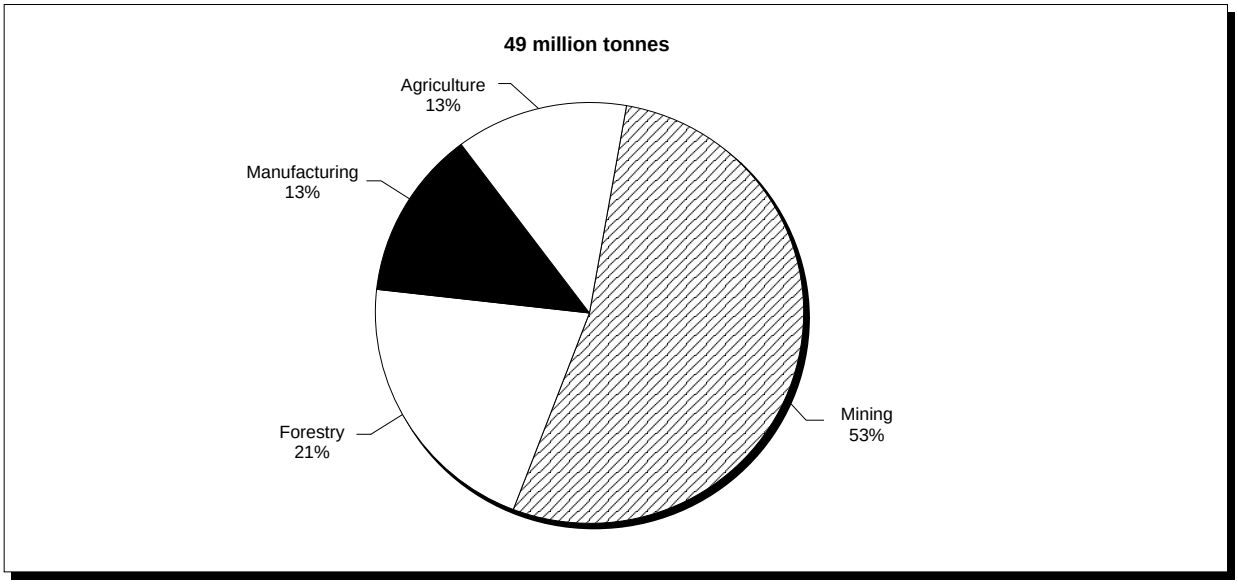
Source: Natural Resources Canada, based on *Transportation in Canada Annual Report, 1998*, Transport Canada, 1999, catalogue TP13198E, p. 119.

Figure 30
Rail Transportation in Canada, by Commodity, 1996



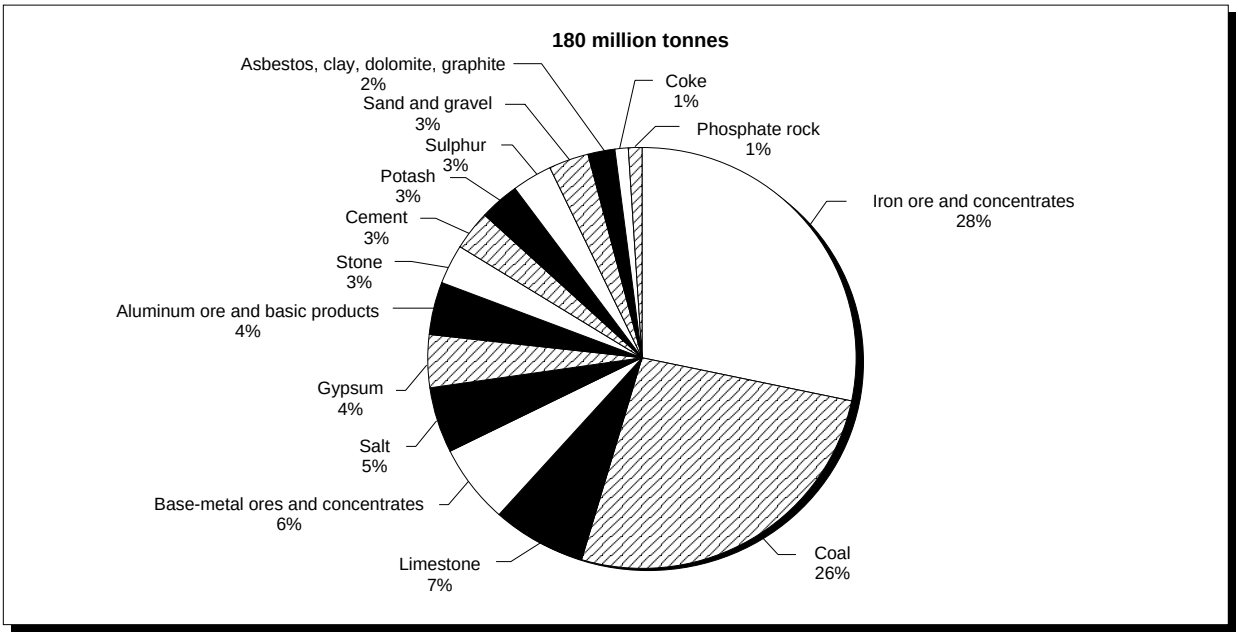
Source: Natural Resources Canada, based on *Transportation in Canada Annual Report, 1998*, Transport Canada, 1999, catalogue TP13198E, p. 119.

Figure 31
Marine Transportation in Canada, by Commodity, 1996



Source: Natural Resources Canada, based on *Transportation in Canada Annual Report, 1998*, Transport Canada, 1999, catalogue TP13198E, p. 119.

Figure 32
Mineral Commodities Handled at Canadian Ports, by Type, 1996



Source: Natural Resources Canada, based on *Shipping in Canada*, 1996, Statistics Canada, catalogue no. 54-205-XPB.

Summary and Conclusions

Canadian mining companies operating in Canada and abroad consume thousands of products, both goods and services, from suppliers in most industrial, commercial and consumer sectors of the economy. The majority of products consumed are specialized and of a scientific or technical nature. Many of the suppliers of these products advertise in mining trade publications. Mining companies also consume substantial quantities of other products that are usually not advertised and which have applications in mining that differ little from applications in other areas of the economy.

The links between Canadian mining companies and the rest of the economy are difficult to quantify. This is because most of the statistical classifications used in Canada do not differentiate supplier transactions with mining companies from those with other areas of the economy. The approaches used here to examine links provide, at best, a preliminary but imperfect understanding of the complex relationships between mining companies and their suppliers. Additional effort and better statistics will be required to increase the understanding of that complexity.

As a result of the rapid globalization that occurred in mining during the 1990s, a disproportionately large amount of the worldwide demand for mining products originates from Canadian companies operating in both Canada and abroad. Canadian companies are involved in thousands of projects in more than 100 countries around the world. In the case of mineral exploration, Canadian projects represent 30% of all the activity worldwide. Although cyclical, this level of Canadian activity around the world is creating unprecedented opportunities for domestic suppliers to provide expertise, goods and services to Canadian and other customers offshore. However, mining companies, like firms in other industrial sectors, buy largely on specifications and price, and developing countries expect multinationals to buy locally. As a result, only some of the opportunities created by mining companies based in Canada and elsewhere will translate into sales for Canadian suppliers.

As much as the demand for mining products is global, so is the supply. No country is cost-competitive or self-sufficient in all of the many goods and services required by mining companies. Nonetheless, the United States appears to be, by far, the leading supplier of mining goods and services. Although there is a wide gulf between the product breadth and depth of American suppliers of mining products and those of other countries, Canadian suppliers appear to rank among the major suppliers in the world.

Competition, especially from Australian and European suppliers, increased substantially following the large amounts of financing that was raised for mineral exploration in 1996 and 1997. Many countries, including Canada, have associations that promote the export of mining goods and services.

There are some 2200 firms of all sizes based in Canada that advertise their products to mining companies. Many hundreds of other suppliers do not advertise. Buyers' guides show that Canadian companies supply several thousand different products for use in all aspects of mining. Although they supply a diversity of mining products, Canadian suppliers appear to have considerable depth in products related to underground mining, the environment,

exploration, feasibility studies, mineral processing and mine automation, among others. Suppliers of specialized mining products sell slightly more goods than services.

Although all sectors of the economy supply the mining industry, suppliers of specialized products are concentrated in the manufacturing sector, the professional, scientific and technical services sector, the wholesale trade sector, and the mineral resource extraction sector (contract drilling and contract mining). These sectors account for 80% of specialized suppliers.

Intellectual capital accounts for a large component of specialized suppliers to mining companies. Almost one quarter of the specialized suppliers identified from advertising are engineers, geologists, geophysicists, geochemists or members of related disciplines. At least 40 associations in Canada foster the exchange of information and experience among these professionals. Suppliers of machinery and equipment comprise a significant proportion of suppliers in the manufacturing sector and in the wholesale trade sector.

Almost three quarters of suppliers of specialized mining products are concentrated in Ontario, British Columbia and Quebec. Although both urban and remote areas benefit from supplying mining products, northern Ontario alone accounts for 15% of specialized suppliers.

It is not possible to determine from survey data the total revenues derived by Canadian suppliers from the sale of goods and services to mining companies in Canada and abroad. However, based on an input-output approach, mining companies and producers of primary metals generated sales of more than $20 billion and contributed over 180 000 jobs in their supporting sectors during 1992.

Nonetheless, survey data do provide insight into a number of areas. The sale of goods and services to mining companies in Canada and abroad accounts for about 25% of the total revenues from all clients of firms that supply specialized products to mining companies: sales to mining companies account for about 90% of the total sales of suppliers in the mineral resource extraction sector (contract drilling and contract mining), 35% of those in the professional, scientific and technical services sector, 25% of those in the manufacturing sector, and 15% of those in the wholesale trade sector. Half of all suppliers depend on sales to mining companies for 50% or more of their total revenues. However, small suppliers derive a substantially larger proportion of their total revenues from mining companies than the larger ones do. Revenues from the sale of goods and services to mining companies in Canada and abroad appear to have grown by 12% from 1996 to 1997. Goods accounted for about 55% of these revenues, while services accounted for the remaining 45%. Suppliers to mining companies are predominantly small companies, but the larger companies, with individual sales of mining products of more than $5 million, account for 80% of total revenues.

Canadian suppliers of mining products have a large propensity to export. In 1994, they exported to 179 countries and had plans to penetrate markets in an additional 20 countries. There is a close correlation between the countries that Canadian suppliers of mining products have targeted and the countries where Canadian mining companies are the most active. In addition, many Canadian suppliers are also exporting to other countries. Revenues from exports of goods and services to mining companies appear to have grown by 25% from 1996 to 1997 – those from goods by 29% and those from services by 20%. Revenues from exports appear to have increased from 30% of all sales to mining companies in 1996 to 32% in 1997, but they could be as high as 50% of total sales.

As many as 25% of the jobs in companies that supply specialized mining products may be related to serving mining companies. Between 1996 and 1997, the total number of jobs related to mining remained fairly constant. However, the number of jobs related to exports of mining goods and services appears to have grown by 11% and, therefore, exports of mining goods and services appear to be generating jobs in Canada. More than half the jobs related to the provision of mining goods and services are in companies with 100 or more employees.

In addition to strong ties with suppliers of specialized goods and services, mining also has strong links to other areas of the economy. Mineral commodities account for half of the tonnage transported in Canada. They account for 60% of the rail tonnage and for more than half of the marine tonnage handled in this country. Mining companies also buy substantial quantities of power.

At the height of the mining cycle, mining companies generate substantial numbers of jobs in the Canadian financial and related industries. In 1996, mining ranked second in terms of capital raised in Canada and probably also in terms of the amount of fees and commissions earned for the financial services and related industries. In 1998, 60% of the $3.8 billion in equity capital raised for mining around the world came from Canada. More than 200 firms in Canada have been active over the past four to five years in raising capital for Canadian mining companies. More than 70 Canadian law firms have a recognized mining practice. More than 100 investment analysts in Canada follow the activities of Canadian mining companies closely.

Globalization of mining is creating export opportunities for domestic suppliers of all types of goods and services across the economy. Supplying expertise, goods and services to mining companies results in good jobs for Canadians, both at home and abroad. There appears to be considerable opportunity to derive further benefits from this activity.

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APPENDIX I

Representative Classification of Mining Goods and Services

- Abrasion-resistant surfaces
- Abrasives
- Absorptions
- Accommodation
  - Camps and shelters
- Acid mine drainage treatment
- Activated carbon
- Adhesives
  - Glue
  - Polyester resin
- Advertising
- Aeration equipment
- Aerial mapping services
- Aerial tramway/ropeways
- Agglomeration equipment
- Agglomeration reagents
- Agitators, vibrators and mixers
- Air compressors
  - Portable
  - Stationary
- Air conditioning
- Air motors
- Air pollution control services
- Aircraft
- Amalgamation equipment
- Analyzers
- Ancillary vehicles
  - Crawlers and wheeled dozers/crawler loaders
  - Graders
  - Utility vehicles, rough-terrain, cranes
  - Vehicle automation radio controls
- Anodes
- Appraisals
- Assayers
- Assaying and sampling
  - Equipment
  - Supplies/suppliers
- Auger mining equipment
- Autoclaves
- Automation/robotics
- Axles
- Bags
- Batch plants
- Batteries and chargers
- Bearings
- Belt and pulley repair services
- Belts
  - Conveyors
  - Power transmission
- Bins and hoppers
- Blasting
  - Anfo loaders and carriers
  - Anfo mixers and chargers
  - Blast monitoring equipment
  - Explosives and coal
  - Hang-up clearing devices
- Blending systems
- Blowers
- Boom assemblies
- Brakes
- Breaker systems
- Breakers
  - Hydraulic rockbreakers
- Buckets and parts
- Buildings
  - Materials
  - Modular, mobile
- Bushings and pins
- Cable
  - Carriers
  - Electrical
  - Protectors
  - Trays
- Cages and ore skips
- Cargo and freight shipping
  - Containers
- Castings
  - Abrasive-resistant
  - Cast iron
  - Steel
- Catalytic converters
- Chemicals
- Classification
  - Cyclones
  - Hydraulic classifiers
  - Mechanical classifiers
- Coal
  - Cutting machines
  - Equipment
  - Spray equipment and materials

- Methane detection equipment
- Safety and rescue equipment

Heat exchangers
- Plate

Heavy rigging and crane service
Heavy transport
Helicopter
- Services

Hoisting equipment
- Slusher hoists
- Tugger hoists

Hoists and sheaves
- Brakes
- Wire rope sheaves

Hose
Hydraulic
- Cylinders
- Designs
- Equipment
- Pumps

Hydrocyclones
- Simulation software

Hydrometallurgical plants
Industrial fasteners
Information services
Inspection services
Instrumentation
- Geophysical
- Geotechnical

Instruments
- Seismic monitoring

Insulation
- Materials
- Services

Insurance
- Mining
- Travel

Irrigation
- Drip

Jacks and pulleys
Joints
Laboratory
- Assay
- Biotechnology
- Chemicals
- Coal and coal analysis
- Crushers
- Crushing equipment
- Design
- Engineering
- Environmental
- Equipment
- Geochemical
- Geotechnical
- Hydraulic testing
- Instruments
- Metallurgical
- Oil analysis
- Supplies/suppliers

Ladders
Lamps and lighting systems
- Miners' lamps

Laser equipment
Leasing and other financial services
Legal services
- Mining law

Liners
- Geomembrane
- Rubber, steel, ceramic, plastic
- Sheave, drum, alumina ceramic
- Steel, manganese steel and chrome-moly steel

Loaders and feeders
Longwall mining equipment
Lubrication
- Equipment
- Oil/grease

Lumber
Magnetic lifting tools
Maintenance
- Equipment
- Program
- Retrofit
- Software
- Vehicle, tool, cleaner

Maps/mapping services
- Geological
- Printing

Material storage
- Abrasion-resistant linings
- Bins, chutes, hoppers and accessories

Materials handling systems
Mechanical services
Medical equipment
- On site

Metal fabricators
Metallurgical engineering
- Commissioning services
- Pilot plant testing
- Plant design
- Process design and improvement
- Simulation software

Metals and special alloys
Metals marketing
Mine cars and wheels
- Wheels and replacement parts

Mineral processing equipment and supplies
- Used

Mineral properties
- Development

Mining machinery
- Custom built

- Mist eliminators
- Mixers
  - Inline
  - Motionless
  - Static
- Monitoring and control
  - Gas
  - Pit design and simulation software
  - Radon/thoron (Radon-220)
  - Slope monitoring
  - Vehicle dispatch and monitoring systems
  - Water monitoring
- Motor graders
- Mud rotary drilling
- Noise control
- Oil
- Opencast and open-pit mining excavators
  - Bucket-wheel excavators
  - Bushings
  - Hydraulic excavators
  - Mining shovels, electric
- Optical sorters
- Ore cars and parts
  - Wheels and replacement parts
- Organizations
  - Associations
  - Chambers
  - Committees
  - Councils
  - Foundations
  - Institutes/institutions
  - Laboratory
  - Miscellaneous
  - Societies
- Parts - new and used
  - Replacement parts
- Photogrammetry services
- Pipework
  - Flexible connectors
  - Hose
  - Polyethylene
  - Steel
  - Valves
  - Wear-resistant lined/polyurethane
- Piping systems
- Plastic
  - Grating and platforms
  - Solvent extraction tanks
  - Tankhouse ventilation
- Pneumatic systems
- Pneumatic tools
- Pollution control
  - Equipment
- Portable floodlighting
- Power transmission
  - Equipment
- Precious metal refining
  - Equipment
  - Services
- Preparation equipment
- Preparation plants
- Pressure cleaning systems
- Process control equipment
  - Control software
  - Control systems
- Process engineering
- Process equipment
  - Mineral
  - Pyrometallurgical
- Production and service equipment
  - Mine doors
  - Scraper winches and accessories
  - Skips and cages
- Production drilling
  - Drill rig alignment systems
  - Drill rigs
  - Drilling services
  - Drills, hand-held
  - Vehicle automation
- Protective coatings and linings
- Publications
  - Books
  - Bulletins
  - Conference proceedings
  - Directories
  - Journals
  - Laboratory
  - Magazines
  - Newsletters/investment
  - Newsletters/other
  - Newsletters/technical
  - Newspapers
  - Reports
- Pumps
  - Grout
  - Slurry
  - Solids handling
  - Water
  - Wear-resistant lined
- Purchasing/transportation logistics
- Pyrometallurgical engineering
  - Commisioning services
  - Plant design
  - Process design and improvement
- Rail
  - Construction services
  - Cranes
  - Locos and cars
  - Parts and service
  - Track
- Raise
  - Borers and parts

- Climbers and parts
- Contractors

Reagents and chemicals
- Flotation reagents
- Reagent handling and feeders

Rebuilding

Reclamation
- Equipment and services

Refinery
- Equipment
- Services

Refueling systems

Remote controls
- Radio

Remote sensing

Research

Road graders

Rock dusting equipment

Roof bolters

Roof ground supports
- Cable bolting
- Injection bored anchors
- Mechanical rock bolts
- Mesh
- Split sets
- Thread bar
- Threaded rebar

Roof scalers

Safety equipment
- Signs

Samplers

Sanitation
- Toilets

Satellite communications
- Communications
- Equipment
- Imagery
- Services

Scales and weighing systems
- Particle size
- Smelter

Scaling bars and equipment

Scrapers
- Motor
- Replacement parts
- Slushers

Screens, grizzlies and trommels
- Screen decks, metal
- Screen decks, polyurethane and rubber
- Screening machines

Sealants

Seals
- Mechanical

Seats, seating

Securities commissions

Security
- Anti-theft device

Separation equipment
- Electrostatic
- Fine particle
- Flotation
- Gravimetric
- Magnetic

Separators
- Centrifugal
- Eddy-current
- Magnetic

Service bodies, cranes

Ships and shipping services

Shotcreting equipment

Shovels and hydraulic shovels

Slurry transportation systems

Slushers and parts

Software
- Cost estimation
- Custom designed
- Data visualization
- Environmental
- Equipment and maintenance
- Exploration
- Geophysical
- Geostatistical
- Geotechnical
- Health and safety monitoring
- Mine design
- Mine modeling
- Mining and survey applications
- Optimization
- Process control
- Process simulation
- Production control

Soil stabilizers

Spirals
- Slurry

Steel
- Fabricators
- Plates
- Sections

Stemming devices

Stock exchanges

Storage facilities

Structures
- Retaining walls

Surveys/surveying
- Aerial
- Borehole
- Geochemical
- Geophysical
- Instruments and equipment

Sweepers

Tailings disposal systems

- Tanks
  - Plastic
  - Steel
  - Water
- Teeth
  - Excavator
- Tires
  - Off road
  - Tire filling systems
  - Tire handlers
  - Tire valves
- Tools
  - Hand
- Tractors
- Training
  - Computerized
- Transformers
- Transportation services
  - Hovercraft
- Travel
  - Air
  - Boat
  - Car/truck
  - Rail
- Travel management services
- Trucks
  - Dump
  - Haulage units
  - Load haul
  - Repair parts
  - Special applications
  - Underground
  - Utility
  - Wheels, rims and parts
- Underground communications
- Underground equipment
- Underground storage
  - Chutes and chute control mechanisms
  - Feeders
  - Fuel storage
- Underground transport, rail-mounted
  - Battery-powered safety lighting
  - Locomotive batteries/chargers
  - Locomotives, battery
  - Locomotives, diesel
  - Locomotives, electric trolley and pantograph
  - Mine car handling equipment
  - Mine cars, tubs and wagons
  - Monorail D.C. power supplies
  - Monorail systems
  - Tracks and accessories
  - Vehicle automation
- Underground vehicles
  - Articulated dump trucks
  - LHDs
  - Parts
  - Production loaders
  - Shuttle cars
  - Underground graders
  - Utility vehicles
  - Vehicle automation
- Undersea mining equipment
- Universal joints
- Urethane (Poly) wear parts
- Utilities
- Vacuum
  - Loaders
  - Systems
- Valves
  - Slurry
- Vehicles
  - Brake systems
  - Off road
  - Towing
- Ventilation
  - Brattice, cloth and sheeting/inflatable bulkheads
  - Ducting, collapsible
  - Equipment
  - Fans, auxillary
  - Fans, main ventilation
- Vibration and fatigue analysis
- Vulcanizers
- Waste handling systems
- Water
  - Monitoring equipment
  - Treatment systems
- Wear parts
- Weighing and recording devices
- Welding equipment and supplies
- Wick drains
- Winches
- Winding and hoisting
  - Contractors
  - Headframes and cages
  - Hoisting system design
  - Loading and shaft station equipment
  - Mine hoisting ropes and accessories
  - Pit bottom buffers
  - Skips
  - Winders and hoists
  - Winding control equipment
- Wire rope
  - Cordage
  - Slings

Source: Natural Resources Canada, based on www.infomine.com/supplies/categorylist.html, Robertson Info-data Inc., Vancouver, British Columbia, November 1999.

Natural Resources Canada | Ressources naturelles Canada

APPENDIX II

SURVEY OF BUSINESSES BASED IN CANADA PROVIDING GOODS AND SERVICES TO THE MINING INDUSTRY WORLDWIDE

IDENTIFYING LABEL

PLEASE RETURN THE COMPLETED QUESTIONNAIRE TO:

Minerals and Metals Sector
Economic Analysis Division
9th Floor, 580 Booth Street
Ottawa, Ontario K1A 0E4

Fax: 1-613-943-8453

FOR ASSISTANCE, PLEASE CALL: 1-800-267-0452

PLEASE CORRECT THE INFORMATION SHOWN ON THE LABEL AS REQUIRED.

REPORTING COMPANY(IES) OR DIVISION(S): ..... SIC: .....

STREET: ..... CITY: ..... PROVINCE: ..... POSTAL CODE: .....

PERSON TO CONTACT: ..... TITLE: ..... TELEPHONE: .....

INTERNET SITE: ..... FAX: .....

FOR PURPOSES OF THIS QUESTIONNAIRE, THE MINING INDUSTRY IS DEFINED AS BUSINESSES ENGAGED, IN CANADA OR ABROAD, IN EXPLORATION, DEVELOPMENT, MINING OR MILLING OF ORES, INDUSTRIAL MINERALS, AGGREGATES OR COAL.

Information is collected under the federal Resources and Technical Surveys Act, c. R-7, R.S.C. 1985, as amended. Information supplied is protected under the Access to Information Act, A/s. 20. Confidentiality is assured. Information supplied will be aggregated.

The results of this survey will provide information to help establish the size, diversity and infrastructure of Canadian businesses supplying goods and services to the mining industry in Canada and abroad.

Promotional literature describing what we supply to the mining industry has been enclosed. Yes ☐ No ☐

List the main types of goods and services supplied to the mining industry:	**LAST TWO YEARS OF OPERATION**	
	Calendar 1996 ☐ **or** **Fiscal 1996-1997** Ending Month of ..... 1997 ☐	**Calendar 1997** ☐ **or** **Fiscal 1997-1998** Ending Month of ..... 1998 ☐
GROSS REVENUES FROM THE SALE OF SERVICES	(Cdn. Dollars)	(Cdn. Dollars)
SALES TO ALL INDUSTRIES		
1. All types of services provided in Canada and abroad		
SALES TO THE MINING INDUSTRY		
Services provided directly to:		
2. The mining industry in Canada		
3. The mining industry abroad		
Services subcontracted to:		
4. Contractors to the mining industry in Canada		
5. Contractors to the mining industry abroad		
GROSS REVENUES FROM THE SALE OF GOODS	(Cdn. Dollars)	(Cdn. Dollars)
SALES TO ALL INDUSTRIES		
6. All types of goods sold in Canada and abroad		
SALES TO THE MINING INDUSTRY		
Goods provided directly to:		
7. The mining industry in Canada		
8. The mining industry abroad		
Sales made indirectly to the mining industry through:		
9. Contractors to the mining industry in Canada		
10. Wholesalers and resellers in Canada		
11. Contractors to the mining industry abroad		
EMPLOYMENT	(Person-Years)	(Person-Years)
TOTAL EMPLOYMENT		
12. Full-time and part-time employees based in Canada		
EMPLOYMENT RELATED TO MINING		
Full-time and part-time employees based in Canada, including prorated portion of management and administration, serving:		
13. The mining industry in Canada		
14. The mining industry abroad		

THANK YOU FOR YOUR COOPERATION. ALL RESPONDENTS WILL BE PROVIDED WITH A COPY OF THE FINAL REPORT.

APPENDIX III

Body of Letter Accompanying Survey Questionnaire

Natural Resources Canada is seeking your help in a study of companies based in Canada providing goods and services to the mining industry worldwide. One of the main objectives of the study is to provide better information on the role that companies such as yours play in creating jobs and export earnings. Existing statistics do not allow many of the significant mining-related activities to be identified. The study is being carried out with the support and cooperation of several national or provincial industry associations. Participating companies will be provided with a copy of the final report.

The enclosed confidential questionnaire has been developed to facilitate the gathering of relevant data on the sale of services, on the sale of goods, and on employment from several types of suppliers. As a result, not all questions may be relevant to your company. In the case of companies with several offices, divisions or business lines, responses to the questionnaire should be consolidated to reflect the activities of the entire company.

I appreciate the competing demands on your time, and I recognize the burden that this request places upon you. Nonetheless, I hope that your company will agree to complete the questionnaire and return it within a week or so. Should you have any questions or require further information, you may reach me at 800-267-0452 (phone), 613-943-8453 (fax) or dhull@nrcan.gc.ca (e-mail).

Thank you for any assistance you may be able to provide.

Enclosure

APPENDIX IV

DISTRIBUTION OF RESPONDENTS TO THE SURVEY OF BUSINESSES BASED IN CANADA PROVIDING GOODS AND SERVICES TO THE MINING INDUSTRY WORLDWIDE, BY QUESTION, BY YEAR

		1996		1997	
		(no.)	(%)	(no.)	(%)
REVENUES FROM THE SALE OF SERVICES					
Q1.	Sales to all industries in Canada and abroad	276	43.9	286	45.5
Q2.	Sales to the mining industry in Canada	293	46.6	305	48.5
Q3.	Sales to the mining industry abroad	128	20.3	134	21.3
Q4.	Sales to contractors to the mining industry in Canada	48	7.6	47	7.5
Q5.	Sales to contractors to the mining industry abroad	19	3.0	15	2.4
REVENUES FROM THE SALE OF GOODS					
Q6.	Sales to all industries in Canada and abroad	318	50.6	326	51.8
Q7.	Sales to the mining industry in Canada	339	53.9	338	53.7
Q8.	Sales to the mining industry abroad	183	29.1	190	30.2
Q9.	Sales to contractors to the mining industry in Canada	68	10.8	69	11.0
Q10.	Sales to wholesalers and resellers in Canada	57	9.1	57	9.1
Q11.	Sales to contractors to the mining industry abroad	39	6.2	40	6.4
EMPLOYMENT					
Q12.	Total full-time and part-time employees based in Canada	576	91.6	591	94.0
Q13.	Employees serving the mining industry in Canada	376	59.8	394	62.6
Q14.	Employees serving the mining industry abroad	153	24.3	161	25.6

Source: Natural Resources Canada, based on 629 responses to its *Survey of Businesses Based in Canada Providing Goods and Services to the Mining Industry Worldwide.*

APPENDIX V

Input-Output Analysis of the Impact of Mining on Canadian Supplier Industries

One way of estimating the impact of the Canadian mining industry on supplier industries is through the use of the Canadian input-output tables. In his book *Rock Solid*,[1] Peter Dungan does this type of analysis based on the 1992 input-output tables.

One of the impacts the mining industry has on supplier industries is through its demand for the goods and services of these industries as inputs into its own production. Dungan finds that, on average, $1 billion of output in mining and primary metals (roughly Stages I and II) directly increases demand for goods and services in Canada by $614.9 million, of which $326.5 million is in other sectors and $288.4 million is in the mining and primary metals sector itself. These expenditures generate a second round of expenditures by the relevant industries and a third round and so on. When this diminishing series of expenditures ends, the original $1 billion of output in mining and primary metals increases demand by $838.8 million, of which $589.1 million is in other sectors.

Total output in the mining and primary metals sector in 1992 was $34.7 billion. Scaling up the above estimate by a factor of 34.7, the mining and primary metals sector is estimated to have generated, in 1992, about $29.1 billion in sales from industries, of which $20.5 billion was from sectors outside of mining and primary metals.

The mining and primary metals industry also generates demand in supplier industries through its investment in exploration, mine development, plant and equipment. Dungan finds that, on average, $1 billion of investment by the mining and primary metals sector directly increases demand for goods and services by $993.4 million. After second, third and subsequent rounds of expenditures are counted, the original $1 billion of output in mining and primary metals is found to increase demand by $1.3 billion.

Total investment in the mining and primary metals sector in 1992 was about $2.9 billion. Scaling up by a factor of 2.9, Dungan estimates that total investment in mining and primary metals in 1992 had an impact on Canadian supplier industries of about $3.8 billion.

In total, through production and investment, the mining and primary metals sector, in 1992, is estimated to have had an impact of about $24.2 billion on supplier industries.

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[1] Peter D. Dungan, *Rock Solid: The Impact of the Mining and Primary Metals Industries on the Canadian Economy*, Institute for Policy Analysis, University of Toronto, 1997, 217 pp.

APPENDIX VI

DISTRIBUTION OF RESPONDENTS TO THE SURVEY OF BUSINESSES BASED IN CANADA PROVIDING GOODS AND SERVICES TO THE MINING INDUSTRY WORLDWIDE, BY SECTOR OF THE ECONOMY

Sector	Number of Respondents	Percentage of all Respondents
	(no.)	(%)
Manufacturing	205	32.6
Professional, scientific and technical services	185	29.4
Wholesale trade	125	19.9
Mining and oil and gas extraction	49	7.8
Construction	22	3.5
Transportation and warehousing	21	3.3
Other services	8	1.3
Administrative and support	4	0.6
Accommodation	3	0.5
Retail trade	3	0.5
Real estate	2	0.3
Finance and insurance	2	0.3
Total	629	100.0

Source: Natural Resources Canada, based on 629 responses to its *Survey of Businesses Based in Canada Providing Goods and Services to the Mining Industry Worldwide.*