

HD62.15
.K6

c. 1 aa



Industry and Science
Canada

Industrie et Sciences
Canada

Striving for Quality:

Survey of Quality Management Practices in the Canadian Manufacturing Sector

***Vicki Kohse, Services to Business Branch
Industry and Science Canada***

Canada

INDUSTRY, SCIENCE AND
TECHNOLOGY CANADA
LIBRARY

DEC - 3 1993
BZYC
BIBLIOTHÈQUE
INDUSTRIE, SCIENCES ET
TECHNOLOGIE CANADA

Striving for Quality:

Survey of Quality Management Practices in the Canadian Manufacturing Sector

*Vicki Kohse, Services to Business Branch
Industry and Science Canada*

Acknowledgements

The Quality Management Practices Survey was conducted by Statistics Canada on behalf of Industry and Science Canada. The contribution of David Hutton & Associates; Small Business and Special Surveys Division and Operations and Integration Division, Statistics Canada are gratefully acknowledged. Special thanks goes to Jean Régner in his role as "Special advisor" in the project and to other members of Services to Business Branch, Industry and Science Canada, for their assistance.

TABLE OF CONTENTS

	Page
EXECUTIVE SUMMARY	i
SECTION I - INTRODUCTION	
1. Introduction	1
2. Survey methodology	2
SECTION II - SURVEY FINDINGS	
1. The quality management practices used	3
2. Typical patterns of use	5
3. Effect of establishment size	8
4. Industry patterns	12
5. Regional differences	16
SECTION III - THE IMPACT OF QM PRACTICES ON COMPANY PERFORMANCE	
1. Respondents' perceptions of the impact of QM	19
2. The impact on productivity	20
3. The impact on market share	22
SECTION IV - CONCLUSIONS	22
APPENDICES	
I. Questionnaire	
II. Definition of practices	
III. Methodology	
IV. Respondent Profile	

Executive Summary

Recognizing the value of quality management (QM) as a key competitive strategy for businesses in the '90s, Industry and Science Canada, in collaboration with Statistics Canada and members of the quality community, conducted a survey of the Canadian manufacturing sector in March 1993. The purpose of the survey was to determine to what extent business establishments were using QM practices. The effects of establishment size, geographic region and industrial sector on the use of QM practices and the impact of the adoption of QM on company performance were analyzed.

This report is based on an analysis of responses provided by a sample of 787 business establishments ranging in size from 20 to over 2500 employees in all industries in the manufacturing sector across Canada. Respondents were primarily plant managers, presidents/CEOs and quality managers.

The survey sought information on the behaviour (i.e. actual practices) used by Canadian manufacturing companies and not on the opinions of the respondents vis-a-vis quality. The questions related to 27 specific quality management practices, grouped into four categories: leadership, employee involvement, process improvement and customer focus.

TOP LINE FINDINGS

Variation in Use and Patterns of Use of QM Practices

- Business establishments in the Canadian manufacturing sector used on average 13 of the 27 quality management practices covered by the survey.
- Canadian manufacturers are broken down into six clusters according to the number and type of quality management practices employed.
- One fifth (21%) of Canadian manufacturers have adopted an integrated approach to quality management, characterized by the use of over 80% of the QM practices covered by the survey in each of four categories (leadership, employee involvement, process improvement and customer focus), but an equal number (20%) made very little use of these management practices.
- The four other clusters, comprising about 60% of the establishments, include one group which have adopted a moderate, balanced approach to quality and three clusters which concentrated on specific areas of quality: one focused on the leadership and employee involvement categories and the other two emphasized the process improvement and customer focus categories.

Effect of Establishment Size

- Large establishments (those with over 200 employees) used considerably more QM practices (on average 18 of 27 practices) than small establishments (on average 13 of 27 practices).

Industry Patterns

- Establishments in the high tech sector (Rubber products, Plastic products, Machinery, Transportation equipment, Electrical and electronic products and Chemicals) were more likely to use quality management practices than those in other industry groups. Establishments in the high tariff industries (Primary textiles, Furniture and fixtures, Textile products and Clothing), were the least likely to use QM practices.

Regional Differences

- While there were no great differences in the average number of practices used in business establishments across the country, firms in the West were more likely to adopt a balanced approach to quality management practices than those in Quebec and the Atlantic provinces.

Use of ISO 9000 and other Quality Assurance (QA) System Standards

- 22% of respondents were registered to a QA system standard and 32% indicated they were working towards registration or planning to seek registration, primarily to ISO 9000 and CSA Z299.

Balanced is Best

- Establishments that made moderate to intensive use of QM practices evenly distributed across the 4 key areas of leadership, employee involvement, process improvement and customer focus were more likely to achieve productivity growth.
- Establishments that concentrated on quality management practices in only one or two categories, not on all four, fared no better, in terms of productivity, than those who used virtually no quality management practices.

Market share

- Establishments that used relatively more practices in the customer focus category were more likely to experience increased market shares.

Section I Introduction

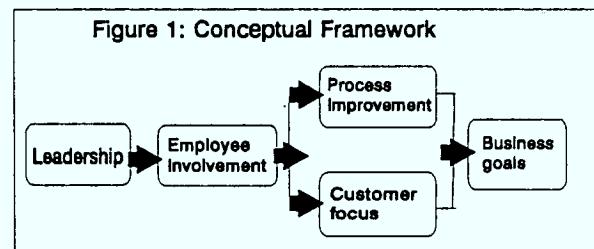
Although quality management is not a new field, the widespread adoption of "Total Quality Management" (TQM) as a business strategy is a recent phenomenon. TQM is the comprehensive application of quality management principles and practices throughout an organization.

There is a mounting body of evidence that this type of approach is an effective strategy for improving business performance. The federal government recognizes the importance of quality and one of Industry and Science Canada's objectives is to help make Canadian private sector companies world class leaders in the field of quality management.

To meet this challenge, in October, 1992 the federal government announced its support for both the National Quality Institute (NQI) and the Canadian Network for Total Quality (CNTQ), charged with providing national leadership, and encouraging the development of quality networks and information programs.

To target quality management information and training where they are most needed, and to identify best practices and areas of weakness, it was first necessary to measure the extent to which quality management practices are used in Canada. The Quality Management Practices Survey was developed for this purpose. It is the first quality survey in Canada that is:

- ▶ **National in scope:** establishments from all regions of Canada were included.
- ▶ **Representative of the entire manufacturing sector:** a sample large enough to support reliable estimates for the entire manufacturing sector was used and was drawn from a survey frame consisting of all establishments in the Canadian manufacturing sector with 20 or more employees.
- ▶ **Behavioural rather than attitudinal:** Questions were designed to determine which of 27 quality management practices companies were actually using (Figure 1) and to avoid opinion-based responses.
- ▶ **Non-prescriptive:** Terminology associated with a particular quality guru was avoided.
- ▶ **Results-oriented:** The survey sought to determine the effect of adopting quality management practices on market share and productivity.



The data from the Quality Management Practices survey will be used to create a databank of quality information about Canadian companies that will help the National Quality Institute (NQI) shape an industry/government quality strategy. This information will help target government programs and services related to quality management.

This report describes the **Quality Management Practices Survey**, beginning with a brief overview of quality management practices and a description of the survey and methodology. Then, the survey results are presented and the effects of company size, geographic region and industry on the use of quality management practices are discussed. Next, the impact of quality management practices on productivity and market share are discussed.

2. Survey Methodology

Telephone Survey

A telephone survey of 1150 manufacturers randomly chosen from across Canada was conducted by the Small Business and Special Surveys division of Statistics Canada in March 1993. A telephone survey was chosen rather than a written questionnaire due to the higher response rate typically associated with this format and the short time commitment on the part of the respondent (10 to 15 minutes to complete the questions.)

Sample Design

The survey sample was drawn from a file of manufacturing establishments obtained from the Business Register Division of Statistics Canada. This was an establishment survey and respondents are considered to have provided information about specific manufacturing plants.

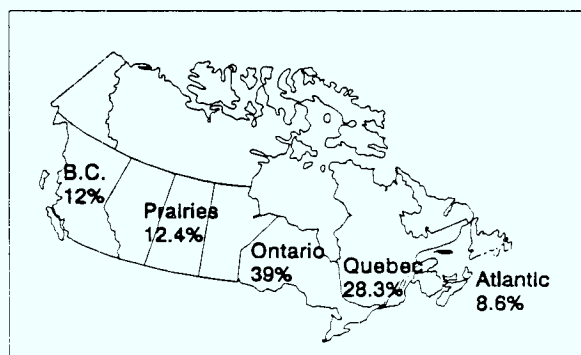
In order for the results of the survey to be representative of Canadian manufacturers in various regions, industry sectors and firm sizes, the establishments on the frame were divided into groups based on industry sector (20 SIC codes)¹, size (small: 20 to 199 employees and large: 200 employees and more) and region (5 geographic regions). Independent random samples were selected from each group. The regional distribution of the sample was representative of the actual number of establishments in each region (Figure 2). As for size, 41% of the establishments had between 26 and 100 employees, 30% had less than 25 employees, 24% between 100 and 500 employees, and 5% over 500 employees. A detailed respondent profile is provided in Appendix IV.

Estimation methods were used to relate the sample results to the entire population and 95% confidence intervals were constructed. A response rate of 84% was achieved, with replies from 787 establishments of the 937 contacted. More details concerning survey and estimation methodology can be found in Appendix III.

Questionnaire Design

Broad consultations on questionnaire content were held with members of the business community in Canada, including members of the Canadian Network on Total Quality. Representatives of the manufacturing sector also reviewed the questionnaire to ensure that questions were easily understood and unambiguous. Questions were designed to gauge the use of specific quality practices by the respondent. In addition to questions concerning the 27 quality management practices selected for the survey, there were also questions concerning the respondents' perceptions of improvements in areas being tracked. The questionnaire is included as Appendix I.

Figure 2: Sample distribution



¹For the purposes of this survey, two small industries, Tobacco (code 12) and Leather Products (Code 17), were collapsed with the Other Manufacturing industries (code 39). The collapsed category was assigned code 50.

Section II Survey Findings

Total Quality Management is an approach to running an organization that focuses on satisfying customers, seeks to involve all employees and makes extensive use of process improvement methods. It is planned and systematic and, since it involves a major shift in management style from traditional methods, it has to be led by top management.

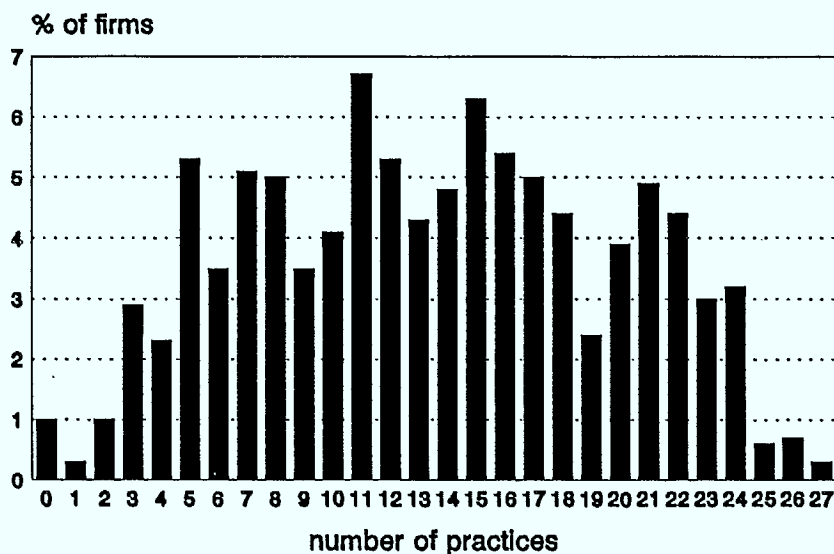
There are various definitions of the scope of TQM, of which the most authoritative and widely accepted are the various national quality awards - such as the Canada Awards for Business Excellence (CABE), Total Quality category and the Baldrige Award in the USA. These describe large numbers of areas to address in a comprehensive approach to quality.

For the purposes of this survey, a simplified model has been adopted. It comprises 27 "practices" which are basic components of a TQM approach, and which could be described in plain language to facilitate a telephone interview. These practices were grouped into four categories: Leadership, Employee Involvement, Process Improvement and Customer Focus. A detailed description of how responses were used to derive each practice is contained in Appendix II.

1. The Quality Management Practices Used

On average, establishments used 13.4 practices, almost exactly half the 27 practices in the survey. The frequency distribution for the number of practices used by each firm follows a fairly normal curve, with fewer firms at either extreme and most firms clustered around the mean (Figure 3).

**Figure 3: Frequency distribution of firms
by number of practices used**



Of the four categories of practices, establishments used more customer focus practices but fewer leadership practices (Table 1).

Table 1: Average number of practices, by category

Practices	Maximum	Mean	%
Leadership	7	3.1	44%
Employee involvement	7	3.2	46%
Process improvement	8	4.2	53%
Customer Focus	5	2.9	58%

Leadership

In the leadership category, 78.6% of establishments had a quality support group, responsible for "providing guidance and support for quality improvement activities". The survey distinguished between this type of entity and traditional quality control inspection and audit groups. This finding suggests that an early response to adopting quality as an objective is the establishment of a quality support group. Over 50% of establishments held regular meetings on quality and had a mission statement. Less than 50% had a written quality improvement plan. With respect to quality training for managers, which was reported by 39% of establishments, this practice was derived from two questions: attending courses and seminars on quality and attending training sessions on team building and coaching skills. Managers in 74.5% of establishments attended courses and seminars on quality. However, only 39% attended both these courses and sessions on team building and coaching skills. Similarly, the management involvement practice was derived from the responses to two questions. Senior management was considered involved if one or several senior managers developed the quality improvement plan and several senior managers were responsible for its implementation, which was the case in 28% of establishments.

Employee involvement

In the employee involvement category, the most frequent practices were assessing employee training needs and providing employee quality training, reported by 66% and 63% of establishments

Table 2: Percentage of firms using each QM practice.

Leadership	%
Quality support group	78.6
Regular meetings on quality	53.3
Mission statement	50.3
Quality improvement plan	44.9
Quality training for managers	38.9
Management involvement	28.2
Assistance of an outside consultant	19.5
Employee involvement	
Training needs assessment	66.2
Quality training for employees	63.1
Suggestions systems	53.4
Recognition and reward schemes	49.0
Employee input into quality plan	32.0
Communication of mission & plan	26.6
Tracking employee satisfaction	26.5
Process improvement	
Tracking cycle times	70.8
Tracking product quality	69.3
Supplier standards	67.1
Tracking waste and inventory turnover	64.5
Problem-solving teams	45.9
Statistical process control	44.6
Benchmarking	37.2
Registration to a QA system	21.8
Customer Focus	
Customer input into product design	80.8
Customer service standards	71.5
Complaint resolution system	51.0
Customer satisfaction relative to competitors	48.0
Customer satisfaction surveys	34.1

Striving for Quality - a survey of Quality Management Practices...

respectively. Around 50% had some kind of employee suggestion system and employee recognition and reward scheme, suggesting a fairly high level of employee input. This is confirmed by the level of employee input in developing quality improvement plans: the views of non-management employees were sought in 71% of the establishments that had a quality improvement plan. Surprisingly, only 58% of those that had a plan reported that "all employees had been informed of the plan."

Process improvement

In the process improvement category, tracking cycle times, product quality and, waste and inventory turnover, was reported by 65% to 70% of the firms. These are fairly standard industrial practices. It is therefore noteworthy that 35% of the firms did not collect even these basic process data. On the other hand, that nearly 50% of the firms used problem-solving teams and statistical process control indicates a fairly high level of sophistication in quality management practice in the Canadian manufacturing sector. At the other end of the scale, less than 25% of establishments were registered to a Quality Assurance system standard or used an outside consultant to assist in the development of a quality improvement plan. 22% of all establishments were registered to at least one recognized quality assurance system standard. About 5% of those were registered to ISO 9000, 8% to CSA Z299 and 11% to other industry standards including AQAP, Sears Certified Supplier program, Ford Q101 and GM Target for Excellence. Of the remaining 78% of establishments not registered to a QA system standard, 36% were working towards registration.

Customer focus

The most widespread practice, used by 80.8% of all establishments, was getting customer input in product design. However, many areas for improvement are immediately apparent in the customer focus category. Only 51% of firms reported having a complaint resolution system, 34% conducted customer satisfaction surveys and 30% of establishments were without customer service standards.

2. Typical Patterns of Use

To determine if there are typical combinations of practices that large numbers of establishments adopt, firms were grouped into clusters, based on the average number of practices they used in each category. Six clusters were found (Table 3).

Table 3: Cluster composition, average number of practices used

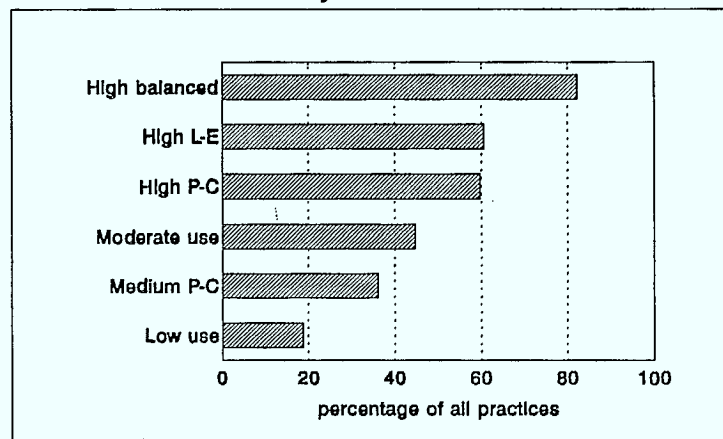
Cluster Name	Leadership	Employee involvement	Process improvement	Customer focus
High Balanced	81%	81%	81%	86%
High L-E	76%	63%	59%	45%
High P-C	43%	51%	73%	72%
Moderate Use	47%	41%	32%	59%
Medium P-C	20%	24%	52%	49%
Low Use	13%	18%	15%	29%

To facilitate the analysis, each cluster was given a name which describes its member firms, e.g. HIGH BALANCED. As the name suggests, this group has adopted a high number of practices in each of the four categories. The names are a combination of the level of use of practices and the areas of focus (L-E for Leadership and Employee involvement, P-C for Process improvement and Customer focus).

Average number of practices used, by cluster

The HIGH BALANCED group used on average 22.1 of 27 practices, or 82%, significantly more than the next group, which used about 60%. The LOW USE group used on average 18% of the practices.

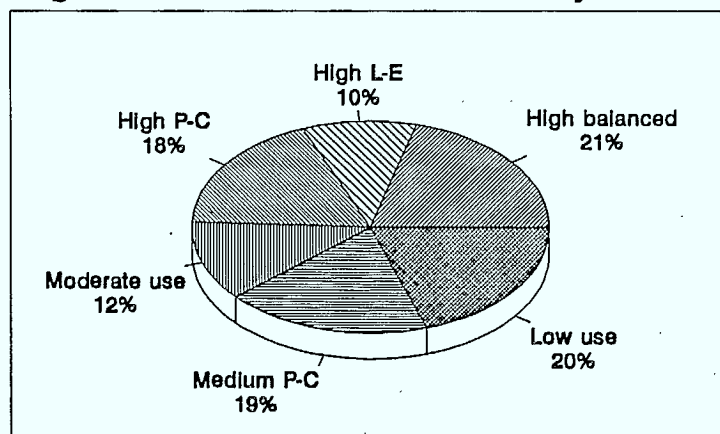
Figure 4: Average number of practices used by cluster



Distribution of clusters

The clusters are fairly evenly distributed throughout the population, with no one cluster accounting for more than 21% of the firms. The largest cluster (21%) is the HIGH BALANCED, the group which has implemented QM practices in the most comprehensive manner.

Figure 5: Distribution of firms by cluster



High Balanced

These establishments used the highest number of QM practices - almost every practice in every category. For this group, it is more instructive to examine what they do not do, rather than what they do. In the leadership practices, even though only 55% of these establishments used an outside

consultant to help them develop their quality improvement plans, this was highest amongst all firms. In the employee involvement category, the least used practice was measuring employee satisfaction at 62%, much more than in any other cluster. In the process improvement category, only 35% of the establishments were registered to a quality assurance system, less than in the HIGH P-C cluster at 39%. Finally, in the customer focus category, the least used practice was measuring client satisfaction relative to competitors, which, at 77%, was more than in any other cluster.

High Leadership and Employee Involvement

This cluster also used a considerable number of QM practices (60%). Almost equal to the HIGH BALANCED in leadership practices, they used somewhat fewer employee involvement practices but significantly less process improvement and customer focus practices. As these categories are more action and measurement oriented, one might question the commitment of these firms to a quality management approach. Even though the strength of the firms in this cluster is in leadership practices, only 58% of the firms had extensive quality training for managers compared to 85% of the HIGH BALANCED. In the employee involvement category, only 26% of the HIGH L-E measured employee satisfaction, less than the HIGH BALANCED and the HIGH P-C. No one process improvement practice stands out, all contributing about equally to the score of 59% in this category. As for customer focus, only 20% and 29% of these firms measured customer satisfaction relative to competitors and conducted customer satisfaction surveys respectively, lower than all but the LOW USAGE group.

High Process Improvement and Customer Focus

These are the opposite of the HIGH L-E cluster: low in the use of leadership practices but significantly higher in process and customer focus practices. These establishments seem to prefer action to exhortation. For example, senior management played an active role in the development and implementation of quality improvement plans in only 19% of these establishments and only 10% used an outside consultant to assist them. However, these establishments were especially active in the process improvement practices: 39% were registered to a quality assurance system, 95% had supplier standards and 96% measured product quality and delivery times, in all cases the highest of any cluster. Their average in the customer focus practices is brought down by the relatively infrequent use of customer satisfaction surveys, with only 49% of the firms using this practice, compared to 78% of the HIGH BALANCED.

Moderate Use

These firms are "middle of the road" QM practitioners, using about half of the suggested practices in the leadership, employee involvement and customer focus categories, and fewer process improvement practices. Only 3% of these firms were registered with a quality assurance system standard, lower than even the LOW USE group.

Medium Process Improvement and Customer Focus

This cluster is similar to the HIGH P-C in that they did not apply many leadership and employee involvement practices but were fairly active, at a lower level of intensity than the HIGH P-C, in the other categories. They used about half the process improvement practices, more than the MODERATE USE, and more customer improvement than the MODERATE USE or the HIGH L-E group.

Low Use

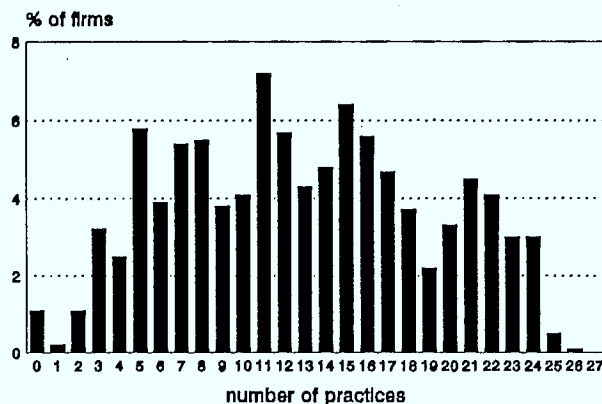
These firms made little use of QM practices. For 13 of the 27 practices, the proportion of establishments responding positively was under 10%.

3. Effect of Establishment Size

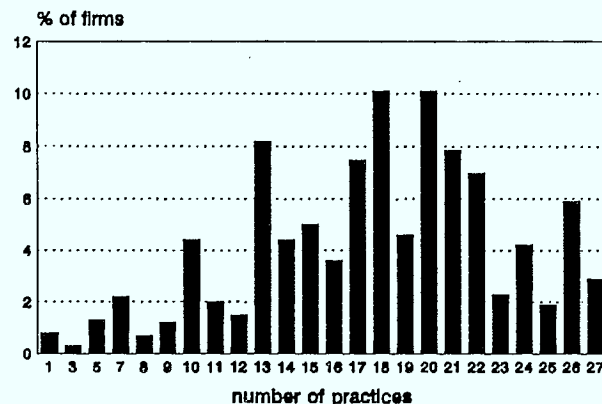
One of the factors which may affect the number and type of quality management practices used is establishment size. It would be reasonable to expect that a firm with 20 employees would have quite different management practices than a firm with 2,000 employees and that this would extend to quality management as well. In fact, large establishments used an average of 18 QM practices compared with 13 in small establishments.

The number of practices used by small establishments follows a normal distribution. However, for large establishments, the distribution is skewed to the right, indicating that large establishments use more quality management practices than small establishments.

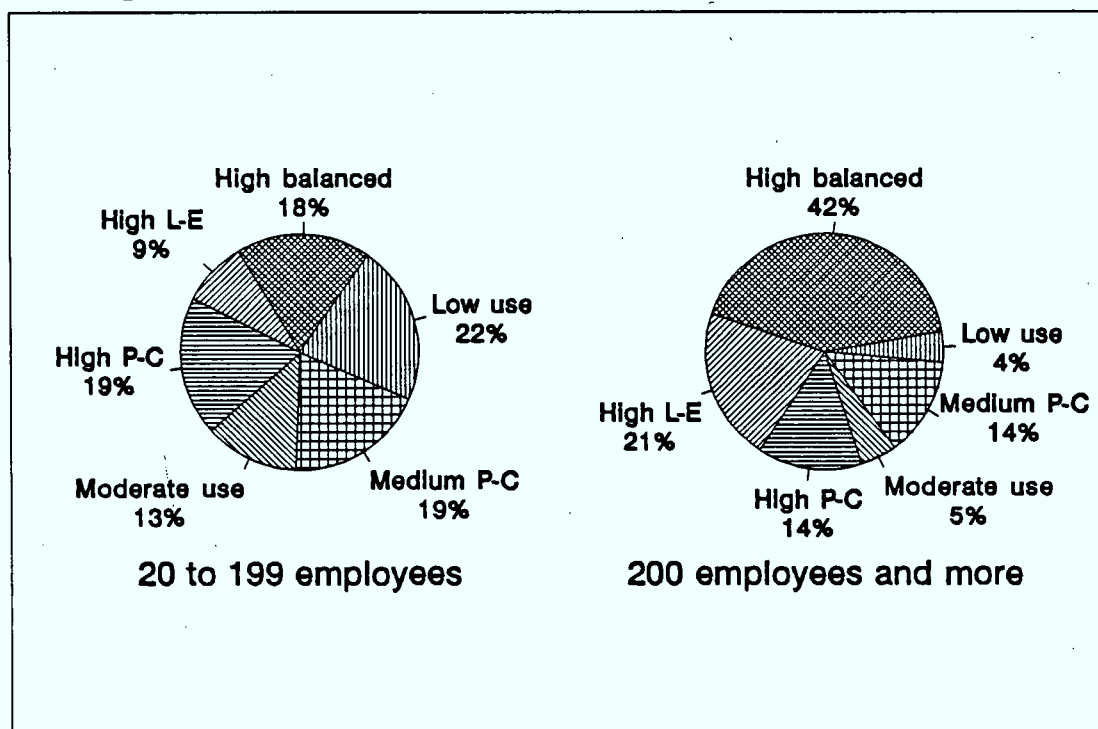
**Figure 6: Frequency distribution of small firms
by number of practices used**



**Figure 7: Frequency distribution of large firms
by number of practices used**



This difference is in part due to the formal nature of many of the practices about which information was collected. Management in small firms is generally more informal, less reliant on formal techniques and procedures than large firms. As communications in small firms are more rapid and direct than in large firms, formal leadership practices are often not considered necessary or even appropriate.

Figure 8: Distribution of firms by cluster

The impact of establishment size on the use of QM practices is also evident in the composition of the clusters. 42% of large establishments are in the HIGH BALANCED group compared to 18% of small establishments. On the other hand, only 4% of large establishments are in the LOW USE group compared to 22% of small establishments. This corroborates the finding that large establishments are more likely to use quality management practices than small establishments.

This holds true for each of the major categories of practices (Table 4) and for all but 1 of the 27 QM practices (Tables 5 and 6).

Table 4: Average Number of Practices used, by category, by size

Categories	Maximum # of practices	Mean (small establishments)	Mean (large establishments)	Difference
Leadership	7	3.0	4.6	23%
Employee involvement	7	3.0	4.2	17%
Process improvement	8	4.1	5.5	18%
Customer Focus	5	2.8	3.4	12%

Table 5: QM practices used, small establishments	%	Table 6: QM practices used, large establishments	
Customer input into product design	80.0	Quality support group	88.7
Quality support group	77.5	Customer input into product design	88.2
Service standards	71.2	Track cycle times	84.2
Track cycle times	69.3	Track waste and turnover	83.9
Track product quality	68.4	Employee quality training	82.4
Supplier standards	65.7	Mission statement	79.9
Employee quality training	64.5	Supplier standards	79.5
Track waste and inventory	62.3	Complaints resolution system	78.6
Employee training needs assessment	62.1	Track product quality	77.5
Employee suggestion system	52.3	Statistical Process Control	76.0
Regular meetings on quality	51.7	Service standards	74.0
Recognition and reward system	48.2	Employee training needs assessment	72.6
Track customer satisfaction relative to competitors	48.1	Quality improvement plan	72.4
Complaint resolution system	48.0	Regular meetings on quality	67.9
Mission or vision statement	47.1	Problem solving teams	65.1
Problem solving teams	43.8	Employee suggestion schemes	63.2
Quality improvement plan	41.9	Management quality training	62.5
Statistical Process Control	41.2	Recognition and reward systems	56.3
Quality training for managers	36.3	Management involvement	55.3
Benchmarking	35.6	Communication of plan to employees	53.0
Customer satisfaction surveys	32.1	Employee input to plan	52.8
Employee input to plan	29.8	Customer surveys	52.2
Management involvement	25.3	Benchmarking	51.7
Track employee satisfaction	24.5	Track customer satisfaction relative to competitors	46.5
Communication of plan to employees	23.7	Track employee satisfaction	44.4
Registration to a QA system	20.9	Outside consultant	37.8
Outside consultant	17.5	Registration to a QA system	30.2

Estimates are within 5% of population values for the small establishments, 10% for the large establishments, with a 95% confidence interval.

In terms of practice type, the largest differences were in the use of leadership practices, and the least variation in establishments' use of customer focus practices. Of the 5 practices with the largest differences between small and large establishments (Figure 9), 3 were in the leadership category - mission statement, quality improvement plan and senior management involvement - confirming that this area of management is most affected by establishment size. Having mission statements and written quality improvement plans is more critical for communicating the quality objectives of a large company than for a small one, where word of mouth and personal contact can do the job as well, if not better. That senior management involvement appeared to be greater in large establishments may be explained by way the results was derived. Only establishments reporting that several senior managers were involved in the development and implementation of the quality improvement plan were considered to use this practice. In many of the smallest firms (25 employees or less, about 30% of the sample), there may not be "several" senior managers.

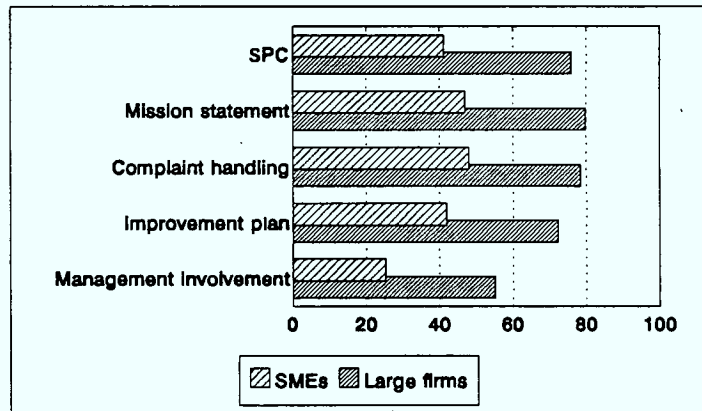
The largest difference was in the use of statistical process control - used in 76% of large establishments compared to 41.2% of small ones - probably as a consequence of lack of information or expertise. With respect to the difference in customer complaint resolution systems, the low incidence of this practice in small firms is puzzling, especially in the light of the importance placed by small establishments on customer focus practices.

Looking at the relative ranking of practices, similarities appear between large and small establishments. For example, 3 practices - having a quality support group, getting customer input in product design, and tracking cycle times - are in the top 4 of both groups.

Similarly, 3 of the bottom 4 practices are common to both groups: tracking employee satisfaction, registration to a QA system standard and using an outside consultant to assist in the development of the quality improvement plan.

However, there are also significant differences in the rankings between large and small establishments. Large establishments place much more emphasis on mission statements (ranked 6th for large establishments, 15th for small ones), statistical process control (10th and 18th) and customer complaints resolution systems (8th and 14th). Small establishments place more importance on tracking customer satisfaction relative to competitors, (13th for small establishments, 24th for large ones), service standards (3rd and 11th), employee suggestion systems (10th and 16th) and employee recognition and reward schemes (12th and 18th).

Figure 9: Differences in QM practices used by firm size



4. Industry Patterns

There is a wide variation in the use of quality management practices among different industries. Most prevalent use of QM practices is by large, capital-intensive industries. At the other end of the scale, are traditional, labour intensive industries. (Table 7)

Table 7: Average number of QM practices used, by industry

INDUSTRY GROUP	% of practices used	C.I. *
HIGH TARIFF		
Primary textile	49	11
Furniture & fixtures	42	5
Clothing	38	5
Textile products	36	11
RESOURCE-BASED		
Paper & allied products	63	24
Refined petroleum & coal	60	13
Primary metals	59	4
Non-metallic minerals	53	13
Wood products	39	4
HIGH TECH		
Rubber products	73	17
Chemicals and chemical products	57	9
Transportation equipment	57	5
Plastic products	57	5
Electrical & electronic products	55	9
Machinery	52	11
OTHER		
Beverage	57	4
Food	52	4
Fabricated metal products	48	8
Other manufacturing (SIC 12,17,39)	48	11
Printing & publishing	47	10
ALL INDUSTRIES	49.6	2

Estimates of the percentage of practices used in each industry are within the number of percentage points shown under "Confidence Interval" 95% of the time.

Since size has an impact on the propensity to use quality management practices, industries with a higher concentration of large establishments are more likely to use quality management practices. This is borne out by Table 8, in which industries were divided into two groups based on whether large establishments represent more than 20% of their population, and which shows whether they are over-represented in the HIGH BALANCED and the LOW USE clusters. In theory, industries with a higher concentration of large establishments should be over-represented in the HIGH BALANCED cluster.

Table 8: Industries, by size of establishment and cluster concentration

Industry	over-represented in HIGH BALANCED	over-represented in LOW USE
Industries with more large establishments		
Rubber products	X	
Primary textiles		
Paper & allied products	X	
Primary metals	X	
Transportation equipment	X	
Refined petroleum	X	
Industries with fewer large est.		
Food		
Beverage		
Plastic products	X	
Textile products		X
Clothing		X
Wood		X
Furniture & fixtures		X
Printing & publishing		
Fabricated metal products		X
Machinery	X	
Electrical & electronic products	X	
Non-metallic mineral products	X	
Chemical products	X	
Other manufacturing		

Five of the six industries with a higher concentration of large establishments are over-represented in the HIGH BALANCED cluster, as expected. The exception is the primary textile industry which does not have a high propensity to use QM practices even though it has a high concentration of large establishments. Also as expected, 5 of the 14 industries in which small establishments dominate (textile products, clothing, wood, furniture and fixtures, fabricated metal products) are over-represented in the LOW USE cluster. However, another 5 industries (plastic products, machinery, electrical and electronic products, non-metallic mineral products, chemicals and chemical products) are over-represented in the HIGH BALANCED cluster, even though they are dominated by small establishments. Although establishment size seems to be an indicator of the propensity to use QM practices, it appears therefore not to be the only factor.

To test this proposition further, large establishments were excluded from the analysis of industry contribution to the various clusters, as shown in Table 9.

Table 9: Industry contribution to the HIGH BALANCED cluster, small establishments only

Industry	% of HIGH BALANCED	% population
Food	9.1	11.0
Beverage	1.3	1.3
Rubber products	1.7	0.5
Plastic products	7.1	4.5
Primary textile	0.1	0.8
Textile products	1.0	2.3
Clothing	4.3	7.8
Wood	1.3	8.7
Furniture and fixtures	1.7	4.0
Paper and allied products	8.8	2.9
Printing and publishing	11.6	9.8
Primary metals	2.1	1.7
Fabricated metal products	12.7	14.3
Machinery	8.0	5.6
Transportation equipment	6.0	4.8
Electrical and electronic products	5.1	5.0
Non-metallic mineral products	7.0	4.2
Refined petroleum and coal	0.7	0.4
Chemicals and chemical products	5.2	4.4
Other manufacturing	5.3	5.3

The industries over-represented in the HIGH BALANCED cluster are indicated by the shadowed text.

The 5 industries which were over-represented in the HIGH BALANCED cluster on account of large establishment size remain over-represented in that cluster, even if large establishments are removed from the analysis, indicating that industry characteristics other than size of establishment influence the propensity to use QM practices.

A number of industry characteristics may influence the propensity to use QM practices, including training and background of managers, level of interest and activity of industry associations, government programs and incentives, regional distribution and degree of exposure to competitors which use QM. In *The Competitive Advantage of Nations*, Porter reports that the most consistent empirical finding of their study is that competitiveness is associated with strong

local competition.² Openness to competition was also singled out as the most important factor in explaining productivity differences between service industries in the U.S, Japan and Europe in a major study by the McKinsey Global Institute.³ To test whether the level of competition is an industry characteristic which influences the propensity to use QM practices, industries were classed into four categories, each representing a particular competitive environment: high tariff, resource-based, high tech and other. (Table 10)

Table 10: Competition-based Industry Groups (SIC codes in brackets)

High Tariff	Resource-based	High tech	Other
Primary textiles (18)	Wood products (25)	Rubber products (15)	Food (10)
Furniture & fixtures (26)	Paper & allied products (27)	Plastic products (16)	Beverage (11)
Textile products (19)	Primary metals (29)	Machinery (31)	Fabricated metal products (30)
Clothing (24)	Non-metallic mineral products (35)	Transportation equipment (32)	Printing & publishing (28)
	Refined petroleum and coal (36)	Electrical & electronic products (33)	Other manufacturing (39,12,17)
		Chemicals & chemical products (37)	

The contribution of the Resource-based and Other industry groups to each of the clusters is about the same as their population shares, 18% and 41% respectively (Table 11). However, with a population share of 15%, the High tariff group is strongly over-represented in the LOW USE cluster (27%) and under-represented in the HIGH BALANCED cluster (7%). The opposite is true of the High tech group. With a population share of 26%, it is over-represented in the HIGH BALANCED cluster (35%) and under-represented in the LOW USE group (16%).

Table 11: Industry group contribution to QM clusters

Industry sector	Population share	Share of HIGH BALANCED	Share of LOW USE
High tariff	14.6%	7.3%	27.0%
Resource based	18.4%	20.6%	14.7%
High tech	25.8%	35.4%	15.9%
Others	41.2%	36.8%	42.4%

This supports the hypothesis that propensity to use QM practices is influenced by the industry in which an establishment operates. In particular, the industry's degree of exposure to competition, especially foreign competitors, is a key determinant in the use of QM practices.

²PORTER, M., The Competitive Advantage of Nations, The Free Press, New York, 1990, p.117

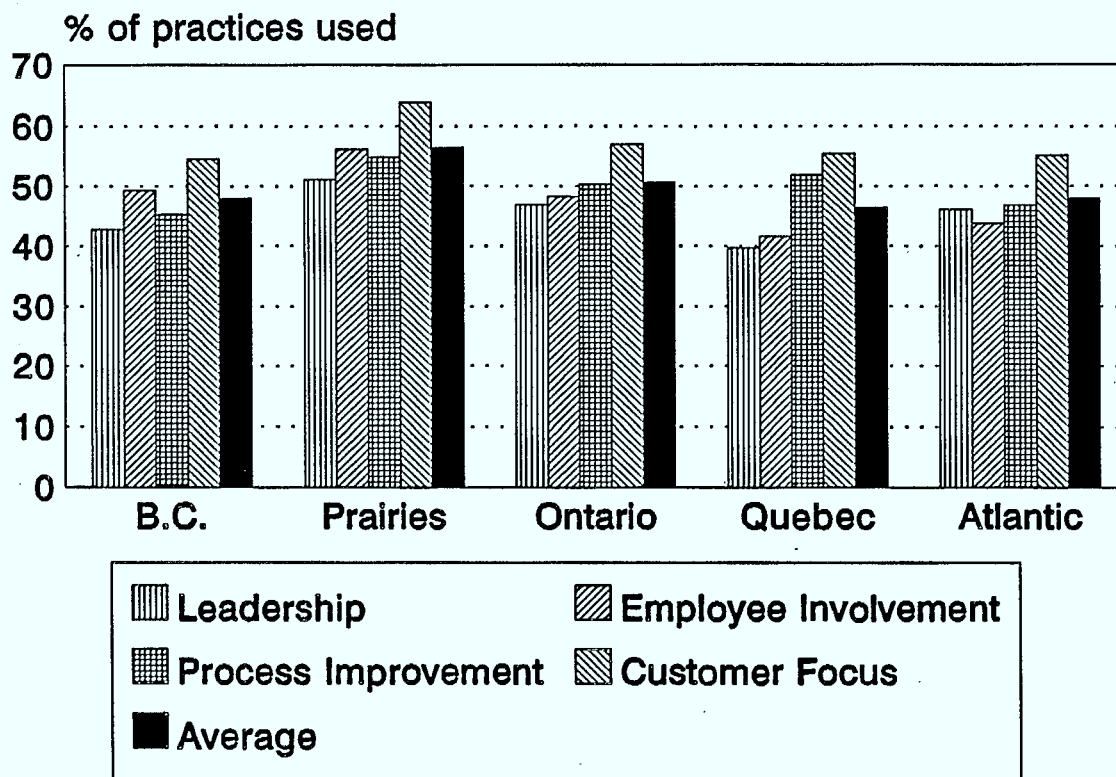
³McKinsey Global Institute, Service Sector Productivity, Washington, D.C., October 1992, p.4

5. Regional differences

While broadly similar, some differences were found in the use of QM practices across Canada (Figure 10). Establishments in the Prairies used an average of 57% of the 27 practices surveyed, while manufacturers in Ontario adopted 51%, followed by those in British Columbia and the Atlantic provinces with 48% and Quebec firms with 47%. These regional differences may be attributable to the size of the establishments and the industry mix in each of the regions. For example, certain high tariff industries that have generally low levels of QM use, are concentrated in Quebec (e.g., primary textiles and clothing). This may be the cause of the lower average number of practices used in that region.

Customer focus practices were the most used in all regions. Leadership practices were the least used in all regions except the Atlantic, where employee involvement practices ranked the lowest.

Figure 10: Use of QM practices by region



Regional estimates of the types of practices used are within 8% of population values, 19 times out of 20.

If the clusters were evenly distributed across regions, each region would account for roughly the same percentage of each cluster as its population share. For example, the Prairie region represents 10% of the establishments in the population. One would expect that it represent about the same proportion of the membership in each cluster. However, 14% of the HIGH BALANCED and only 6% of the LOW USE clusters are in that region (Table 12).

Table 12: Regional distribution of QM clusters, all firms

Region	Population share	Share of HIGH BALANCED	Share of LOW USAGE
B.C.	9.7%	11.3%	12.9%
Prairies	10.4%	13.8%	6.0%
Ontario	44.9%	50.0%	36.3%
Quebec	29.2%	20.6%	38.7%
Atlantic	5.8%	4.2%	6.2%

Since size and industry each have an effect on the propensity to use QM practices, it is necessary to control for these variables. In Table 13, establishments in high tariff industries, which have a lower propensity to use QM practices, and establishments with more than 200 employees, which have a higher propensity to use QM practices, are excluded. Remaining differences could be ascribed to purely regional factors.

Table 13: Regional distribution of QM clusters (excluding high tariff industries and firms with 200 employees or more)

Region	Population share	Share of HIGH BALANCED	Share of LOW USAGE
B.C.	10.7%	14.9%	14.5%
Prairies	11.3%	16.2%	7.2%
Ontario	45.8%	45.7%	40.2%
Quebec	26.2%	20.3%	30.2%
Atlantic	6.0%	2.9%	7.9%

Even after excluding large establishments and those in high tariff industries, the HIGH BALANCED cluster is under-represented in Quebec and the Atlantic and over-represented in the Prairies and B.C. This indicates a west to east penetration pattern of QM practices in Canada, based solely on regional factors. These may include the West's openness to innovation, a more "free enterprise" business climate and more cross-cultural exchange with Pacific Rim nations, the world leaders in innovative management practices, including QM.

Regional QM profiles

In British Columbia, three clusters account for 70% of the population: the LOW USE and the HIGH BALANCED, each with about a quarter, and the MODERATE USE, with 20%. This indicates quite a wide range of QM usage within the province, with concentrations at the extremes and a smaller intermediate group. This pattern is unique to B.C.

British Columbia

Low Usage	26.3%
High Balanced	24.3%
Medium Balanced	20.0%
Medium P-C	17.1%
High P-C	6.6%
High L-E	5.7%

Prairie provinces

High P-C	32.5%
High balanced	27.8%
Low Usage	11.5%
Moderate use	9.9%
High L-E	9.6%
Medium P-C	8.7%

The Prairie provinces are dominated by two clusters, the HIGH P-C and the HIGH BALANCED, each with about 30% of the population. The rest of the population is about evenly distributed among the four remaining clusters. This indicates that QM practices are well implanted in the Prairie region.

Ontario shows a relatively even distribution across all clusters. The HIGH BALANCED is the largest cluster, representing 23% of establishments. With 45% of all the manufacturing establishments in Canada, the Ontario distribution has a major impact on the national picture.

Ontario

High balanced	23.2%
Medium P-C	18.1%
High P-C	16.3%
Low usage	16.1%
Moderate use	14.8%
High L-E	11.5%

Quebec

Low usage	26.4%
Medium P-C	23.2%
High P-C	21.4%
High Balanced	14.7%
High L-E	8.8%
Medium Balanced	5.5%

In Quebec, three large clusters make up over 70% of establishments: LOW USE, HIGH P-C and MEDIUM P-C. Establishments in the LOW USE and MEDIUM P-C clusters (50% of the population) make the least use of quality management practices, indicating a low level of penetration of QM among Quebec establishments. About 20% of establishments (HIGH P-C) emphasize process improvement and customer focus rather than leadership and employee involvement.

In the Atlantic provinces, there is a fairly even distribution across all clusters, led by the LOW USE and MEDIUM P-C groups. This indicates a fairly low degree of penetration of quality management practices in the Atlantic region. The main difference compared to Quebec is the lower percentage of HIGH P-C. In the Atlantic region, there are more establishments in the HIGH L-E cluster, characterized by a greater emphasis on leadership and less on actual process improvement and customer focus practices.

Atlantic provinces

Low usage	21.4%
Medium P-C	20.3%
High L-E	17.2%
High Balanced	15.2%
Medium Balanced	15.0%
High P-C	10.9%

Part III The Impact of QM practices on establishment performance

Canadian manufacturing establishments use varying numbers and patterns of QM practices, depending on their size, industry group and region. Since QM is seen as a means of attracting and retaining customers by offering high quality products at competitive prices, the effects of QM on corporate performance were investigated. Respondents were asked if they perceived improvements as a result of using QM practices. In addition, the economic performance of the companies was examined using three different measures of productivity and one of market share⁴.

1. Respondents' perceptions of the impact of QM practices

A QM precept is that what get measured gets improved. Accordingly, the QMP survey included questions on the measurement of different aspects of manufacturing operations. Respondents were asked if they tracked 12 items shown in Table 14. Those that answered affirmatively were asked whether they had seen improvements in these areas.

Table 14: Management Perception of Improvements, % of respondents

Area of improvement	%
Employees on problem-solving teams	88.5
Employee suggestions	83.9
Product quality	83.1
Customer satisfaction	82.6
Internal waste/scrap	79.3
Customer satisfaction relative to competitors	79.2
Delivery times	76.6
Employee satisfaction	75.3
Returns	74.5
Customer complaints	74.5
Cycle times	71.4
Inventory turnover	70.3

In each of these areas, the vast majority of those who tracked performance reported seeing improvements. Areas in which the fewest improvements were observed were inventory turnover and cycle times: 30% of respondents reported seeing no improvements in these areas. Improvements may be more difficult to achieve in these internal processes. On the other hand, these may be areas which have been monitored for a long time and which now afford little room for improvement. The more items were measured, the more areas of improvement were reported. The number of tracking practices used is highly correlated to the number of areas of improvement reported (correlation coefficient of 0.75).

⁴To get comparable performance measures, the survey file was linked to selected fields from the Annual Survey of Manufactures. Shipments, value-added and employment data were retrieved for 1990 and 1991, the most recent years for which data are available at the necessary level of detail. The reference period for the survey was 1992. Given the lags between conception and implementation of QM programs, however, the inconsistency in time frames was not considered serious.

2. The impact on productivity

Labour productivity, 1991

Regardless of the industry sector, the HIGH BALANCED cluster had the highest level of labour productivity, in some cases by an extremely wide margin. No consistent pattern emerges for the other clusters⁵.

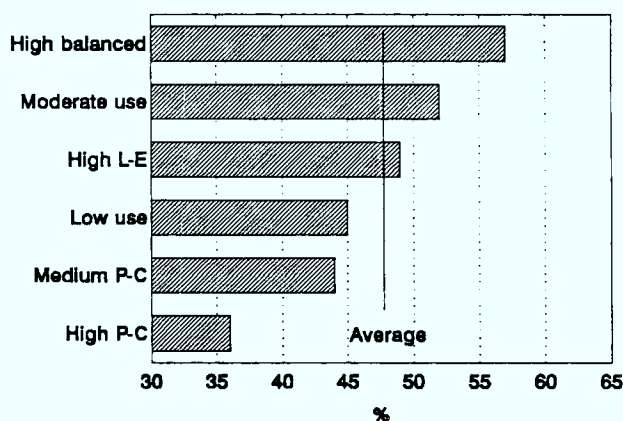
Table 15: Value-added per employee, 1991

Clusters	High tariff	Rank	Resource based	Rank	High tech	Rank
HIGH BALANCED	\$60.69	1	\$164.51	1	\$75.48	1
LOW USAGE	\$45.90	2	\$41.87	5	\$60.41	3
MODERATE USE	\$41.85	3	\$114.48	2	\$37.69	6
HIGH P-C	\$30.56	6	\$54.59	4	\$69.16	2
MEDIUM P-C	\$36.99	4	\$59.82	3	\$40.58	5
HIGH L-E	\$35.53	5	\$33.92	6	\$49.95	4

Growth in value-added per employee, 1990-91

The second measure is growth in value-added per employee between 1990 and 1991. Figure 11 shows the percentage of establishments in which this measure of labour productivity increased, in each cluster. From 1990- to 1991, labour productivity in the manufacturing sector tended to decline, reflecting the persistence of the economic slowdown which had started in 1989. Accordingly, a majority of respondents experienced decreasing labour productivity. However, in two clusters - the HIGH BALANCED and the MODERATE USE, labour productivity improved for a majority of firms.

Figure 11: Labour productivity
proportion of firms with increased value-added per employee

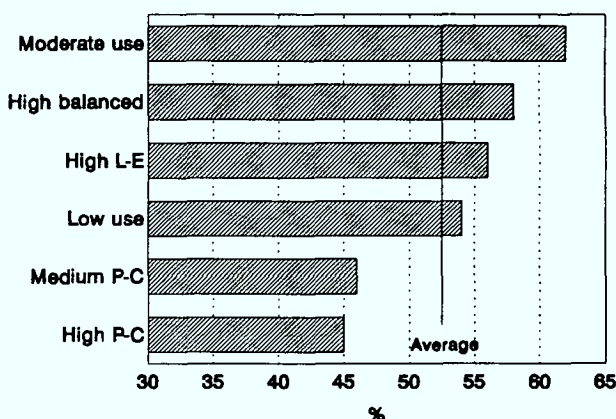


⁵The fourth industry grouping, "Other", included industries that have little in common. Measures of the level of labour productivity across such disparate industries are not comparable and are therefore not shown in this chart.

Growth in value-added per employee compared to industry average, 1990-91

Comparing productivity growth of respondents to the average for their industries (4-digit SIC), the MODERATE USE and the HIGH BALANCED lead the way once again, with 62% and 58% of establishments respectively showing greater labour productivity growth than their industry average. That the MODERATE USE outdistanced the HIGH BALANCED on this measure of growth can be explained by the difference in their respective levels of labour productivity. As previously shown in Table 15, the MODERATE USE have a significantly lower level of value-added per employee to start with than the HIGH BALANCED and so have more room to grow.

Figure 12: Labour productivity
Proportion of firms with higher growth than industry average



Summary of labour productivity measures

Firms in the HIGH BALANCED cluster consistently achieve better results than firms in other clusters in terms of labour productivity. The MODERATE USE cluster is next, suggesting that a balanced approach to QM is preferable to an approach which favours one type of practice over another, even if more practices are used overall, as in the HIGH L-E and the HIGH P-C clusters. The four remaining clusters differ little from each other. These findings are consistent with the view that QM is an integrated approach to management which relies on self-reinforcing practices in each of the four categories of leadership, employee involvement, process improvement and customer focus.

Table 16: Ranking of clusters by labour productivity measures

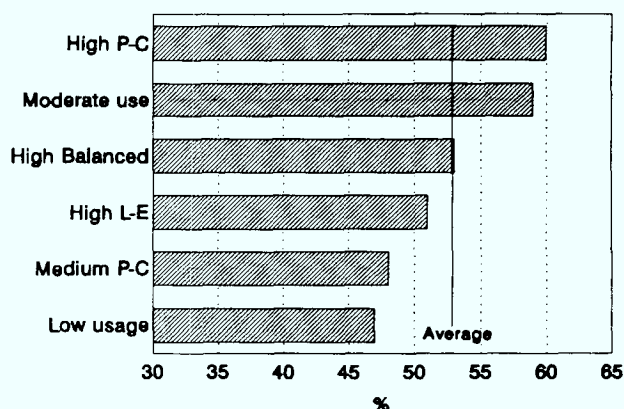
Cluster	Value added per employee	Value-added per employee vs industry average	Level of value-added per employee	Average rank
High balanced	1	2	1	1.3
Moderate use	2	1	3	2.0
High P-C	6	4	4	4.7
Low use	4	6	2	4.0
Medium P-C	5	5	5	5.0
High L-E	3	3	6	4.0

3. The impact on market share

The other fundamental objective of QM is customer satisfaction, which translates into market share. Market share can only be sustained and increased through the provision of products which meet the needs and expectations of the customers.

Market share can be defined as the fraction of the consumption of a commodity in a particular market which is supplied by a manufacturer. The closest approximation which can be constructed from the survey data is total manufacturing shipments for an establishment as a proportion of total manufacturing shipments for an industry at the 4-digit SIC level.

Figure 13: Market Share
proportion of firms with increased market share



Overall, 52% of establishments increased their market share between 1990 and 1991. However, in two clusters, the LOW USE and the MEDIUM P-C, less than half the firms increased their market share. The HIGH L-E cluster also shows below average growth in market share. These three clusters all made limited use of customer focus practices - less than half the practices in that category. In the other clusters, which make moderate to extensive use of customer focus practices, more firms experienced an increase in market share than a decrease.

Part IV Summary

Canadian manufacturers have adopted QM practices in varying levels of intensity. While about one fifth are practitioners of a comprehensive and balanced approach, a similar proportion make little use of any of the practices surveyed. Factors associated with the use of QM include large size (over 200 employees), participation in the high tech sector of the manufacturing industry and location in western Canada. Conversely, small size, membership in tariff protected industries and location in Quebec or the Atlantic provinces are associated with low QM use.

Establishments which adopted a comprehensive and balanced approach to QM were found to be more likely to experience productivity growth. In addition, those that used more than half the customer focus practices surveyed were more likely to achieve increased market shares.

These findings suggest that the adoption of quality management practices can be a key component of strategies for improving the competitiveness of Canadian manufacturing businesses.

APPENDICES

REGISTRATION NUMBER: IST/IST-400-05581

QUALITY MANAGEMENT PRACTICES TELEPHONE SURVEY

Note: all text enclosed in [] constitutes operator notes or computer instructions and is not to be read. The system is programmed so that "company" is used throughout unless the respondent represents one establishment of a multi-branch company, in which case "establishment" is used. The program also includes various reference screens that explain why the survey is being done, how their company was chosen, etc. that are not included here and operators were provided with training and manuals containing definitions of all terms used.

Introduction [To be used once the appropriate person (i.e., head of company or plant, quality manager, other senior manager) has been reached.]

Hello Mr./Mrs./ _____. This is _____ from Statistics Canada. We are conducting a survey about quality management practices on behalf of the federal department of Industry, Science and Technology. While this is a voluntary survey, your assistance in answering a few questions would be greatly appreciated and it should only take about ten minutes of your time. I will be entering your answers directly into a computer and my supervisor may listen in to evaluate my performance.

Could you give me your title please? _____

Currently how many employees are there in the [fill company/establishment name]? ____

- 1.1 Manufacturers use various strategies to enhance their performance. Could you please tell me which of the following were considered to be priorities in [fill company name] in 1992?
 - a) Improved product quality
 <1> Yes <2> No <3> Don't Know
 - b) Improved internal processes (i.e., less internal waste/scrap, reduced cycle times)
 <1> Yes <2> No <3> Don't Know
 - c) Improved employee training
 <1> Yes <2> No <3> Don't Know
 - d) Greater employee involvement
 <1> Yes <2> No <3> Don't Know
 - e) Greater customer satisfaction
 <1> Yes <2> No <3> Don't Know
- 1.2 You mentioned that [fill answers from 1.1] are important in enhancing performance. Which would you say are the most important? (maximum of 3)
- 1.3 Are any of these part of a written plan? <1> Yes <2> No <3> Don't Know
 [If N, skip directly to #2.1 without reading lead-in.]
- 1.4 Was this plan developed by one senior manager or several senior managers?
 <1> Yes <2> No <3> Don't Know
- 1.5 Was an outside consultant involved? <1> Yes <2> No <3> Don't Know
- 1.6 When developing the plan, did your company seek the views of:
 - a) non-management employees(including salaried and production workers)? <1> Yes <2> No <D> Don't know
 - b) your customers or suppliers? <1> Yes <2> No <D> Don't know
- 1.7 Within your company, who is primarily accountable for the implementation of the plan?
 - a) All senior managers <1> Yes <2> No <3> Don't Know
 - b) Several senior managers <1> Yes <2> No <3> Don't Know
 - c) One senior manager <1> Yes <2> No <3> Don't Know
 - d) Anyone else? If Y, please specify _____

- 1.8 Have ALL employees been informed of the plan?
 <1> Yes <2> No <3> Don't Know

[Section 2] We have talked about your company's improvement plan. The next set of questions covers how your organization deals with specific quality issues...

- 2.1 During 1992, did the management group attend regular meetings to discuss any of the following issues:
- a) Improved product quality
 <1> Yes <2> No <3> Don't Know
 - b) Improved internal processes (i.e., less internal waste/scrap, reduced cycle times)
 <1> Yes <2> No <3> Don't Know
 - c) Improved employee training
 <1> Yes <2> No <3> Don't Know
 - d) Greater employee involvement
 <1> Yes <2> No <3> Don't Know
 - e) Greater customer satisfaction
 <1> Yes <2> No <3> Don't Know
- 2.2 If yes to any of these, how frequently were these meetings held:
 a) weekly b) monthly c) quarterly d) annually
 [If N, go to #2.3]
- 2.3 The 5 issues just mentioned are some of the key elements of the philosophy of total quality management. How do senior managers at your firm learn about such management practices:
- a) By attending courses and seminars? <1> Yes <2> No <3> Don't Know
 - b) By participating in management meetings/retreats?
 <1> Yes <2> No <3> Don't Know
 - c) By reading magazine articles/books on quality management practices?
 <1> Yes <2> No <3> Don't Know
 - d) Through customers or suppliers? <1> Yes <2> No <3> Don't Know
- 2.4 Is there a person or group of people in your company that is responsible for coordinating quality activities? <1> Yes <2> No <3> Don't Know
 [If Y,] is it/are they responsible for the following?
- a) Monitoring product and process quality through inspection and audit?
 <1> Yes <2> No <3> Don't Know
 - b) Providing guidance and support for quality improvement activities?
 (e.g., providing training)
 <1> Yes <2> No <3> Don't Know
- If a group, how many people are involved? _____

[Section 3 - Quality Practices]

Managing to improve quality includes many different techniques and practices. I am going to ask you some questions about the practices your company uses.

- 3.1 Does [fill with name of company or establishment] have a written mission or vision statement?
 <1> Yes <2> No <3> Don't Know
- 3.2 [If Y], have all employees been informed of it/them?
 <1> Yes <2> No <3> Don't Know

Now I would like to talk about quality assurance...

- 3.3 Does [fill with name of company or establishment] use statistical process control (SPC)?

<1> Yes <2> No <3> Don't Know

3.4 Do you use other process improvement methods (*i.e., studying and improving key production processes*)? <1> Yes <2> No <3> Don't Know

3.5 Does [fill with name of company or establishment] track any of the following:

- a) Product quality improvement? <1> Yes <2> No <D> Don't know
- b) Meeting delivery times? <1> Yes <2> No <D> Don't know
- c) Cycle times? <1> Yes <2> No <D> Don't know
- d) Inventory turnover? <1> Yes <2> No <D> Don't know
- e) Internal waste/scrap? <1> Yes <2> No <D> Don't know

[If Y to one or more], you mentioned you track [fill text with answers from 3.5 a-e].

Have you seen any improvements? <1> Yes <2> No [go to Q3-6] <D> Don't know [go to Q3-6]

[If Y,] in which areas have you seen improvements?

- [fill text with answer from 3.5 a to 3.5e] <1> Yes <2> No <D> Don't know

3.6 Is [fill name] registered to a quality assurance system such as CSA Z299, ISO 9000 or any others? <1> Yes <2> No <D> Don't know

If Y, which one(s) CSA Z299 _____
 ISO 9000 series _____
 AQAP _____
 Other(s), please specify _____

3.6a Are you working towards registration to a quality assurance system?

<1> Yes <2> No <D> Don't know

If Y, which one(s) CSA Z299 _____
 ISO 9000 series _____
 AQAP _____
 Other(s), please specify _____

3.7 Does [fill name] ask that its key suppliers meet documented quality standards? Y/N

<1> Yes <2> No <D> Don't know

The next area I would like to talk about is customer satisfaction...

3.8 Does [fill company name] have documented customer service standards?

<1> Yes <2> No <D> Don't know

3.9 In your company or establishment, do you conduct formal customer satisfaction surveys?

<1> Yes <2> No <D> Don't know

3.10 Does [fill company name] track any of the following:

- a) Levels of customer satisfaction? <1> Yes <2> No <3> Don't know
- b) Customer complaints? <1> Yes <2> No <3> Don't know
- c) Returns? <1> Yes <2> No <3> Don't know
- d) Customer satisfaction relative to competitors? <1> Yes <2> No <3> Don't know

[If Y to one or more], You mentioned you track [fill text with answers from 3.10 a-d].

[If No, go to 3.11]

Have you seen any improvements?

<1> Yes <2> No [go to Q3-13] <D> Don't know [go to Q3-13]

[If Yes] Have you seen any improvements in:

- [fill text with answer from 3.10 a to 3.10d] <1> Yes <2> No <D> Don't know

- 3.11 Is there a formal system in [fill name] to handle customer complaints?
 <1> Yes <2> No <D> Don't know
- 3.12 [Added to another question]
- 3.13 Does [fill company name] use customers' suggestions when designing new products?
 <1> Yes <2> No <D> Don't know
- 3.14 In [fill company name] do use any of the following specialized techniques:
- Self-assessment (*i.e. using Canada Awards for Business Excellence (CABE) or Malcolm Baldrige guidelines*) <1> Yes <2> No <D> Don't know
 - Benchmarking, <1> Yes <2> No <D> Don't know
 - Design of experiments (DOE) <1> Yes <2> No <D> Don't know

Finally, I would like to ask a few questions on employee training and involvement:

- 3.15 Does [fill company name] assess non-management employees' training needs?
 <1> Yes <2> No <D> Don't know
 [If Y,] is training provided in response to these needs?
 <1> Yes <2> No <D> Don't know
- 3.16 Does employee training include any of the following:
- a) Basic quality awareness? <1> Yes <2> No <D> Don't know
 - b) Problem-solving techniques, e.g., process flowcharting? <1> Yes <2> No <D> Don't know
 - c) Statistical tools such as Statistical Process Control (SPC)?
 <1> Yes <2> No <D> Don't know
 - d) Any others, please specify _____
- Do you track the effectiveness of training courses?
 <1> Yes <2> No <D> Don't know
- 3.17 In [fill company name], do managers attend training sessions on team building or coaching skills? <1> Yes <2> No <D> Don't know
- 3.18 Does [fill company name] use any of the following?
- a) Formal processes for employees to offer ideas and make suggestions?
 <1> Yes <2> No <D> Don't know
 - b) Employee opinion surveys? <1> Yes <2> No <D> Don't know
 - c) Employee recognition/reward systems? <1> Yes <2> No <D> Don't know
 - d) Formal problem-solving teams? <1> Yes <2> No <D> Don't know
- 3.19 Does [fill company name] track any of the following:
- a) Areas of employee satisfaction/dissatisfaction?
 <1> Yes <2> No <D> Don't know
 - b) Number of suggestions made by employees?
 <1> Yes <2> No <D> Don't know
 - c) Number of employees participating in improvement teams?
 <1> Yes <2> No <D> Don't know
- [If Y to any of the above (#3.19 a - c)], have you seen any improvements? Y/N
 [If Yes] Have you seen any improvements in:
 - [fill text with answer from 3.19 a to 3.19c] <1> Yes <2> No <D> Don't know
- 4.1 I have no more questions. Are there any comments you would like to make?

Quality Management Practices and Definitions

A. LEADERSHIP

1. Mission/Vision Statement
2. Quality Improvement Plan
3. Planning/implementation of quality
4. Regular meetings on quality
5. Management quality training
6. Outside consultant assistance
7. Quality coordination group

B. EMPLOYEE INVOLVEMENT

1. Employee participation in quality plan
2. Communication of mission/plan to employees
3. Assessment of employees' training needs
4. Quality training for employees
5. Employee suggestion system
6. Employee recognition & rewards
7. Measurement of employee satisfaction

C. PROCESS QUALITY

1. Registration to a QA system
2. Supplier standards
3. Statistical process control (SPC)
4. Problem-solving teams
5. Benchmarking
6. Measurement of product quality
7. Measurement of cycle times
8. Measurement of waste/scrap

D. CUSTOMER FOCUS

1. Customer input in product design
2. Customer service standards
3. Customer satisfaction relative to competitors
4. Customer satisfaction surveys
5. Complaint resolution systems

Total: 27 practices

DEFINITIONS of QUALITY MANAGEMENT PRACTICES

(Numbers in parentheses indicate the numbers of the questions from which the 27 quality management practices were derived. When a practice was derived from a combination of questions all relevant questions numbers are noted.)

Leadership - senior management group's personal leadership in developing quality values in all areas of the company and incorporating them into the planning process.

1. **Mission/vision statement:** a company's declaration of its fundamental purpose. For example, the mission of former ISTC was "to promote international competitiveness and excellence in Canadian industry, science and technology". (Q3.1)
2. **Quality improvement plan:** the company's business plan or other documented plan written with the objective of improving the quality, productivity, and customer satisfaction. (Q1.3)
3. **Senior management involvement** in the development and implementation of the plan: the business plan is developed and implemented by the president or plant manager in consultation with vice presidents and other senior managers. (Q1.4 and Q1.7)
4. **Regular meetings on quality:** meetings of the senior management group at least monthly to discuss improving product or process quality, greater employee participation and training and greater customer satisfaction. (Q2.1 and Q2.2)
5. **Quality training for managers:** training in quality management concepts and in coaching/facilitation skills for the senior management group (Q3.17)
6. **Assistance of outside consultant:** hiring an expert in quality management to assist in developing and implementing a quality improvement plan. (Q1.5)
7. **Quality support group:** resources deployed with the specific responsibility of providing guidance and support, such as training, for quality improvement activities within the company. (Q.24b)

Employee Involvement - the way that the company prepares its employees to carry out its quality objectives and provides the means for all employees to contribute to meeting these objectives.

1. **Employee participation in quality plan:** management sought the views of employees when developing a quality improvement plan. (Q1.6a)
2. **Communication of mission/vision statement:** employees have been informed of the corporate mission or vision statement and the quality plan. (Q1.8 and Q3.2)
3. **Assessment of employee training needs:** the systematic evaluation of the training needs of employees. (Q3.15)
4. **Quality training for employees:** provision of training to employees on the subject of basic quality awareness as well as at least one of the following: problem-solving techniques or statistical methods. (Q3.16)
5. **Employee suggestion scheme:** formal processes for employees to offer ideas and make suggestions. (Q3.18a)
6. **Employee recognition and rewards:** public celebration of employees' suggestions and contributions through certificates of service, cash awards, trophies, etc. presented by senior officials in the company. (Q3.18b)
7. **Tracking employee satisfaction:** the collection of information about areas of employee satisfaction and dissatisfaction through employee opinion surveys. (Q3.19b)

Process Improvement - internal processes used by the company to ensure product and process quality, including the company's quality requirements for its suppliers and the systems in place to measure product and process quality (e.g., standards).

1. **Registration to a QA system:** A QA system is the organizational structure, responsibilities, procedures, processes and resources in place for implementing quality assurance. (Everything in the company having an effect on the quality of the product.) Standards for such systems are set by international or national organizations so that the common elements of quality systems, i.e., overall quality policies and guidelines, quality procedures and product specifications can be compared. (Q3.6)
2. **Supplier standards:** "proof of the quality" of a raw material or product that is supplied to the company. (Q3.7)
3. **Statistical process control (SPC):** the use of statistical techniques such as Control Charts to monitor, measure, analyze and reduce variations in quality of products or processes. It identifies and controls the levels of variation in product characteristics and eliminates the need for mass inspection. (Q3.3)
4. **Problem-solving teams:** small groups (4-9 people) often from various parts of an organization working together to tackle process problems. Such teams are formally set-up with explicit goals mandated by senior management and use problem-solving tools or techniques. (Q3.18d)
5. **Benchmarking:** comparing your organization's products and processes to world leaders, not necessarily in the same type of business, and adapting these "best practices" to your own organization (Q3.14b)
6. **Tracking product quality:** systematic measurement of the quality of products and their delivery to the customer. (Q3.5a & b)
7. **Tracking cycle times:** recording the time taken to complete a specific production process or business action, e.g., invoicing. (Q3.5c)
8. **Tracking waste and inventory turnover:** systematic measurement of the rate of inventory turnover and the amount of waste/scrap resulting from production processes. (Q3.5d)

Customer Focus - the company's knowledge of its customers' needs and expectations, levels of satisfaction and its comparison with competitors.

1. **Customer input into product design:** recording, analyzing and incorporating suggestions from customers into the design of new or enhanced products. (Q3.13)
2. **Customer service standards:** documented guidelines for service to clients, such as maximum time to complete a repair. (Q3.8)
3. **Customer satisfaction relative to competitors:** the company systematically collects and records information concerning the levels of customer satisfaction with its products and services compared to those of its competitors. (Q3.10d)
4. **Customer satisfaction surveys:** formal surveys of customers conducted on a regular basis to determine their levels of satisfaction or dissatisfaction with the company's products. (Q3.9)
5. **Complaint resolution systems:** the company has implemented a systematic system for recording and resolving complaints. (Q3.11)

Methodology of the Pilot Survey on Quality Management Practices

The Quality Management Practices survey was a pilot survey conducted by Statistics Canada on behalf of Industry, Science and Technology Canada. The survey was conducted from March 1, 1993, to April 2, 1993. For this survey, a sample of 1150 establishments was selected in order to obtain information on the penetration of total quality management practices in the Canadian manufacturing sector.

There were 787 firms who responded to the survey, four of which refused to continue answering the survey at some point during the survey. 102 firms refused to answer any part of the survey. Additionally, there were 48 firms in which the appropriate contacts were absent for the survey period. All together, 937 firms were contacted. The remaining 213 firms in the sample were either out of business (66), or had no phone number listing (147).

This document describes the design of the sample as well as the methods which were used to calculate estimates of population characteristics from the sample results. Procedures which were used to measure the precision of the estimates are also described.

1. Data Requirements of the Survey

Estimates of the proportion of manufacturing firms which use particular management practices were required at the following levels of aggregation:

- 1) Major industry group - Twenty industry groups were formed based on the first 2 digits of the 1980 Standard Industrial Classification (SIC) codes. One of these industry groups corresponded to three 2-digit level SIC codes. Eight of the twenty industry groups were identified as being high priority areas. Estimates were required to be more precise for these priority groups than for the other groups.
- 2) Establishment size - Two size groups were formed based on number of employees, one size group corresponding to firms with 20 to 199 employees and the other group corresponding to firms with 200 or more employees.
- 3) Geographic region - The five regions used were British Columbia, the Prairie provinces, Ontario, Quebec and the Atlantic provinces.

These data requirements were key factors in the design of the sample.

2. Design of the Sample

Survey Frame

The survey frame was created from a file of manufacturing establishments resulting from the 1990 Annual Survey of Manufactures of Statistics Canada. From this file, establishments in the ten provinces with 20 or more employees were included on the frame. The resulting frame consisted of 16,032 establishments.

Stratification

The manufacturing establishments on the frame were divided into distinct groups, called strata, according to their industry group, size group and geographic region. Out of a possible 200 groups (20 industry groups x 2 size groups x 5 regions), 189 strata were formed. There were "no" establishments on the frame with 200 or more employees for 11 combinations of industry group by region. Once the frame was stratified, independent samples of designated sizes were selected from each stratum.

This process of dividing the frame into relatively homogeneous groups (strata) and the selection of samples independently in each of those strata is called stratified sampling. Stratified sampling is a widely used technique which offers several advantages:

- 1) If estimates are required for certain subdivisions of the population, stratified sampling ensures that each subgroup is adequately represented in the overall sample. In addition, separate estimates for different subgroups (individual strata or groups of strata) may be obtained whenever needed.
- 2) If estimates of a certain precision are required for certain subdivisions of the population, this can be accomplished through stratified sampling. Since independent samples are selected from each stratum the sample size can be controlled for each subgroup so as to achieve the desired precision.
- 3) When sampling from a heterogeneous population of units, significant increases in the precision of estimates of the whole population may be achieved through the use of stratified sampling. The heterogeneous population is divided into groups, each of which is internally relatively homogeneous. If within a stratum the measurements vary little from one use to another, a precise estimate for the whole stratum can be obtained by a small sample in that stratum. Estimates can then be combined into a precise estimate for the whole population;

Sample Allocation and Selection

The total sample size of 1150 establishments was allocated among the strata so as to maximize the precision of the estimates at the industry group level, with the restriction of obtaining more precise estimates for the high priority industry groups. Precision refers to how closely the results from a sample would compare to the result which would be obtained if the entire population of establishments were to be contacted. In addition to the sample size of the stratum, the total population and the variability within the stratum of the characteristic being measured affect the precision of an estimate. These factors were taken into account when determining appropriate stratum sample sizes. Once the individual stratum sizes were determined, an independent random sample was drawn from each of the strata.

3. Imputation

There were two general cases in which it was necessary to impute a response for a firm. The first case (and the most common of the two) involved respondents who did not know the answer to a particular question. The second case concerned respondents who did respond to the beginning of the survey, but refused to continue part way through. In both of these cases it was necessary to impute a response for the firm.

used to estimate this true response. The first piece of information is the answers provided by other firms in the same industry group, employment size and region, which we hypothesized would be most like that of the firm in question. The second piece of information used for imputation was the belief that if firms did not know the answer to that question, the true answer was more likely to be "no" than "yes".

These two pieces of information were combined in the imputing process. The number of respondents who said "yes" and "no", within each stratum, were each calculated, and the "yes's" were given a weight of 1/3 and the "no's" were given a weight of 2/3. The "yes" proportion was calculated based on these weights. The "don't know" responses were changed to "yes" based on this proportion. This is equivalent to using the actual number of "yes" responses and twice the number of "no" responses when calculating the proportion of "don't know" responses which should be changed to "yes".

For example, suppose for a given question there are 5 "yes" responses, 5 "no" responses and 6 responses of "don't know" within a stratum. If the "yes" and "no" responses were applied in the same proportion as observed, half of the "don't know" responses would be changed to "yes" ($\text{yes}/(\text{yes} + \text{no}) = 5/(5 + 5) = .5$). However, by applying the "no" responses in twice the rate observed, a third of the "don't know" responses would be changed to "yes" ($\text{yes}/(\text{yes} + 2 \times \text{no}) = 5/(5 + 10) = .33$). Using this method, 2 of the 6 "don't know" responses would be changed to "yes" and the other 4 "don't know" responses would be changed to "no".

Measuring the Precision of the Estimates (Confidence Intervals)

In order to make proper use of the results of the survey, it is important to have an indication of the potential size of the sampling errors. The precision of the results from the sample were measured from the sample itself. In order to express the precision of the estimates in a meaningful way, 95% confidence intervals were used. A confidence interval consists of a statement on the level of confidence that the true value for the population is contained within a specified range of values. A 95% confidence interval can be interpreted in the following manner. If the process of selecting a sample, obtaining the survey results from the sample and calculating a confidence interval from the survey results were to be repeated indefinitely, then for 95% of the samples the confidence interval will contain the true population value.

The 95% confidence intervals are constructed by first estimating the standard error of the estimates. The standard error is defined as the square root of the sampling variance, which is a measure of the differences in sample estimates which would be observed in all possible samples of a given size. This sampling variance can be estimated from a single sample. Once the standard error of an estimate is determined, the confidence interval is defined to be the range of values that are within a certain distance of the estimate. For a 95% confidence interval this distance is the standard error multiplied by 1.96.

In the example above, the estimated proportion for industry group 15 was determined to be 28%. The estimated standard error of this estimate is 1.3. The 95% confidence interval for the estimated proportion consists of all values within 2.5 percentage points (1.3×1.96) of the estimate, giving an interval of 25.5% to 30.5%.

The details of the methods used to calculate the estimated standard error are not described here, but the general approach is similar to that for the estimates themselves. Since an independent

sample was selected from each stratum, the sampling variance is first estimated at the stratum level. Estimated variances are then obtained for various subgroups of the population by combining the variance estimates from the appropriate strata. As previously mentioned the stratum sample size, total population stratum size and the variability within the stratum of the characteristic being measured all affect the precision (measured in terms of variance) of a stratum-level estimate. The actual variability of a characteristic within a stratum is estimated by the observed variability within the respondents in the stratum. For a given sample size, a more precise estimate is likely to be obtained when the majority of the establishments respond similarly (for example if almost all answer "yes" to a question) as opposed to when the responses vary considerably (for example if half of the responses are "yes" and half are "no"). If the number of respondents is equal to the total number of establishments in a stratum (as in stratum 2 of the example), the variance corresponding to that stratum will be zero.

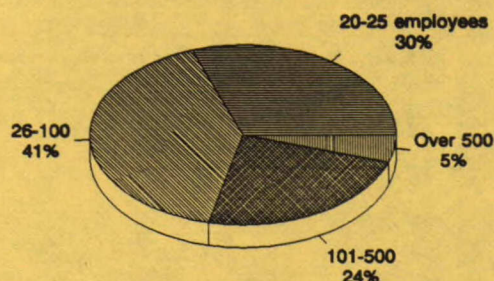
In the actual survey, 42 of the strata had only one responding establishment where the total number of establishments was two or more. Since there was only one response for each of these strata, it was not possible to estimate the variability within the strata directly from the sample. The variances for these strata were estimated by simulating a second response within these strata. The proportions estimated from the sample were taken into account in the simulation of whether the second response would be a "yes" or a "no". These simulated responses did not affect the estimated proportions themselves, they were only used in determining the confidence intervals.

It should be noted that while the confidence intervals provide a useful measure of the precision of the estimates, they are estimates themselves.

Respondent Profile

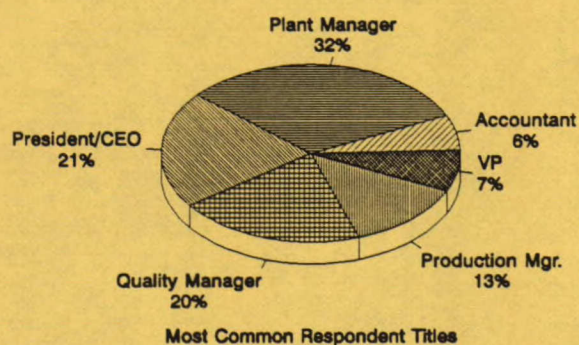
The respondents' company size ranged from 20 to over 2500 employees, with over 70% of respondents having between 20 and 100 employees.

Respondent company size by number of employees



size.ch3

Respondent Titles

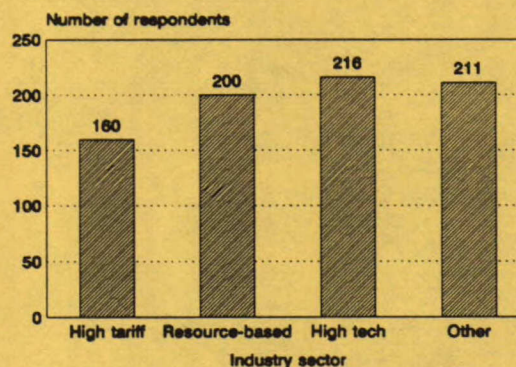


Most Common Respondent Titles

The questionnaire was designed for responses from top management levels in each establishment. Respondents to the questionnaire were primarily plant managers, company presidents or quality managers.

All industry groups were well represented in the survey, with the highest number from the High tech sector and the lowest from the High tariff sector, corresponding roughly to their proportion of Canadian manufacturing firms.

Respondents by sector



HD62.15/.K6

Kohse, Vicki.

Striving for quality :

survey of quality

BZYC c. 1 aa ISC

~~APR 06 1995~~

[illegible]

INDUSTRY CANADA/INDUSTRIE CANADA



47362

