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Quality in Canadian Manufacturing: A Survey of Quality Management Practices

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Quality in Canadian Manufacturing:

A Survey of Quality Management Practices

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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).

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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 achieved higher than average 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 which 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 managements.

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: all establishments in the Canadian manufacturing sector with 20 or more employees were included in the survey frame.

Behavioural rather than attitudinal: Questions were designed to determine which quality management practices companies were actually used and to avoid opinion-based responses.

Non-prescriptive: Terminology associated with a particular quality guru or textbook approach 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, its methodology and sample design. In the second section, 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 QM practices on productivity and market share are discussed.

1. An overview of Total Quality Management (TQM)

Total Quality Management is an approach to running an organization which is focussed 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 change 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.

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2. The 27 Quality Management Practices

Leadership

Mission or vision statement Quality improvement plan Senior management involvement in the development and implementation of the quality improvement plan Regular meetings on quality Quality training for managers Assistance of outside consultants in developing a quality improvement plan Quality support group

Employee involvement

Employee input into the quality improvement plan Communication of the mission statement and quality improvement plan to all employees Assessment of employee training needs Quality training for employees Employee suggestion schemes Employee recognition and reward systems Tracking employee satisfaction

Process improvement

Registration to a quality assurance (QA) system standard Supplier standards Statistical process control Problem solving teams Benchmarking Tracking product quality Tracking cycle times Tracking waste and Inventory turnover

Customer Focus

Customer input into product design Customer service standards Customer satisfaction relative to competitors Customer satisfaction surveys Complaint resolution systems

The survey determined whether business establishments used each of these practices based on the responses provided to the survey questions. A detailed description of how responses were used to derive each practice is contained in Appendix II.

3. 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 frame consisting of 16,032 establishments. The frame was created 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) and 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 in the manufacturing sector pretested 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.



¹There are 22 SIC codes in the manufacturing sector. For 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

1. Quality Management Practices Used

The most widespread practices, used by more than 75% of all establishments, were getting customer input in product design and having a quality support group.

34% establishments used customer satisfaction surveys and 50% had a system to track and resolve customer complaints. It is likely that other, probably more informal, means of getting customer input in product design were employed by other respondents.

Over 75% of establishments also 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, and easy, response to adopting quality as an objective is the establishment of a quality support group.

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% (2%) 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 or planned to become registered. Table 1: Use of Quality Management Practices, all firms

Practice Name	% of firms
Customer input into product design	80.8
Quality support group	78.6
Customer service standards	71.5
Tracking cycle times	70.8
Tracking product quality	69.3
Supplier standards	67.1
Quality training for employees	66.2
Tracking waste and inventory turnover	64.5
Training needs assessment	63.1
Employee suggestion schemes	53.4
Regular meetings on quality	53.3
Complaint resolution systems	50.8
Mission/vision statement	50.3
Recognition and reward systems	49.0
Customer satisfaction relative to competitors	48.2
Problem-solving teams	45.9
Quality improvement plan	44.9
Statistical process control	44.6
Quality training for managers	38.9
Benchmarking	37.2
Customer satisfaction surveys	34.1
Employee input into quality plan	32.0
Senior management involvement	28.2
Communication of mission & plan	26.6
Tracking employee satisfaction	26.5
Registration to a QA system standard	22.3
Assistance of an outside consultant	19.5

All estimates are within 3% to 5% of population values with a 95% confidence interval.

Types of practices used

In addition to the number of practices used, the type of practices favoured by firms is an indicator of how TQM is being implemented in the Canadian manufacturing sector. Table 2 shows the practices, in descending order of frequency, by category.

The most frequently used practice in the leadership category was having a quality support group; in the employee involvement category, assessing training needs or providing quality training for employees; in the process improvement category, tracking cycle times; and, in the customer focus category, customer input in product design.

Practice Name	% of firms
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
Subliner Subliced on Surreys	34.1

Table 2: Use of Quality Management Practices, by category

All estimates are within 3% to 5% of population values, with a 95% confidence interval.

Leadership

In the **leadership** category, over 50% of establishments had a quality support group, 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 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.

Customer focus

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. How establishments are implementing TQM

Rather than examining the number of establishments that employ each quality managment practice, another way of looking at quality management in Canadian manufacturing is to consider the number of practices employed by each establishment.



Figure 3

On average, establishments used 13.4 practices, almost exactly half the 27 practices in the survey. As shown in Figure 4, the frequency of firms by number of practices used follows a fairly normal distribution, with fewer firms at either extreme and most firms clustered around the mean. However, peaks at 5, 11, 15 and 21 practices indicate that this distribution may conceal a deeper clustering of firms.

On average, firms reported using about half the practices in each category, with customer focus practices showing a bit of a lead and leadership practices lagging somewhat behind, as shown in Table 3.

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

Table 3: Average Number of Practices, by category

The peaks in the distribution in Figure 3 gave a hint that firms may be clustered by type and number of practices used. To determine if there are typical combinations of practices that large numbers of establishments adopt, each practice was given a weight of 1 and a percentage calculated for each category. For example, the Customer focus category is made up of 5 practices. Therefore, for this category, each firm was assigned 0%, 20%, 40%, 60%, 80% or 100% depending on whether it used none, 1, 2, 3, 4 or all of those practices. Firms were then grouped into clusters, based on the average number of practices they used in each category.

Six clusters were found (Table 4). 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).

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

Table 4: Cluster composition, average number of practices used

High Balanced

These establishments used the highest number of QM practices, using 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 L-E

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

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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 P-C

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.

Medium Balanced

These firms are "middle of the road" TQM 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 USAGE group.

Medium P-C

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 MEDIUM BALANCED, and more customer improvement than the MEDIUM BALANCED or the HIGH L-E group.

Low Usage

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

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 USAGE group used on average 18% of the practices.

Fig. : Average number of practices used, by cluster as a percentage of all practices



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.

Table : Distribution of Firms by Cluster



The clusters will be used to assist in the analysis of the effect of size, industry and region on the use of QM practices and to evaluate the impact of the adoption of QM on establishment performance.

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 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.





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.

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Distribution of firms by cluster



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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 USAGE 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 category of practices. Large and small establishments differed the most in the use of leadership practices. On the other hand, small establishments used almost the same number of customer focus practices on average as large establishments.

Table 7: Average number of Practices used, by category, by s
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Categories	Meximum # 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%

Each of the 27 quality management practices is used by a greater percentage of large establishments than small establishments. (Tables 5 and 6)

Table 5 – QM practices used, small establishments

Customer input into product design	80.0
Quality support group	77.5
Service standards	71.2
Track cycle times	69.3
Track product quality	68.4
Supplier standards	65.7
Employee quality training	64.5
Track waste and inventory	62.3
Employee training needs assessment	62.1
Employee suggestion system	52.3
Regular meetings on quality	51.7
Recognition and reward system	48.2
Track customer satisfaction relative to competitors	48.1
Complaint resolution system	48.0
Mission or vision statement	47.1
Problem solving teams	43.8
Quality improvement plan	41.9
Statistical Process Control	41.2
Quality training for managers	36.3
Benchmarking	35.6
Customer satisfaction surveys	32.1
Employee input to plan	29.8
Management involvement	25.3
Track employee satisfaction	24.5
Communication of plan to employee	23.7
Registration to a QA system standard	20.9
Outside consultant	17.5

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Table 6 - QM practices used, large establishments %

Quality support group 88.7 88.2 Customer input Track cycle times 84.2 Track waste and turnover 83.9 Employee quality training 82.4 Mission statement 79.9 Supplier standards 79.5 Complaints resolution system 78.6 Track product quality 77.5 Statistical Process Control 76.0 Service standards 74.0 Employee training needs assessment 72.6 Quality improvement plan 72.4 Regular meetings on quality 67.9 Problem solving teams 65.1 Employee suggestion system 63.2 Management quality training 62.5 Recognition and reward scheme 56.3 Management involvement 55.3 Communication of plan to employees 53.0 Employee input to plan 52.8 Customer surveys 52.2 51.7 Benchmarking Track customer satisfaction relative to competitors 46.5 Track employee satisfaction 44.4 Outside consultant 37.8 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.

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Three of the 5 practices which differed the most between small and large establishments were in the leadership category (Figure...). This confirms 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 the senior management involvement practice was used in a greater percentage of large establishments may be explained by way this practice was derived. Only establishments reporting that several senior managers were involved in the development and implementation of the quality improvement plan were



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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.

There is nothing to prevent small establishments from using statistical process control. Its low incidence in small firms is probably more a consequence of lack of information or expertise and this is an area which can be addressed. 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.

Discounting differences in overall frequency, similarities appear in the relative importance accorded the various practices by both 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 either group. 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).

4. Industry Patterns

There is 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 8 - Average number of QM practices used, by industry

INDUSTRY	# practices	CI *
Rubber products	19.7	4.6
Paper and allied products	17.0	6.6
Refined petroleum and coal	16.2	3.5
Primary metals	16.0	1.1
Chemical products	15.5	2.6
Transportation equipment	15.4	1.4
Beverage	15.4	1.2
Plastic products	15.3	1.4
Electrical & electronic products	14.8	2.6
Non-metallic mineral products	14.4	3.6
Food	14.1	1.2
Machinery	14.1	3.1
Primary textile	13.3	3.2
Fabricated metal products	13.0	2.1
Other manufacturing	12.9	2.9
Printing and publishing	12.6	2.7
Furniture and fixtures	11.2	1.4
Wood	10.6	1.1
Clothing	10.3	1.4
Textile products	9.6	2.9
All industries	13.4	0.6

* CI - confidence interval

Since size has an impact on propensity to use quality management practices, it will be necessary to take into account the higher concentration of large establishments in certain industries. Establishments in those industries are in principle more likely to use quality management practices.

Industries can be divided into two groups, based on whether large establishments represent more than 20% of their population. Table 9 lists the industries, by size, and shows whether the HIGH BALANCED and the LOW USAGE group are over-represented in the industry. In theory, the HIGH BALANCED cluster should be over-represented in industries which have a higher concentration of large establishments.

Table 9 Industries, by size of establishment and cluster concentration

Industry	HIGH BALANCED over-represented	LOW USAGE over-represented
Industries with more large establishments		
Rubber products	x	
Primary textiles	•	
Paper and allied products	x	
Primary metals	x	
Transportation equipment	x	
Refined petroleum and coal products	X	
Industries with fewer large establishments		
Food	• .	
Beverage		
Plastic products	x	
Textile products		x
Clothing		x .
Wood		x
Funiture and fixtures		x
Printing and publishing		
Fabricated metal products		x
Machinery	x	
Electrical and electronic products	x	•
Non-metallic meineral products	×	
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.

Of the 14 industries in which small establishments dominate, 5 are over-represented in the LOW USAGE cluster (textile products, clothing, wood, furniture and fixtures, fabricated metal products). This supports the proposition that establishment size is an indicator of propensity to use QM practices. However, another 5 industries (plastic products, machinery, electrical and electronic products, non-metallic mineral

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products, chemicals and chemical products) are over-represented in the HIGH BALANCED cluster, even though they are dominated by small establishments. This indicates that establishment size is not the only factor which influences the propensity to use QM practices.

To test this further, large establishments were excluded from the analysis of industry contribution to the various clusters, as shown in Table 10.

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	17
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
Chemical and chemical products	5.2	4.4
Other manufacturing	5.3	5.3

Table 10 - Industry contribution to the HIGH BALANCED cluster, small establishments only

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. This indicates that industry characteristics other than size of establishments influence the propensity to use QM practices.

Industry characteristics which may influence the propensity to use QM practices include 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. The latter includes exposure to foreign competition where QM is used extensively, for example competition from Japanese firms. In <u>The Competitive Advantage of Nations</u>, 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 In order 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 11 : Competition-based Industry Groups (SIC codes in brackets)

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

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 12). However, with a population share of 15%, the High tariff group is strongly over-represented in the LOW USAGE cluster (27%) and underrepresented 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 underrepresented in the LOW USAGE group (16%).

TABLE 12 Industry group contribution to QM clusters

Industry sector	Population share	Share of HIGH BALANCED	Share of LOW USAGE
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 who themselves use QM, is a key determinant of an establishment's propensity to use QM practices.

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

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

5. Regional differences

In addition to establishment size and industry sector as determinants of the use of QM practices, geographic region was considered. Establishments in the Prairie region used on average 57% of the practices, in Qu bec 46% (estimates are within 5.6% of population values with a 95% confidence interval).

Customer focus practices were the most commonly used in all regions, leadership practices the least used, except in the Atlantic region. Establishments in the two western regions used relatively more employee involvement practices than in other regions.





Regional estimates of the types of practices used are within 8% of population values, with a 95% confidence interval.

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Regional QM profiles

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

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

Prairie provinces			
High P_C		22.6%	
High Pelanood	07.00/	32.0 %	
I myn Dalai koru	21.076		
Low Usage	11.5%		
Medium Balanced	9.8%		
High L-E	9.5%		
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 more 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, which basically reflects the same distribution across all clusters.

Ontario				
High Balanced	23.2%			
Medium P-C	18.1%			
High P-C		16.3%		
Low usage	16.1%			
Medium Balanced	13.8%			
High L-E	11.5%			

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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%			

Finally, in the Atlantic provinces, there is a fairly even distribution across all clusters, led by the LOW USAGE 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, a style of quality management that puts more emphasis on leadership and less on actual process improvement and customer focus practices. In Quebec, three large clusters account for over 70% of establishments: the LOW USAGE, HIGH P-C and MEDIUM P-C. Establishments in the LOW USAGE and MEDIUM P-C clusters (50% of the population) make the least use of quality management practices, which indicates a low level of penetration of QM among Quebec establishments. About 20% of establishments (the HIGH P-C) emphasize process improvement and customer focus rather than leadership and employee involvement.

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%

These regional differences may be attributable to the size of the establishments and industry mix in each of the regions. For example, certain high tariff industries (primary textiles and clothing) are concentrated in Quebec. This may be the cause of the lower average number of practices used in that region.

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 USAGE group are in that region (Table 13).

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%

Table 13. Regional distribution of QM clusters, all firms

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 14, 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.

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%
Atiantic	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.

Part III The impact of using quality management practices on establishment performance

Canadian manufacturing establishments use varying numbers and patterns of QM practices, depending on their size and industry group. Whether this had any effect on their performance was investigated.

Essentially, TQM is promoted as a means of attracting and retaining more customers by offering high quality products at competitive prices. Customer focus practices support the former, process improvement practices, with attendant cost reduction, the latter. Both are brought about through leadership practices and employee involvement.

1. Respondents' perceptions of the impact of QM practices

Based on the rationale that what get measured gets improved, the QMP survey included questions on tracking. Respondents were asked if they tracked 12 items shown in Figure 6. Those that answered affirmatively were asked whether they had seen improvements in these areas.

Table 15 – 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 reported. The number of tracking practices used Is highly correlated to the number of areas of Improvement reported (correlation coefficient of 0.75).

2. The impact on labour productivity

The final section of this report looks at whether using QM practices makes a difference on the bottom line - the economic performance of a company. Five performance measures are presented: four dealing with labour productivity and one with market share. Labour productivity is a measure of the relative efficiency of labour in the production process and is therefore related to the cost reduction objectives of QM, whereas market share is related to the market objectives of QM. It would be reasonable to expect that the firms that use the most practices, the HIGH BALANCED cluster, would achieve the best results, the LOW USAGE cluster the worst results, the other clusters, somewhere in between.

Other than the number of practices, the type of practice used may also have an impact. Three of the clusters present a balanced profile in terms of the types of practices used, differing only in terms of the numbers used. The HiGH BALANCED use almost all of each type of practice, the MEDIUM BALANCED about half the practices in each category, the LOW USAGE, only one or two practices in each category. On the other hand, the other three clusters show a marked leaning toward certain types of practices. The HIGH L-E and the HIGH P-C both use about two thirds of the practices, but with a different mix. The HIGH L-E use many leadership and employee involvement practices but very few customer focus and process improvement practices, many customer focus and process improvement practices, many customer focus and process improvement practices. Is one or the other of these approaches associated with better results?

To 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. The reference period for the QMP survey was 1992. As QM programs require considerable time to implement, establishments using QM practices during the survey period have likely been practicing quality management for some years. Therefore, it is assumed that performance data for 1990 and 1991 can be related to management practices in 1992.

Labour productivity, 1991

Labour productivity, expressed as value-added per employee, was calculated for the high tariff, resource-based and high tech industry groups described earlier.⁴ 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 clusters.

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
MEDIUM BALANCED	\$41.85	. 3	\$114.48	2	\$37.69	6
. HIGH P-C	\$30.56	6	\$54.59	4.	\$69.1 6	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

Table 16 - Value-added per employee, 1991

⁴The 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, 1990-91

The second measure is growth in value-added per employee between 1990 and 1991. Fig... shows the percentage of establishments in which this measure of labour productivity increased, in each cluster.



Overall, fewer establishments, 47%, showed an increase in labour productivity from 1990 to 1991 than showed a decrease. This is an expected result as the economy continued its contraction in the recession which started in 1989. However, in two clusters, the HIGH BALANCED and the MEDIUM BALANCED, more firms experienced an increase in labour productivity than a decrease. Growth in value-added per employee compared to industry average, 1990-91

A similar measure is the proportion of firms for which labour productivity increased faster from 1990 to 1991 than the average for their industry. This measure takes into account the unique dynamics of each detailed industry group, in this case at the 4-digit SIC.



Once again, the MEDIUM BALANCED and the HIGH BALANCED lead the way, with 62% and 58% of establishments respectively showing greater labour productivity growth than their industry average. That the MEDIUM BALANCED 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 1, the MEDIUM BALANCED have a significantly lower level of value-added per employee to start with than the HIGH BALANCED and so have more room to grow.

Summary of labour productivity measures

In summary, according to the various measures presented, the firms in the HIGH BALANCED cluster consistently achieve better results than firms in other clusters in terms of labour productivity, ranking first in two of the three measures and second in the other. The MEDIUM BALANCED cluster is next, favouring the argument 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 indicate that half-measures are no better than doing nothing at all. 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.

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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
MEDIUM BALANCED	2	1	3	2.0
HIGH P-C	6	4	4	4.7
LOW USAGE	4	6	2	4.0
MEDIUM P-C	5	5	5	5.0
HIGH L-E	3	3	6	4.0

Table 17 - Ranking of clusters by labour productivity measures

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, more or less narrowly defined, 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.

Chart 5 shows the performance of the various QM clusters under this definition, expressed as the percentage of establishments whose market share increased between 1990 and 1991.

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Overall, 52% of establishments increased their market share between 1990 and 1991. However, in two clusters, the LOW USAGE 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 have in common 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.

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6. Conclusions

Conclusions

Canadian manufacturing companies are using quality management practices, in varying levels of intensity. Factors that appear to significantly influence the use of QM practices are company size, industry sector and geographic region, although the size factor does not preclude the use of QM practices. In terms of numbers of practices, larger firms used a higher average number of practices than SMEs. However, there is a core group of practices that are used by most firms and conversely, a group of practices that are used by very few firms, regardless of size.

However, size was found to be less of a determinant in the use of QM practices than originally thought. In fact, industry sector likely has a greater effect on a firm's propensity to adopt a quality approach.

In terms of industry sector variations in QMP use, companies in the High tech sector were using considerably more practices than those in the high tariff sector. This may be due to the influence of global competition in the high tech sector, among other factors.

All five regions were consistent in that the most used QM practices were in the customer focus category, however, the Prairie region used the greatest number of practices. The effect of high tariff industries can be seen in the regional differences with textiles and clothing industries concentrated in Quebec. However, even when high tariff firms are excluded, a pattern of west to east penetration of Qm practices remains.

In terms of bottom-line results, companies that make moderate to intensive use of QM practices evenly distributed across the 4 key areas of leadership, employee involvement, process improvement and client focus achieved higher than average productivity results. Companies which make intensive use of QM practices reported a greater number of internal performance improvements as well as ranked the highest in 3 of 4 productivity measures. Companies using more customer focus practices are also more likely to experience higher growth in market share.

Preliminary Recommendations (to be completed...)

- There are specific, well-defined groups of companies (i.e., in the high tariff sector particularly) that could benefit from more information about quality management practices and assistance in their use and implementation...
- Use of a balanced approach of QMP leads to greater productivity and market share to motivate companies to adopt a quality approach...
- There are some anomalies in the data that may warrant further research, i.e., over 96% of respondents claimed that improving customer satisfaction was a priority in their company, yet only 34% conduct customer satisfaction surveys and even less had seen improvements in customer satisfaction levels. Why? Service sector, better measurement of customer satisf. here we used market share

ETC.....

Appendices

- I. Questionnaire
- II. Definition of practices
- III. Methodology
- IV. Respondent Profile

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