Science and Technology Redesign Project

Survey of Advanced Technology in Canadian Manufacturing - 1998

Confidential when completed

Si vous préférez ce questionnaire en français, veuillez cocher ☐

Collected under the authority of the Statistics Act, Revised Statutes of Canada, 1985, Chapter S19. Completion of this questionnaire is a legal requirement under the Statistics Act.

For information only - Pour information seulement

Please correct name and mailing address, if necessary.

Survey Objective and Coverage

The objective of this survey is to provide statistics on the technological capabilities of establishments in the manufacturing industry. Statistics Canada will create a data base combining individual survey responses with existing Statistics Canada data records. These data will be released in aggregate form only so as to maintain the confidentiality of individual business records. The survey will provide the basis for informed decisions on policies and programs concerning technology adoption in the manufacturing industry.

Confidentiality

Statistics Canada is prohibited by law from publishing any statistics which would divulge information obtained from the survey that relates to any identifiable business without the previous written consent of that business. Data reported on this questionnaire will be treated in confidence, used for statistical purposes and published in aggregate form only. The confidentiality provisions of the Statistics Act are not affected by either the Access to Information Act or any other Legislation.

Questions?

If you require assistance in the completion of this questionnaire or have any questions regarding this survey, please telephone one of the Statistics Canada regional offices listed on page 6.

In this questionnaire, we refer to both your manufacturing **"plant"** and to your **"firm"**. By **firm**, we refer to the legal entity that owns your **plant** or establishment. **Controlling firm** refers to a firm which directly or indirectly owns fifty percent of the voting stock of the company or at least a sufficient share to control its management.

Section A: General Questions

A1. Please indicate (√) the geographic region of the **head office** of your **controlling firm.**

Canada	1 ◯	Pacific Rim	4 ◯
U.S.A.	2 ◯	Other foreign	5 ◯
Europe	3 ◯		

A2. Please indicate (√) the **average number of employees** working in your **plant**.

Less than 50	1 ◯	100 to 249	3 ◯
50 to 99	2 ◯	250 or more	4 ◯

A3. Please indicate (√) in which of the following markets your **plant's** primary product is sold.

Canadian markets	1 ◯	Pacific Rim markets	4 ◯
U.S. markets	2 ◯	Other foreign markets	5 ◯
European markets	3 ◯		

A4. Please indicate (√) how many **firms** (both domestic and foreign owned) offer products directly competing with your **plant's** primary product.

None	1 ◯	6 to 20	3 ◯
1 to 5	2 ◯	over 20	4 ◯

A5. Please rate the importance of the following factors in your **firm's** business strategy.

	Importance (low 1 2 3 4 5 high)
Products and Marketing	
a) Developing new products	1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯
b) Entering new markets	1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯
Technology	
c) Reducing manufacturing costs	1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯
d) Developing new manufacturing technology	1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯
e) Using new materials	1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯
Human Resources	
f) Using teams (e.g., cross-functional, quality improvement)	1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯
g) Ongoing technical training	1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯

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Section B: Advanced Technologies

B1. Please indicate (√) whether you are currently using, plan to use (within two years), or have no plans to use the following advanced technologies in your **plant.**

	In use	Plan to use within 2 years	No plans to use/ Not applicable
Design and Engineering			
a) Computer Aided Design/Engineering (CAD/CAE)	1	3	0
b) Computer Aided Design/Manufacturing (CAD/CAM)	1	3	0
c) Modelling or simulation technologies	1	3	0
d) Electronic exchange of CAD files	1	3	0
Processing, Fabrication and Assembly			
a) Flexible Manufacturing Cells or Systems (FMC/FMS)	1	3	0
b) Programmable Logic Control (PLC) machine(s) or process(es)	1	3	0
c) Lasers used in materials processing (including surface modification)	1	3	0
d) Robot(s) with sensing capabilities	1	3	0
e) Robot(s) without sensing capabilities	1	3	0
f) Rapid Prototyping Systems (RPS)	1	3	0
g) High speed machining	1	3	0
h) Near net shape technologies	1	3	0
Automated Material Handling			
a) Part identification for manufacturing automation (e.g. bar coding)	1	3	0
b) Automated Storage and Retrieval System (AS/RS)	1	3	0
Inspection			
a) Automated vision-based systems used for inspection/testing of inputs and/or final products	1	3	0
b) Other automated sensor-based systems used for inspection/testing of inputs and/or final products	1	3	0
Network Communications			
a) Local Area Network (LAN) for engineering and/or production	1	3	0
b) Company-wide computer networks (including Intranet and WAN)	1	3	0
c) Inter-company computer networks (including Extranet and EDI)	1	3	0
Integration and Control			
a) Manufacturing Resource Planning (MRP II)/Enterprise Resource Planning (ERP)	1	3	0
b) Computer(s) used for control on the factory floor	1	3	0
c) Computer Integrated Manufacturing (CIM)	1	3	0
d) Supervisory Control and Data Acquisition (SCADA)	1	3	0
e) Use of inspection data in manufacturing control	1	3	0
f) Digital, remote controlled process plant control (e.g. Fieldbus)	1	3	0
g) Knowledge-based software	1	3	0

B2. Over the last three years, what percentage of your **plant's** investment in machinery and equipment was spent on advanced equipment (as listed in question B1 above)?

- zero percent 1
- 1% to 25% 2
- 26% to 50% 3
- 51% to 75% 4
- 76% to 100% 5

B3. How would you compare your **plant's** production technology with that of your most **significant competitors**?

	less advanced 1	2	3	4	more advanced 5	N/A
COMPETITORS						
a) Other producers in Canada	1	2	3	4	5	0
b) Producers in the U.S.	1	2	3	4	5	0

B4. For what purposes does your **plant** use **communications networks** (Internet, Intranet, Extranet, VAN)? Check (√) all that apply.

	Yes	No	N/A
a) Ordering products	1	3	0
b) Tracking production flow	1	3	0
c) On-line maintenance	1	3	0
d) Tracking sales and inventory	1	3	0
e) Tracking distribution	1	3	0
f) Sharing technology information	1	3	0
g) Accounting and financing	1	3	0
h) Human resources purposes	1	3	0
i) Management planning system	1	3	0
j) Marketing/customer information	1	3	0
k) Financial transactions (e.g., banking)	1	3	0
l) Consumer information	1	3	0
m) Production status information	1	3	0
n) General reference (e.g., phone numbers)	1	3	0
o) Other (please specify):	1	3	0

Section C: Business Practices

C1. Are the following **practices** or **techniques** regularly used in your **plant**?

	Yes	No	N/A
a) Cross-functional design teams	1◯	3◯	0◯
b) Concurrent engineering	1◯	3◯	0◯
c) Continuous improvement (including TQM)	1◯	3◯	0◯
d) Benchmarking	1◯	3◯	0◯
e) Plant certification (e.g., ISO9000)	1◯	3◯	0◯
f) Certification of suppliers	1◯	3◯	0◯
g) Just-in-time inventory control	1◯	3◯	0◯
h) Statistical Process Control (SPC)	1◯	3◯	0◯
i) Electronic work order management	1◯	3◯	0◯
j) Process simulation	1◯	3◯	0◯
k) Distribution Resource Planning (DRP)	1◯	3◯	0◯
l) Quality Function Deployment (QFD)	1◯	3◯	0◯

Section D: Development and Implementation of Advanced Technologies

D1. Have any advanced technologies (as listed in question B1) been introduced into your **plant**?

Yes 1◯ **No** 3◯

If NO, then please go to question G1.

D2. If YES, by which method does your **plant** introduce advanced technologies?

	Yes	No
a) By purchasing off-the-shelf equipment	1◯	3◯
b) By licensing new technology	1◯	3◯
c) By customizing or significantly modifying existing technology	1◯	3◯
d) By developing brand new advanced technologies (either alone or in conjunction with others)	1◯	3◯

D3. Please indicate which of the following sources play an important role in providing **ideas** for the adoption of advanced technology in your **plant.** Please check (√) all that apply.

	Yes	No	N/A
INTERNAL to your firm			
a) Research	1◯	3◯	0◯
b) Experimental development	1◯	3◯	0◯
c) Production engineering	1◯	3◯	0◯
d) Corporate head office	1◯	3◯	0◯
e) Related plants	1◯	3◯	0◯
f) Technology watch program	1◯	3◯	0◯
g) Production staff	1◯	3◯	0◯
h) Design staff	1◯	3◯	0◯
i) Sales and marketing	1◯	3◯	0◯
j) Other (please specify):	1◯	3◯	0◯
EXTERNAL to your firm			
k) Trade fairs, conferences, publications	1◯	3◯	0◯
l) Patents	1◯	3◯	0◯
m) Consultants/service firms	1◯	3◯	0◯
n) Suppliers	1◯	3◯	0◯
o) Customers	1◯	3◯	0◯
p) Related firms	1◯	3◯	0◯
q) Universities	1◯	3◯	0◯
r) Governments/institutes/ associations	1◯	3◯	0◯
s) Other producers in your industry	1◯	3◯	0◯
t) Other (please specify):	1◯	3◯	0◯

Section E: Skill Requirements

E1. Have your **plant** employees received any **training** pertaining to the adoption of advanced technology in the last three years?

Yes 1◯ **No** 3◯

If NO, then please go to question E3.

E2. If YES, please indicate in which of the following areas **training** was provided. Please include both on-site and off-site training. Check (√) all that apply.

	Yes	No	N/A
a) Basic literacy/numeracy	1◯	3◯	0◯
b) Computer literacy	1◯	3◯	0◯
c) Technical skills	1◯	3◯	0◯
d) Quality control skills	1◯	3◯	0◯
e) Safety skills	1◯	3◯	0◯
f) Other (please specify):	1◯	3◯	0◯

E3. In the operation of advanced technology, for which types of skilled personnel have you experienced **shortages** at your **plant** during the past year? Please check (√) all that apply.

	Yes	No	N/A
Professionals with University Degree:			
a) Mechanical/aerospace	1◯	3◯	0◯
b) Electronic/computer	1◯	3◯	0◯
c) Chemical/chemical process	1◯	3◯	0◯
d) Industrial/manufacturing process	1◯	3◯	0◯
e) Science professionals	1◯	3◯	0◯
f) Computer scientists	1◯	3◯	0◯

E3. In the operation of advanced technology, for which types of skilled personnel have you experienced **shortages** at your **plant** during the past year? Please check (√) all that apply. - *(continued)*

	Yes	No	N/A
Management:			
g) Production management	1	3	0
h) Design management	1	3	0
i) Human resources management	1	3	0
Technicians/Technologists (Community College/CEGEP):			
j) Electronics/computer hardware	1	3	0
k) Science technicians	1	3	0
l) Engineering science technicians	1	3	0
m) Computer programmers	1	3	0
n) Communications network administration	1	3	0
o) Computer aided design	1	3	0
p) Instrumentation	1	3	0
Skilled Trades:			
q) Machinist (including tool, die mould)	1	3	0
r) Machine operator	1	3	0
s) Electrical equipment operator	1	3	0
t) Process plant operator	1	3	0
Other:			
u) Other (please specify):	1	3	0

If you are NOT experiencing any skill shortages at your plant, then please go to question F1.

E4. Have you taken any steps at your **plant** to deal with these shortages?

Yes 1 **No** 3

If NO, then please go to question F1.

E5. If YES, what steps have you taken? Check (√) all that apply.

	Yes	No	N/A
a) Provided training	1	3	0
b) Improved wages and benefits	1	3	0
c) Established stronger links with educational institutions (e.g, research scholarships, hired summer students)	1	3	0
d) Searched for skilled personnel	1	3	0
e) Other (please specify):	1	3	0

E6. In order to deal with these skill shortages, did you search for personnel

a) Within your region	**Yes** 1	**No** 3
b) Outside your region (in Canada)	**Yes** 1	**No** 3
c) Outside Canada	**Yes** 1	**No** 3

Section F: Results of Adoption

F1. Rate the importance of the following **effects** related to the adoption of advanced technology by your **plant**.

EFFECTS	Importance low 1	2	3	4	high 5	don't know 0
Improvement in Productivity Due to:						
a) Reduced labour requirements per unit of output	1	2	3	4	5	0
b) Reduced material consumption per unit of output	1	2	3	4	5	0
c) Reduced capital requirements per unit of output	1	2	3	4	5	0
d) Reduced set-up time	1	2	3	4	5	0
e) Reduced rejection rate	1	2	3	4	5	0
Product Improvement:						
f) New product features	1	2	3	4	5	0
g) Reduced time to market	1	2	3	4	5	0
h) Improvement in product quality	1	2	3	4	5	0
Plant Organization Changes:						
i) Increased production flexibility	1	2	3	4	5	0
j) Increased skill requirements	1	2	3	4	5	0
Plant Efficiencies:						
k) Increased equipment utilization rate	1	2	3	4	5	0
Market Performance:						
l) Increased market share	1	2	3	4	5	0
m) Increased profitability	1	2	3	4	5	0
Other:						
n) Other (please specify):	1	2	3	4	5	0

Section G: Obstacles to Adoption

G1. Rate the importance of the following factors as **obstacles** to advanced technology adoption by your **plant**.

OBSTACLES	Importance (low 1 2 3 4 5 high)
Lack of Financial Justification Due to:	
a) Small market size	1 2 3 4 5
b) High cost of equipment	1 2 3 4 5
c) Cost of capital	1 2 3 4 5
d) Costs to develop software	1 2 3 4 5
e) Cost of integration of new technology	1 2 3 4 5
Human Resources:	
f) Shortage of skillls	1 2 3 4 5
g) Worker resistance	1 2 3 4 5
Management:	
h) Resistance to introduction of new technology	1 2 3 4 5
i) Inability to evaluate new technology	1 2 3 4 5
External Support Services:	
j) Lack of technical support or service (from consultants or vendors)	1 2 3 4 5
Other:	
k) Other (please specify):	1 2 3 4 5

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Section H: Research and Development Activity

H1. Please indicate (√) whether or not your **firm** has been involved in any of the following R&D activities over the last three years. Please **exclude** quality control, routine testing, style changes, minor adaptations and market research.

	Yes	No
a) Does your firm do R&D in-house?	1	3
b) Does your firm do R&D jointly with another firm?	1	3
c) Does your firm contract out R&D?	1	3

If you answered NO to all three parts of question H1, then please go to question I1.

H2. Please indicate (√) the frequency of R&D in your **firm**.

	Yes	No
a) R&D are performed on an ongoing basis.	1	3
b) R&D are performed on an occasional basis.	1	3

H3. What is your **firm's** R&D program responsible for?

	Yes	No
a) Creating original products	1	3
b) Creating original production equipment or new process technology	1	3
c) Substantially adapting technology acquired from others	1	3
d) Introducing off-the-shelf equipment or process technology	1	3

Section I: Electronic Communication

I1. Does your **firm** use e-mail?

Yes 1 **No** 3

I2. Does your **firm** use the Internet?

Yes 1 **No** 3

If NO, then please go to question I5.

I3. If YES, please indicate (√) for what purposes your **firm** uses the Internet.

	Yes	No
a) Searching on the World Wide Web	1	3
b) Selling your goods and services	1	3
c) Advertising/marketing your goods and services	1	3
d) Purchasing goods and services	1	3
e) Secure electronic transactions	1	3
f) Sharing research and development (R&D)	1	3
g) Other (please specify):	1	3

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I4. Does your **firm** have a home page on the World Wide Web?

Yes 1 **No** 3

I5. Does your **firm** use electronic data interchange (EDI)?

Yes 1 **No** 3

If NO, then please go to the end of the questionnaire.

I6. If YES, what type of communication network setup does your **firm** use for EDI? Check (√) all that apply.

	Yes	No
a) Value Added Network (VAN)	1	3
b) Internet	1	3
c) Extranet	1	3

Please indicate your main function in the operation of the firm.

Are you:

a) The plant manager 1◯

b) Responsible for R&D operations 2◯

c) Responsible for other operations (please specify): 3◯

_____

Thank you for your co-operation

COMMENTS

If you have any comments regarding this survey, please provide them in the space below.

Do not hesitate to contact the regional office if you have any concerns or questions.

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Please mail the completed form in the return envelope today (postage paid)