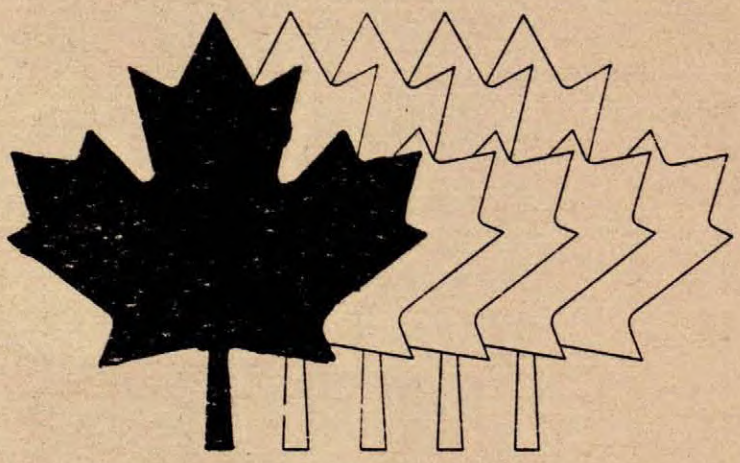
Ministry of State
Science and Technology Canada

Ministère d'État
Sciences et Technologie Canada

TECHNOLOGY CENTRE STUDY

SYNOPSIS



Canada

TECHNOLOGY CENTRE STUDY

SYNOPSIS

MINISTRY OF STATE FOR SCIENCE AND TECHNOLOGY

OTTAWA, 1986

1. INTRODUCTION

Background

In May 1985, the Ministerial Task Force on Program Review recommended that the Ministry of State for Science and Technology (MOSST) develop a plan for consolidating and rationalizing federal support to technology centres. The Task Force was concerned that the proliferation of technology centres had resulted in undesirable levels of duplication and fragmentation. Industry had also expressed concerns that the rapid increase in the number of centres in recent years was draining critical skills from more productive applications.

Scope of the Study

The MOSST study employed the following definition of technology centres:

> "Organizations sustained (through grants, contributions or contracts) or operated by the federal government and which function predominantly in support of industry needs for new technology or specific technical skills.

Using this definition, over 200 technology centres were identified. While a number were distinct organizations, most belonged to a larger entity, particularly a government department or university. A complete list of technology centres identified by the study is attached as Appendix A.

All centres were asked for information on services, clients, and human and financial resources. More than half were interviewed in-depth to obtain further data. In addition, MOSST interviewed approximately 90 experts from federal, provincial, industry, and university circles to ascertain their views on the importance of promoting a more rapid rate of technology diffusion in Canada and the role and effectiveness of technology centres in this respect.

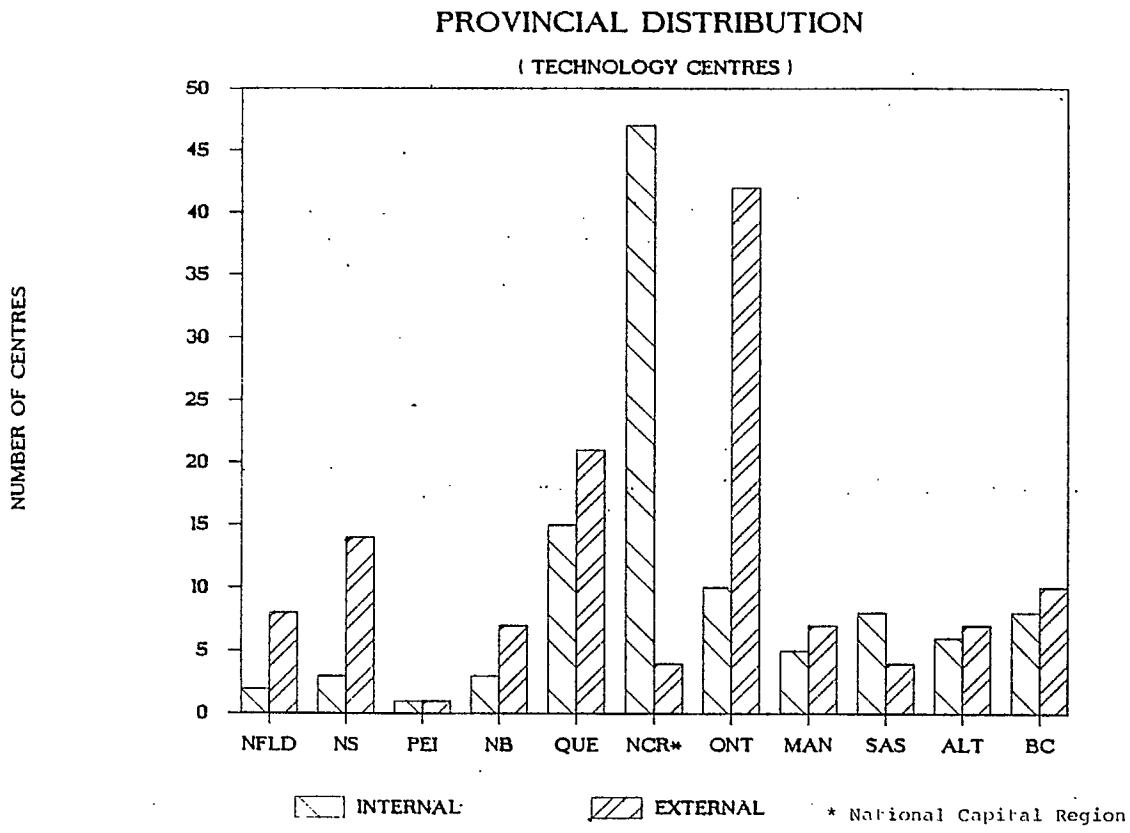
2. PROFILE OF TECHNOLOGY CENTRES

Numbers and Distribution

Technology centres were categorized as either internal (i.e., federally-managed) or external (i.e., university, industry, and provincially-managed)

organizations. The following graph shows the provincial distribution of external and internal technology centres:

FIGURE 1



- The study identified a total of 233 centres of which 108 were internal federal facilities and 125 were non-federally managed, but receiving federal support.

- The heavy concentration of internal technology centres in Ontario is due to the fact that the main research facilities of many federal

departments and agencies are located in the National Capital Region (NCR), consequently the NCR location has been separately identified in the graph above.

Financing and Source of Funds

Table 1 below shows the total financial and scientific resources associated with the identified centres and disaggregates these by basic sponsor group.

TABLE 1

FEDERAL SUPPORT TO TECHNOLOGY CENTRES (1984-1985)

GROUP	Technology Centres	Scientific PYs	Federal Contracts ($000's)	Federal Grants ($000's)	Total Federal Support ($000's)	Operating Budget ($000's)
INTERNAL:						
Federal	108 46%	5,259 60%	150 1%	496,842 93%	496,992 88%	499,416 * 66%
EXTERNAL:						
Industry	19 8%	715 8%	6,560 25%	5,723 1%	12,283 2%	48,637 6%
Provincial	16 7%	1,128 13%	9,803 37%	4,807 1%	14,610 3%	117,901 16%
University	90 39%	1,637 19%	9,991 37%	27,832 5%	37,823 7%	91,421 12%
Total	233 100%	8,739 100%	26,504 100%	535,204 100%	561,708 100%	757,375 100%

* Over $100 M of the total operating budget of federal centres is in direct support of industry, with the remainder devoted to long-term industrial R&D, mission research and support to regulatory activities.

- Federal grants and contracts total $562 million which represents over 74% of the total operating budget of the identified centres.

- Internal centres receive approximately 88% of the total federal support directed to technology centres. These grants and appropriations represent nearly 100% of their total operating requirements.

- By comparison, the 12% of total federal support received by external centres represents only 25% of their total operating requirements.

Level of Support to Industry

Centres were asked to indicate what proportion of their time and effort was spent in direct support of industry. This information was used to develop a "direct service to industry" (DSI) index which, while not a measure of centre effectiveness, provides an indication of the potential for technology transfer and diffusion to industry. Table 2 categorizes internal and external centres as low, medium or high DSI depending on whether they spend under 20%, 20% to 50% or over 50% of their time in support of industry.

TABLE 2

DISTRIBUTION OF TECHNOLOGY CENTRE EFFORT IN DIRECT SUPPORT OF INDUSTRY

PERFORMER	LOW DSI	MEDIUM DSI	HIGH DSI	TOTAL
FEDERAL	83	23	2	108
INDUSTRY	0	1	18	19
PROVINCE	1	4	11	16
UNIVERSITY	29	20	41	90
TOTAL	113	48	72	233

- While the number of Low DSI and High/Medium DSI technology centres is roughly equal, the former group receives 80% of federal support.

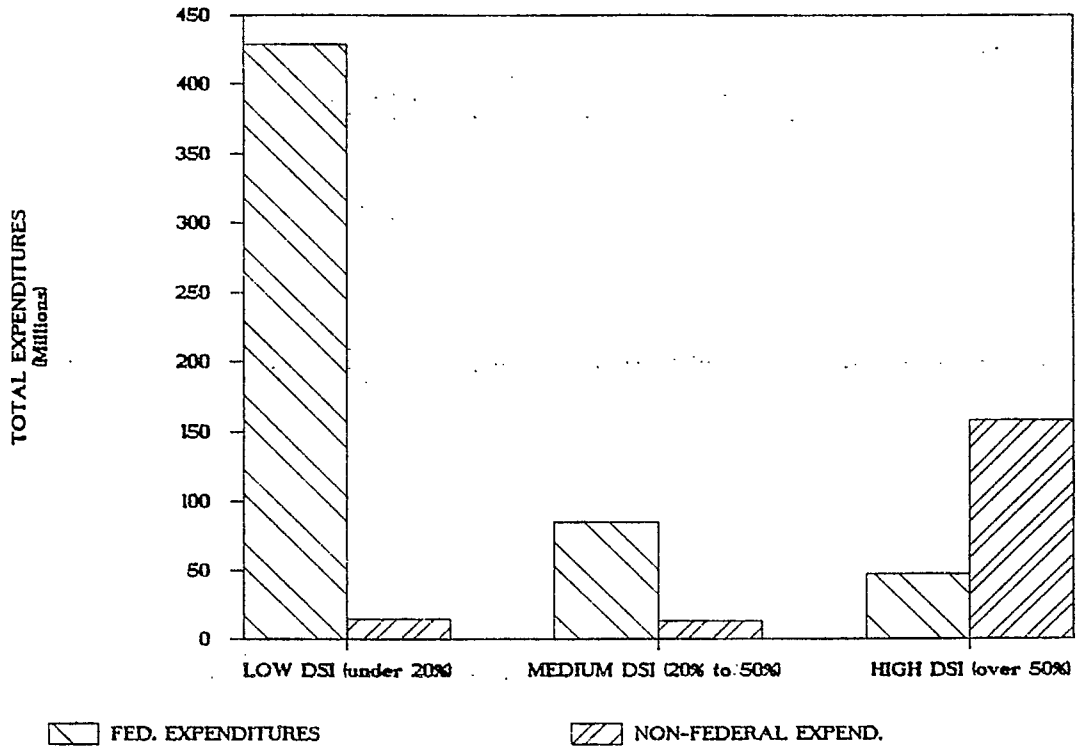
DSI and Federal Funding

The relationship between resource levels for technology centres and the DSI index is further illustrated in Figure 2.

FIGURE 2

TOTAL AND FEDERAL EXPENDITURES BY DSI CATEGORIES

(1984 - 1985)



- Federal funding dollars are being channelled mainly to centres with a low DSI, most of which are internal government centres;
- The $429 million in federal support provided to Low DSI centres represents 96% of their total financial requirements and 76% of the total federal support provided to all technology centres;

- The $36 million received by external High DSI centres represents less than 7% of federal support provided to all centres.

3. ANALYSIS OF KEY ISSUES (related to external centres only)

Proliferation

There has indeed been a rapid increase in the rate of formation of external technology centres in recent years. The majority of new start-ups have been in the areas of energy, software computing technologies, informatics, and CAD/CAM. However, there is no clear evidence that this growth is unwarranted.

The key question in determining whether this growth is justified or not is whether it has occurred primarily in response to industry needs and whether industry users are finding the services useful. There are several important considerations in this respect. First, many of the external centres are initiated with industry sponsorship. The relatively high level of industry contributions and contracts to these centres is evidence of continued support.

Second, a survey of external centres reveals that the vast majority of centres were fully or over-utilized. In this regard, it should be noted that there are over one million small and medium-size manufacturing firms in Canada, very few of which have in-house engineering or research staff to help adapt and adopt, let alone develop new technology.

Third, while a comprehensive study of effectiveness was not possible within the time available, a selective review was undertaken on how instrumental centres are in helping firms adopt or commercialize new technology. Two-thirds of the sixty projects surveyed had already realized benefits to the client company in terms of expanded sales, increased productivity, and/or greater in-house expertise. Most clients responded very favourably to the technology centres with which they were associated and indicated that they would use their services again.

Duplication

The study found that duplication was not a significant problem in terms of the services provided by centres to industry. Technology centres were plotted on a two-dimensional matrix of technology fields and

industry sectors being served. This matrix is attached as Appendix B. Only 33 cells out of a potential total of 171 were found to contain simultaneous activity by more than one centre. Each of the 33 potential overlap situations was investigated and found to be fully differentiated in all but one case when type and level of service and regional limitations were take into account.

Fragmentation and Coordination

Although initial concerns about proliferation and duplication were not borne out by the investigation, the evidence does suggest that there may be significant scope for specialization and coordination between centres. In this respect it is notable that over 50% of all centre efforts in various technology fields are valued at less than $100,000 per annum. Despite a high degree of awareness about the benefits of networking, the actual level of interaction between centres is minimal.

Skills Shortages

Another concern raised by industry is that the rapid expansion in the number of technology centres has created shortages in various critical skills. However, very few of those interviewed during the course of the study believed technology centre growth was a major contributor to any resource shortages generally. In fact, a number of experts indicated that technology centres may be an important part of the solution for several reasons.

First, few centres can compete adequately with well-established firms in terms of salary, career paths or even research prospects. Consequently, many centres find it difficult to retain their more qualified staff and the staff turn-over to industry is quite high in some cases. In fact, many centres see their role in training junior scientific and engineering talent to assume more senior positions in industry as one of their core functions.

Second, centres also serve as a buffer for retaining technological resources in Canadian industry when depressed business conditions might otherwise force researchers, especially new graduates, to migrate to government, academia or offshore.

Third, centres make highly qualified engineering and scientific resources available to many small and medium-sized firms which would not normally have access to them due to cost constraints.

Financial Self-Sufficiency

Another aspect of the study was to determine the potential for either full self-sufficiency or partial cost recovery. The concept of full self-sufficiency was seen, almost unanimously as unworkable in the foreseeable future. Fewer than 20% of external centres studied earned half their income from industry sources in 1984 and only 2 internal centres are in similar circumstances. In this context, it was considered that attempting to achieve this objective would have serious negative implications, including reducing the level of technology transfer to small business, encouraging centres to offer services in direct competition with profit-oriented research and consulting firms, and forcing centres to abandon core research activities.

On the other hand, there was a clear recognition that a move to greater cost recovery, especially on the part of internal centres may be warranted. Increased client contributions for services rendered would promote the industrial relevance of R&D in federal laboratories, foster stronger relationships between laboratories and their clients, and reduce the costs to the federal government.

A number of those interviewed suggested that some portion of the savings achieved from cost recovery on internal centre services should be used to expand federal support to external centres. This would lead to a better balance of federal support across all centres and would help accelerate technology diffusion, especially to the small business sector. The concept of performance funding was suggested by several experts as a way to ensure expanded federal support would not detract from the current industry service orientation of external centres.

APPENDIX A

PRELIMINARY LISTING OF TECHNOLOGY CENTRES BY PROVINCE AND MAIN SPONSOR GROUP

NEWFOUNDLAND:

Federal:

Institute for Marine Dynamics
National Research Council
P.O. Box 12093, Station A
St. John's, Newfoundland
A1B 3T5

Research Station (St.John's)
Agriculture Canada
P.O. Box 7098
St. John's, Newfoundland
A1E 3Y3

Industry:

NORDCO Ltd.
P.O. Box 8833, 23 Glencoe Dr.
St. John's, Newfoundland
A1B 3T2

Atlantic Analytical Services
P.O. Box 489
Springdale, Newfoundland
A0J 1T0

University:

Centre for Cold Ocean Resources Engineering
Memorial University
Elizabeth Ave.
St. John's, Newfoundland
A1C 5S7

Centre for Earth Resources Research - Dept. of Earth Sciences
Memorial University
Elizabeth Ave.
St. John's, Newfoundland
A1C 5S7

Centre for Remote and Offshore Medicine
Memorial University
Elizabeth Ave.
St. John's, Newfoundland
A1B 3V6

Marine Sciences Research Laboratory
Memorial University
Elizabeth Ave.
St. John's, Newfoundland
A1C 5S7

Newfoundland Institute for Cold Ocean Sciences
Memorial University
4 Clark Place, University Campus
St. John's, Newfoundland
A1B 3X7

Water Analysis Facility - Dept. of Chemistry
Memorial University
Elizabeth Ave.
St. John's, Newfoundland
A1B 3X7

NOVA SCOTIA:

Federal:

Atlantic Region
Agriculture Canada
1888 Brunswick St., Suite 512
Halifax, Nova Scotia
B3J 3J8

Experimental Farm (Nappan)
Agriculture Canada
Nappan, Nova Scotia
B0L 1C0

Research Station (Kentville)
Agriculture Canada
Kentville, Nova Scotia
B4N 1J5

Provincial:

Nova Scotia Research Foundation Corporation
100 Fenwick St., P.O. Box 790
Dartmouth, Nova Scotia
B2Y 3Z7

University:

Applied Microelectronics Institute
Technical University of Nova Scotia
1127 Barrington St.
Halifax, Nova Scotia
B3H 2P8

Atlantic Coal Institute
University College of Cape Breton
P.O. Box 1594
Sydney, Nova Scotia
B1P 6R8

Atlantic Industrial Research Institute
Technical University of Nova Scotia
P.O. Box 1000
Halifax, Nova Scotia
B3J 2X4

Bras D'Or Institute
University College of Cape Breton
P.O. Box 5300
Sydney, Nova Scotia
B1P 6L2

Canadian Institute of Fisheries Technology
Technical University of Nova Scotia
P.O. Box 1000
Halifax, Nova Scotia
B3J 2X4

Canadian Marine Transportation Centre
Dalhousie University
1236 Henry St.
Halifax, Nova Scotia
B3H 2J5

Centre for Energy Studies
Technical University of Nova Scotia
P.O. Box 1000
Halifax, Nova Scotia
B3J 2X4

Centre for Marine Geology - Dept. of Geology
Dalhousie University
Life Sciences Bldg.
Halifax, Nova Scotia
B3H 3J5

Centre for Water Resource Studies
Technical University of Nova Scotia
P.O. Box 1000, 1360 Barrington St.
Halifax, Nova Scotia
B3J 2X4

Institute of Oceanography (Aquatron Laboratory)
Dalhousie University
Life Sciences Bldg.
Halifax, Nova Scotia
B3H 4J1

Microelectronics Centre - Dept. of Physics
Dalhousie University
Halifax, Nova Scotia
B3H 3J5

Nova Scotia CAD/CAM Centre
Technical University of Nova Scotia
P.O. Box 1000
Halifax, Nova Scotia
B3J 2X4

PRINCE EDWARD ISLAND:

Federal:

Research Station (Charlottetown)
Agriculture Canada
P.O. Box 1210
Charlottetown, Prince Edward Island
C1A 7M8

Provincial:

Institute of Man and Resources
49 Downal St.
Charlottetown, Prince Edward Island
C1A 3W2

NEW BRUNSWICK:

Federal:

Animal Pathology Laboratory (Sackville)
Agriculture Canada
P.O. Box 1410
Sackville, New Brunswick
E0A 3C0

Research Station (Fredericton)
Agriculture Canada
P.O. Box 20280
Fredericton, New Brunswick
E3B 4Z7

Senator Hervé J. Michaud Experimental Farm (Buctouche)
Agriculture Canada
P.O. Box 667
Buctouche, New Brunswick
E0A 1G0

Provincial:

New Brunswick Research and Productivity Council
P.O. Box 6000, College Hill Road
Fredericton, New Brunswick
E3B 5H1

University:

Centre de recherche et de développement de la tourbe
Université de Moncton
C.P. 2000, 218 bld. J.D. Gauthier
Shippagan, New Brunswick
E0B 2P0

Centre for Research in Engineering and Applied Science
University of New Brunswick
P.O. Box 4400
Fredericton, New Brunswick
E3B 5A3

Fire Science Centre
University of New Brunswick
P.O. Box 4400
Fredericton, New Brunswick
E3B 5A3

Manufacturing Technology Centre
University of New Brunswick
P.O. Box 4400
Fredericton, New Brunswick
E3B 5A3

CADMI Microelectronics Inc.
University of New Brunswick
P.O. Box 4400
Fredericton, New Brunswick
E3B 5A3

Manufacturing Technology Centre
New Brunswick Community College (Moncton)
P.O. Box 2100, Station A
Moncton, New Brunswick
E1C 8H9

Transportation Group
University of New Brunswick
P.O. Box 4400
Fredericton, New Brunswick
B3H 5A3

QUEBEC:

Federal:

Animal Pathology Laboratory (St.-Hyacinthe)
Agriculture Canada
3000 rue Sicotte
St.-Hyacinthe, Québec
J2S 2L8

Automated Forming Processes/Engineering
Industrial Materials Research Institute/NRC
75 De Mortagne Blvd.
Boucherville, Québec
J4B 6Y4

Biotechnology Research Institute
National Research Council
687 Pine Ave. West
Montréal, Québec
H3A 1A1

Ceramics and Coatings
Industrial Materials Research Institute/NRC
75 De Mortagne Blvd.
Boucherville, Québec
J4B 6Y4

Experimental Farm (Kamouraska)
Agriculture Canada
P.O. Box La Pocatière
Kamouraska, Québec
G0R 1Z0

Experimental Farm (L'Assomption)
Agriculture Canada
P.O. Box 1070
L'Assomption, Québec
J0K 1G0

Experimental Farm (Normandin)
Agriculture Canada
1472 Saint Cyrville
Normandin, Québec
G0W 2E0

Food Research Station (St.-Hyacinthe)
Agriculture Canada
3100 blvd. Laframboise, Suite 103
St.-Hyacinthe, Québec
J2S 4Z4

Metallic Materials and Metallic Composites
Industrial Materials Research Institute/NRC
75 De Mortagne Blvd.
Boucherville, Québec
J4B 6Y4

Polymer and Composite Materials/Plastics
Industrial Materials Research Institute/NRC
75 De Mortagne Blvd.
Boucherville, Québec
J4B 6Y4

Québec Region
Agriculture Canada
Suite 1002-R - 200 Dorchester St. West
Montréal, Québec
X2Z 1Y3

Research Station (Lennoxville)
Agriculture Canada
P.O. Box 90
Lennoxville, Québec
J1M 1Z3

Research Station (Ste.-Foy)
Agriculture Canada
2560 Hochelaga Blvd.
Ste.-Foy, Québec
G1V 2J6

Research Station (St. Jean sur Richelieu)
Agriculture Canada
P.O. Box 457
St. Jean sur Richelieu, Québec
J3B 6Z8

Technical Research Division
National Film Board
3155 Cote de Liesse Rd.
St. Laurent, Québec
H4N 2N4

Industry:

Forest Engineering Research Institute of Canada
143 Place Frontenac
Pointe Claire, Québec
H9R 4Z7

Pulp and Paper Research Institute of Canada
570 blvd. St. Jean
Pointe Claire, Québec
H9R 3J9

Provincial:

Centre de recherche industrielle du Québec
333 rue Franquet, C.P. 9038
Ste.-Foy, Québec
G1V 4C7

Service de la cartographie
Ministère de l'énergie et ressources
1995 blvd. Charest Ouest
Ste.-Foy, Québec
G1N 4H9

University:

Aerospace Medical Research Unit
McGill University
3655 Drummond St.
Montréal, Québec
H3G 1Y6

Centre de développement technologique
Université de Montréal
C.P. 6079 Succ. A
Montréal, Québec
H3C 3A7

Centre de recherche en pâtes et papiers
Université du Québec a Trois-Rivières
3351 blvd. des Forges, C.P. 500
Trois-Rivières, Québec
G9A 5H7

Centre de recherche informatique de Montréal
Concordia University
326 - 1440 rue Ste.-Catherine Ouest
Montréal, Québec
H3G 1R8

Centre de recherche sur les transports
Université de Montréal
3535 Queen Mary Rd.
Montréal, Québec
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Centre de recherche en nutrition
Université Laval
Cité Universitaire
Québec, Québec
G1K 7P4

Centre d'innovation industrielle
Université de Montréal
500-6600 Chemin de la Côte-des-Neiges
Montréal, Québec
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McGill University
817 Sherbrooke West
Montréal, Québec
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Dairy Herd Analysis Centre
McGill University
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Montréal, Québec
H3A 2T5

Geotechnical Research Centre
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Montréal, Québec
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Groupe pour l'avancement productique
Université Laval
Ste-Foy, Québec
G1K 7P4

INRS Telecommunications Centre
Université du Québec
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Québec, Québec
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Institut d'ordinique du Québec
CEGEP Lionel Groulx
100 rue Duquet
Ste-Thérèse, Québec
J7E 3G6

Institut national de la recherche scientifique
Université du Québec
C.P. 7500, 2700 rue Einstein
Québec, Québec
G1V 4C7

Science Industrial Research Unit
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Montréal, Québec
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Université de Sherbrooke
Cité Universitaire
Sherbrooke, Québec
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Acoustics Section
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K1A 0S1

Animal Diseases Research Institute (Nepean)
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801 Fallowfield Rd.,P.O. Box 11300
Nepean, Ontario
K2H 8P9

Animal Pathology Laboratory (Guelph)
Agriculture Canada
620 Gordon St.
Guelph, Ontario
N1G 1Y4

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Agriculture Canada
Bldg. 60, Central Experimental Farm
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K1A 0C6

Biological Production of Fuels Unit
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100 Sussex Dr.
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Energy, Mines and Resources
580 Booth St., 20th Floor
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Thunder Bay, Ontario
P7C 4V8

Food Research Institute
Agriculture Canada
Central Experimental Farm
Ottawa, Ontario
K1A 0C6

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Division of Mechanical Engineering/NRC
Building M-10, Montreal Rd.
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K1A 0R6

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K1A 0S1

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Ottawa, Ontario
K1A 0R6

Hydraulics Laboratory
Division of Mechanical Engineering/NRC
Building M-32, Montreal Rd.
Ottawa, Ontario
K1A 0R6

Information Science Section
Division of Electrical Engineering/NRC
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Land Resource Research Institute
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Laser and Plasma Physics Section
Division of Physics/NRC
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Ottawa, Ontario
K2C 2T8

Length and Mechanical Standards Section
Division of Physics/NRC
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Ottawa, Ontario
K1A 0R6

Libraries Division
Agriculture Canada
Sir John Carling Bldg.
Ottawa, Ontario
K1A 0C5

Low Speed Aerodynamics Unit
National Aeronautical Establishment/NRC
Building M-2, Montreal Rd.
Ottawa, Ontario
K1A 0R6

Low Temperature Laboratory
Division of Mechanical Engineering/NRC
Building M-17, Montreal Rd.
Ottawa, Ontario
K1A 0R6

Manufacturing Technology Centre
Division of Mechanical Engineering/NRC
Building M-4, Montreal Rd.
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Metallic Corrosion and Oxidation Unit
Division of Chemistry/NRC
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Ottawa, Ontario
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Molecular Genetics Unit
Division of Biological Sciences/NRC
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Division of Chemistry/NRC
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Photometry and Radiometry Section
Division of Physics/NRC
Montreal Rd.
Ottawa, Ontario
K1A 0S1

Power Engineering Unit
Division of Electrical Engineering/NRC
Montreal Rd.
Ottawa, Ontario
K1A 0R8

Radar and Communication Technology, Research & Development
Communications Research Centre/DOC
3701 Carling Ave.
Ottawa, Ontario
K2H 8S2

Railway Laboratory
Division of Mechanical Engineering/NRC
Building U-89, Montreal Rd.
Ottawa, Ontario
K1A 0R6

Research Branch Headquarters
Agriculture Canada
930 Carling Ave.
Ottawa, Ontario
K1A 0C5

Research Program Service
Agriculture Canada
K.W. Neatby Bldg., Carling Ave.
Ottawa, Ontario
K1A 0C6

Research Station (Delhi)
Agriculture Canada
P.O. Box 186
Delhi, Ontario
N4B 2W9

Research Station (Harrow)
Agriculture Canada
Harrow, Ontario
N0R 1G0

Research Station (London)
Agriculture Canada
University Sub Post Office
London, Ontario
N6A 5B7

Research Station (Ottawa)
Agriculture Canada
Ottawa, Ontario
K1A 0C6

Research Station (Vineland)
Agriculture Canada
Vineland, Ontario
L0R 2E0

River Road Environmental Technology Centre
Environment Canada
River Rd.
Ottawa, Ontario
K1A 1C8

Smithfield Experimental Farm (Trenton)
Agriculture Canada
P.O. Box 340
Trenton, Ontario
K8V 5A5

Space Technology and Applications
Communications Research Centre/DOC
3701 Carling Ave.
Ottawa, Ontario
K2H 8S2

Structures and Materials Laboratory
National Research Council
Building M-14, Montreal Rd.
Ottawa, Ontario
K1A 0R6

Systems and Consulting Directory
Agriculture Canada
Sir John Carling Bldg.
Ottawa, Ontario
K1A 0C5

Textile Chemistry Unit
Division of Chemistry/NRC
Montreal Rd.
Ottawa, Ontario
K1A 0R6

Wastewater Technology Centre
Environment Canada
867 Lakeshore Rd.
Burlington, Ontario
L7S 1A1

Industry:

Canadian Gas Research Institute
55 Scarsdale Rd.
Don Mills, Ontario
M3B 2W7

Canadian Institute of Metalworking
1276 Sandhill Rd., P.O. Box 7317
Ancaster, Ontario
L9G 3N6

Canadian Plastics Institute
1262 Don Mills Rd., Suite 48
Don Mills, Ontario
M3B 2W7

Computer Integrated Manufacturing
1276 Sandhill Rd., P.O. Box 7317
Ancaster, Ontario
L9G 3N6

Forintek Canada Corp. Eastern Laboratory
800 Montreal Rd.
Ottawa, Ontario
K1G 3Z5

Welding Institute of Canada
391 Burnhamthorpe Rd. East
Oakville, Ontario
L6J 6C9

Provincial:

Ontario Auto Parts Centre
63 Church St., Suite 502
St. Catherines, Ontario
L2R 3C4

Ontario Centre for Farm Machinery and Food Processing Technology
870 Richmond St.
Chatham, Ontario
N7M 5J5

Ontario Centre for Microelectronics
1150 Morrison Dr.
Ottawa, Ontario
K2H 9B4

Ontario Centre for Advanced Manufacturing CAD/CAM
400 Collier-MacMillan Dr.
Cambridge, Ontario
N1R 7H7

Ontario Centre for Resource Machinery Technology
127 Cedar St., 4th Floor
Sudbury, Ontario
P3E 1B1

Ontario Research Foundation
2395 Speakman Dr., Sheridan Park
Mississauga, Ontario
L5K 1B3

Ontario Centre for Advanced Manufacturing Robotics
743 Monaghan Rd.
Peterborough, Ontario
K9J 5K2

University:

Building Engineering Group
University of Waterloo
Waterloo, Ontario
N2L 3G1

Canadian Institute of Guided Ground Transportation
Queen's University
St. Lawrence Bldg.
Kingston, Ontario
K7L 3N6

Carbohydrate Research Institute
Queen's University
Gordon Hall Bldg.
Kingston, Ontario
K7L 3N6

Centre for Advanced Technology Education
Ryerson Polytechnical Institute
101 Gerrard St. East
Toronto, Ontario
M5B 1E8

Centre for Flexible Manufacturing
McMaster University
John Hodgins Bldg., Room 208A
Hamilton, Ontario
L8S 4I7

Centre for Industrial Development
Ryerson Polytechnical Institute
350 Victoria St.
Toronto, Ontario
M5B 2K3

Centre for Regional Development
Lakehead University
Thunder Bay, Ontario
P7B 5E5

Centre for Resource Studies
Queen's University
100 Barrie St.
Windsor, Ontario
K7L 3N6

Computer Communications Network Group
University of Waterloo
CPH Bldg., Room 2369
Waterloo, Ontario
N2L 3G1

Computer Systems Group
University of Waterloo
158 University Ave.
Waterloo, Ontario
N2L 3G1

Computer Systems Research Institute
University of Toronto
Toronto, Ontario
M5S 1A4

Group for Computing Research
University of Western Ontario
London, Ontario
N6A 3K7

Hybridoma Centre
University of Windsor
Windsor, Ontario
N9B 3P4

Industrial Research Institute
University of Windsor
Windsor, Ontario
N9B 3P4

Institute for Aerospace Studies
University of Toronto
4925 Dufferin St.
Downsview, Ontario
M3H 5T6

Institute for Computer Research
University of Waterloo
Mathematics and Computer Bldg., Room 6018
Waterloo, Ontario
N2L 3G1

Institute for Enviromental Studies
University of Toronto
Toronto, Ontario
M5S 1A4

Institute for Groundwater Research
University of Waterloo
Physics Bldg., Room 229
Waterloo, Ontario
N2L 3G1

Institute for Polymer Research
University of Waterloo
Engineering Bldg. 1, Room 2350
Waterloo, Ontario
N2L 3G1

Institute of Bio-Medical Engineering
University of Toronto
Toronto, Ontario
M6A 3K3

Institute of Materials Research
McMaster University
1280 Main St. West
Hamilton, Ontario
L8S 4M1

McMaster Institute for Polymer Production
McMaster University
John Hodgins Bldg., Room 374
Hamilton, Ontario
L8S 4L7

Microelectronics Development Centre
University of Toronto
35 St. George St., Room 2046
Toronto, Ontario
M5S 1A4

Mining Development and Minerals Exploration
Laurentian University
Sudbury, Ontario
P3E 2C6

NE Ontario Occupational Health and Safety Resource Centre
Laurentian University
Ramsey Lake Rd.
Sudbury, Ontario
P3E 2C6

Ontario Quality Assurance Centre - Statistical Laboratory
University of Western Ontario
London, Ontario
N6A 3K7

Ottawa-Carleton Centre for Geoscience Studies
Carleton University
Ottawa, Ontario
K1S 5B8

Ottawa-Carleton Research Institute
Carleton University
1150 Morrison Dr., 3rd Floor
Ottawa, Ontario
K2H 8S9

Piezoelectricity Research Laboratory
York University
4700 Keele St.
Downsview, Ontario
M3J 1P3

Surface Science Centre
University of Western Ontario
London, Ontario
N6A 3K7

Systems Analysis, Control and Design Activity
University of Western Ontario
London, Ontario
N6A 5B9

ISOTRACE Laboratory
University of Toronto
60 George St.
Toronto, Ontario
M5S 1A7

Waterloo Centre for Process Development
University of Waterloo
Engineering Bldg. 1, Room 2516
Waterloo, Ontario
N2L 3G1

MANITOBA

Federal:

Animal Pathology Laboratory (Winnipeg)
Agriculture Canada
408 Federal Bldg., 269 Main St.
Winnipeg, Manitoba
R3C 1B2

Canadian Grain Commission - Grain Testing and Research
Agriculture Canada
600 - 303 Main St.
Winnipeg, Manitoba
R3G 3G8

Research Station (Brandon)
Agriculture Canada
P.O. Box 610
Brandon, Manitoba
R7A 5Z7

Research Station (Morden)
Agriculture Canada
P.O. Box 3001
Morden, Manitoba
R0G 1J0

Research Station (Winnipeg)
Agriculture Canada
195 Dafoe Rd.
Winnipeg, Manitoba
R3T 2M9

Industry:

Brewing and Barley Malting Research Institute
206 - 167 Lombard Ave.
Winnipeg, Manitoba
R3B 0T6

Canola Council of Canada
Room 301 - 433 Main St.
Winnipeg, Manitoba
R3B 1B3

Industrial Applications of Microelectronics Centre Inc.
5th Floor Engineering Bldg., U. of Manitoba
Winnipeg, Manitoba
R3T 2N2

Provincial:

Manitoba Research Council
214 - 155 Carlton St.
Winnipeg, Manitoba
R3C 3H8

University:

Taiga Biological Station - Dept. of Zoology
University of Manitoba
Winnipeg, Manitoba
R3T 2N2

Textile Testing Service
University of Manitoba
Winnipeg, Manitoba
R3T 2N2

Transport Institute
University of Manitoba
Winnipeg, Manitoba
R3T 2N2

SASKATCHEWAN:

Federal:

Animal Pathology Laboratory (Saskatoon)
Agriculture Canada
116 Veterinary Rd.
Saskatoon, Saskatchewan
S7N 2R3

Experimental Farm (Indian Head)
Agriculture Canada
Indian Head, Saskatchewan
S0G 2K0

Plant Biotechnology Institute
National Research Council
110 Gymnasium Rd.
Saskatoon, Saskatchewan
S7N 0W9

Prairie Region
Agriculture Canada
Room 401 - 1955 Smith St.
Regina, Saskatchewan
S4P 2N8

Research Station (Melfort)
Agriculture Canada
P.O. Box 1240
Melfort, Saskatchewan
S0E 1A4

Research Station (Saskatoon)
Agriculture Canada
107 Science Crescent
Saskatoon, Saskatchewan
S7N 0X6

Research Station (Swift Current)
Agriculture Canada
P.O. Box 1030
Swift Current, Saskatchewan
S9H 3X2

Researh Station (Regina)
Agriculture Canada
P.O. Box 440
Regina, Saskatchewan
S4P 3A2

Industry:

POS Pilot Plant Corporation
118 Veterinary Rd.
Saskatoon, Saskatchewan
S7N 2R4

Provincial:

Saskatchewan Research Council
30 Campus Drive
Saskatoon, Saskatchewan
S7N 0X1

University:

Energy Research Institute
University of Regina
Regina, Saskatchewan
S4S 0A2

Veterinary Infectious Disease Organization
University of Saskatchewan
Saskatoon, Saskatchewan
S7N 0W0

ALBERTA:

Federal:

Animal Diseases Research Institute (Lethbridge)
Agriculture Canada
Lethbridge, Alberta
T1J 3Z4

Experimental Farm (Fort Vermilion)
Agriculture Canada
Fort Vermilion, Alberta
T0H 1N0

Research Station (Beaverlodge)
Agriculture Canada
P.O. Box 29
Beaverlodge, Alberta
T0H 0C0

Research Station (Lacombe)
Agriculture Canada
Lacombe, Alberta
T0C 1S0

Research Station (Lethbridge)
Agriculture Canada
Lethbridge, Alberta
T1J 4B1

Western Laboratory - Services Division
Agriculture Canada
102 - 11th Ave.,S.E.
Calgary, Alberta
T2G 0X5

Industry:

Alberta Masonry Institute
200 - 10712 - 176 St.
Edmonton, Alberta
T5S 1G7

Alberta Sulphur Research Ltd.
2500 University Dr. NW.
Calgary, Alberta
T2N 1N4

Petroleum Recovery Institute
3512 - 33rd St. NW.
Calgary, Alberta
T2L 2A6

Provincial:

Alberta Research Council
4445 Calgary Trail South, 7th Floor
Edmonton, Alberta
T6H 5R7

University:

Alberta Microelectronics Centre
University of Alberta
Edmonton, Alberta
T6G 2E5

Edmonton Radiopharmaceuticals Centre
University of Alberta
Edmonton, Alberta
T6G 2E5

Institute for Coal Research
University of Alberta
Edmonton, Alberta
T6G 2E7

BRITISH COLUMBIA:

Federal:

Animal Pathology Laboratory (Vancouver)
Agriculture Canada
3802 West 4th Ave.
Vancouver, British Columbia
V6R 1P5

Experimental Farm (Prince George)
Agriculture Canada
R.R. #8, R.M.D. #6
Prince George, British Columbia
V2N 2H8

Pacific Region
Agriculture Canada
550 - 750 Cambie St., Centennial Bldg.
Vancouver, British Columbia
V6B 4T5

Research Station (Agassiz)
Agriculture Canada
P.O. Box 1000
Agassiz, British Columbia
V0M 1A0

Research Station (Kamloops)
Agriculture Canada
3015 Ord Rd.
Kamloops, British Columbia
V2B 8A6

Research Station (Sidney)
Agriculture Canada
8801 East Saanich Rd.
Sidney, British Columbia
V8L 1H3

Research Station (Summerland)
Agriculture Canada
Summerland, British Columbia
V0H 1Z0

Research Station (Vancouver)
Agriculture Canada
6660 N.W. Marine Dr.
Vancouver, British Columbia
V6T 1X2

Industry:

Council of Forest Industries - R&D Laboratory
735 West 15th St.
Vancouver, British Columbia
V6M 1T2

Forintek Canada Corp. Western Laboratory
6620 NW. Marine Dr.
Vancouver, British Columbia
V6T 1X2

Provincial:

BC Research Council
3650 Westbrook Mall
Vancouver, British Columbia
V6S 2L2

University:

Bamfield Marine Station
University of Victoria
Bamfield, British Columbia
V0R 1B0

BC Microelectronics Society
University of British Columbia
310 - 3700 Gilmore Way
Burnaby, British Columbia
V5G 4M1

Department of Mining and Mineral Processing
University of British Columbia
6350 Stores Rd.
Vancouver, British Columbia
V6T 1W5

Energy Research Institute
Simon Fraser University
Burnaby, British Columbia
V5A 1S6

Laboratory for Computer and Communications Research
Simon Fraser University
Burnaby, British Columbia
V5A 1S6

Surface Physics Laboratory
Simon Fraser University
Burnaby, British Columbia
V5A 1S6

Westwater Research Centre
University of British Columbia
#200 - 1933 West Mall
Vancouver, British Columbia
V6T 1W5

APPENDIX B

EXTERNAL CENTRE ACTIVITY
BY INDUSTRY SECTOR AND TECHNOLOGY FIELD

TECHNOLOGY FIELDS / INDUSTRY SECTORS	Agriculture	Forestry	Fishing and Trapping	Mines & Oil Wells	Food, Beverage, Tobacco	Rubber and Plastics	Leather	Textiles, Knitting, Clothing	Wood Products, Furniture	Paper & Allied Products	Printing, Publishing	Primary Metal Products	Metal Fabricating	Machinery & Equipment	Aircraft & Aircraft Parts	Other Transportation Equip.	Communications, Electronics	Office Equip., Computers	Other Electrical Products	Non-Metallic Mineral Products	Pharmaceuticals, Medicines	Other Chemical Products	Petroleum, Coal Products	Scientific, Professional Equip.	Other Manufacturing	Construction	Transportation Services	Communications Services	Utilities	Other Services
- Biotechnology	1				2					1											2			2						
- Micro-electronics									1	1			1	2	1	1	4	1						1					2	
- Software Computing Technology Informatics				1		2								1	1		2	2							1	2		1	1	1
- CAD/CAM Robotics Flexible Manufacturing						1			1				9	5	1	3	3	1	1						1				2	
- Instrumentation Sensing Devices				1		1							1	1	1		1				1	1	1				1		1	
- Lasers Photonics Fibre Optics						1							1		1															
- Metallurgy Metalworking Welding				2						1	1	2	6	5	1														2	
- Industrial Materials						2							5	5	1	1	1		1							1			1	
- Chemical processes	1	1		1	2	2				2									1	1	3	4								
- Transportation Communication				4										1	2	2	2	1			1						2	1		1
- Artificial Intelligence														1													1			

Note: Rows and columns cannot be totalled meaningfully, as centres often provide services in more than one technology area, or to more than industry sector, and so are repeated in the table.