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"Performance Measurement for Total Quality Management"

by

Franck R. Choisine, M.B.A.

A thesis submitted to
the Faculty of Graduate Studies and Research,
in partial fulfilment of
the requirements for the degree of

Master of Management Studies.

School of Business
Carleton University
Ottawa, Ontario
April 29, 1994

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in partial fulfilment of the requirements for
the degree of Master of Management Studies**

Thesis Supervisor

Director, School of Business

**Carleton University
April 29, 1994**

ABSTRACT

The purpose of this thesis is to describe the perception of recognized Total Quality Management (TQM) adopters on two issues: one, the impact of TQM practices on overall company performance, and two, the performance measures necessary in a TQM environment.

Fifteen companies that have been "Quality" finalists (winners or certificates of merit) from the Canada Award for Business Excellence (CABE) have been selected randomly for the study.

The study develops a better understanding of the impact of TQM in terms of company performance. This study also identifies the perceived characteristics, the extent of use and the perceived appropriateness of current TQM-related performance measures and systems necessary for adequately assessing the impact and facilitating a successful implementation of TQM's principles. Valuable findings and recommendations are drawn for current and future TQM adopters, management consultants, policy makers and academics who wish to promote or use TQM practices.

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TABLE OF CONTENTS

ACCEPTANCE SHEET	ii
ABSTRACT	iii
ACKNOWLEDGEMENTS	iv
TABLE OF CONTENTS	v
LIST OF TABLES	viii
LIST OF FIGURES	ix
LIST OF APPENDICES	ix
 INTRODUCTION.....	 1
 CHAPTER 1- BACKGROUND.....	 4
1.1- Quality and International Competitiveness.....	4
1.1.1- General Economic Trends Related to the Quality Issue.....	4
1.1.2- Quality as a Crucial Competitive Asset	6
1.1.2.1- Defining Quality.....	6
1.1.2.2- Quality as a Strategic Weapon	8
1.2- Total Quality Management	9
1.2.1- Brief History	9
1.2.2- Defining TQM	10
1.2.3- The Underlying Concepts and Techniques in TQM practices	16
1.2.4- Benefits.....	17
1.2.5- Quality Beyond the Manufacturing Department	18
1.3- TQM Awareness and Degree of Implementation.....	18
1.3.1- In Canada	19
1.3.2- In USA	20
1.3.3- In Other Countries around the World	21
 CHAPTER 2- LITERATURE REVIEW	 22
2.1- Performance Measures.....	22
2.1.1- Issues with Existing Performance Measures	22
2.1.2- Integration of Performance Measures and TQM	23
2.1.2.1- Corporate Level.....	26
2.1.2.2- Organizational Level	27
2.1.2.3- Customer Level	31
2.1.3- Importance of Benchmarking.....	31
2.1.4- Need for New Performance Measures and Systems/Methods	32
2.1.4.1- Process and Value-adding Oriented Measurements	32
2.1.4.2- New Accounting and Profitability Measurement	33
2.1.4.3- Summary.....	34
2.2- The Cost-effectiveness of TQM.....	37
2.2.1- The cost of Non-quality.....	37
2.2.2- Impact of TQM Practices on Company Performance	39
2.3- Total Quality Management Model: a Model Derived from the Literature Review	42
 CHAPTER 3- THE CANADIAN STUDY	 43
3.0- Introduction.....	43
3.1- Research Questions and Objectives.....	43
3.2- Research Model.....	44
3.3- Methodology.....	46
3.3.1- Research Design	46
3.3.1.1- Data collection	47
3.3.1.2- Population and Sample	48

3.3.2-Fieldwork plan.....	51
3.3.3-Data Analysis.....	51
CHAPTER 4- IMPACT OF TQM ON COMPANY PERFORMANCE	53
4.1- Introduction.....	53
4.2- Analysis of Qualitative results	55
4.2.1- Better Employee Relations	57
4.2.2- Improved Operating Procedures	58
4.2.3- Greater Customer Satisfaction.....	59
4.2.4- Increased Financial Performance.....	60
4.3- Summary and Benefits for Other Studies.....	61
CHAPTER 5- CHARACTERISTICS OF PERFORMANCE MEASURES, METHODS AND SYSTEMS.....	63
5.1- TQM Principles.....	63
5.2- Perceived Characteristics of Performance Measures	64
5.3- Perceived Characteristics of Performance Measurement System/Method.....	65
5.4- DISCUSSION.....	67
CHAPTER 6- PERFORMANCE MEASURES, METHODS AND SYSTEMS IN A TQM ENVIRONMENT.....	69
6.1- Extent of use of Performance Measures (PMs) and Systems/Methods (PMS) favoured by TQM adopters.....	69
6.1.1- Extent of use of TQM related systems by TQM adopters	70
6.1.2- Extent of use of employee-related measures and methods by TQM adopters	71
6.1.3- Extent of use of production-oriented measures and methods by TQM adopters	72
6.1.4- Extent of use of productivity-based measures by TQM adopters.....	74
6.1.5- Extent of use of finance-based measures by TQM adopters.....	75
6.1.6- Extent of use of market-based measures by TQM adopters	76
6.1.7- Extent of use of customer-based measures by TQM adopters	77
6.1.8- Extent of use of quality of products/services-related methods by TQM adopters	79
6.1.9- Extent of use of methods related to quality of suppliers' products/services by TQM adopters	80
6.1.10- Extent of use of methods for tracking continuous improvement of employees by TQM adopters	81
6.2- Appropriateness of Performance Measures (PMs) and Systems/methods (PMS) favoured by TQM adopters.....	81
6.2.1- Appropriateness of TQM related systems by TQM adopters	82
6.2.2- Appropriateness of employee-related measures by TQM adopters.....	82
6.2.3- Appropriateness of production-oriented measures and methods by TQM adopters	84
6.2.4- Appropriateness of productivity-based measures by TQM adopters.....	86
6.2.5- Appropriateness of finance-based measures by TQM adopters.....	87
6.2.6- Appropriateness of market-based measures by TQM adopters	88
6.2.7- Appropriateness of customer-based measures by TQM adopters	89
6.2.8- Appropriateness of quality of products/services-related methods by TQM adopters	90
6.2.9- Appropriateness of use of methods related to quality of suppliers' products/services by TQM adopters.....	91
6.2.10- Appropriateness of methods for tracking continuous improvement of employees by TQM adopters	92
6.3- Continuous Improvement and Need for new PMs and PMS	92
6.4- Link between usefulness and appropriateness.....	94

6 5- Summary and benefits for other studies.....	95
CHAPTER 7- CONTINUOUS IMPROVEMENT OF PERFORMANCE MEASURES	96
7.1- Frequency of improvements	96
7.2- Mechanisms of improvements.....	97
CHAPTER 8- DISCUSSION AND IMPLICATION FOR FURTHER RESEARCHS	100
8.1- Discussion	100
8 2- Further Research Implications	103
CONCLUSION	104
REFERENCES	

LIST OF TABLES

Table 1: Average Rating of Questionnaire Quality	48
Table 2: Percentage of Company's Domestic Total Sales	50
Table 3: Time Frame of TQM Adoption	54
Table 4: Overall Indicators	56
Table 5: Employee-Related Indicators	57
Table 6: Operating Indicators	58
Table 7: Customer Satisfaction Indicators	59
Table 8: Financial Performance Indicators	60
Table 9: Best Impacts on Company Performance	61
Table 10: Link Between TQM's Principles and Performance Measures	63
Table 11: Perceived Characteristics of Performance Measures	64
Table 12: Perceived Characteristics of Performance Measurement System/Method	65
Table 13: Extent of Use of TQM-Related Systems by TQM Adopters	70
Table 14: Future Use of TQM-Related Systems by TQM Adopters	70
Table 15: Extent of Use of Employee-Related Measures and Methods by TQM Adopters	71
Table 16: Extent of Use of Production-Oriented Measures and Methods by TQM Adopters	72
Table 17: Extent of Use of Productivity-Based Measures by TQM Adopters	74
Table 18: Extent of Use of Finance-Based Measures by TQM Adopters	75
Table 19: Extent of Use of Market-Based Measures by TQM Adopters	76
Table 20: Extent of Use of Customer-Based Measures by TQM Adopters	77
Table 21: Extent of Use of Quality of Products/Services-Related Methods by TQM Adopters ...	79
Table 22: Extent of Use of Methods Related to Quality of Suppliers' Products/Services by TQM Adopters	80
Table 23: Extent of Use of Methods for Tracking Continuous Improvement of Employees by TQM Adopters	81
Table 24: Appropriateness of TQM-Related Systems by TQM Adopters	82
Table 25: Appropriateness of Employee-Related Measures by TQM Adopters	82
Table 26: Appropriateness of Production-Oriented Measures and Methods by TQM Adopters ...	84
Table 27: Appropriateness of Productivity-Based Measures by TQM Adopters	86
Table 28: Appropriateness of Finance-Based Measures by TQM Adopters	87
Table 29: Appropriateness of Market-Based Measures by TQM Adopters	88
Table 30: Appropriateness of Customer-Based Measures by TQM Adopters	89
Table 31: Appropriateness of Quality of Products/Services-Related Methods by TQM Adopters ..	90
Table 32: Appropriateness of Use of Methods Related to Quality of Suppliers' Products/Services by TQM Adopters	91
Table 33: Appropriateness of Methods for Tracking Continuous Improvement Of Employees by TQM Adopters	92
Table 34: Usefulness versus Appropriateness of PMs & PMS	94
Table 35: Frequency of Updating Measures Related to the Following Domain	96
Table 36: Monitors of Performance Measures	97
Table 37: Creators/Updaters of Performance Measures	97
Table 38: Employee Participation and Training in PMs	97

LIST OF FIGURES

Figure 1: The TQM Philosophy	12
Figure 2: Johnston & Daniel's TQM Model	14
Figure 3: Baldrige Award Criteria Framework: A TQM Model	15
Figure 4: The Performance Pyramid	25
Figure 5: Relationships Between Direct Costs of Quality and Organizational Capability	38
Figure 6: Impact of TQM Practices on Corporate Performance	42
Figure 7: The Research Model	45
Figure 8: TQM Adoption : Three Basic Steps (average time)	54

LIST OF APPENDICES

Appendix 1: Thesis Meetings
Appendix 2: Definitions of Quality (Garvin, 1984)
Appendix 3: Dimensions of Quality (Garvin, 1987)
Appendix 4: Definitions of Quality (Quality finalists of the 1989 Canada Awards for Business excellence)
Appendix 5: TQM Principles, Core Values and Concepts
Appendix 6: 1992 Malcolm Baldrige National Quality Award Criteria
Appendix 7: SPC's Tools
Appendix 8: PDCA Cycle or Deming Wheel
Appendix 9: Quality Cost Measurement
Appendix 10: Operating and Employee-related Performance Indicators
Appendix 11: List of the Quality Finalists of Canada Awards for Business Excellence
Appendix 12: Cover Letter and Questionnaire

INTRODUCTION

Why do North American firms need to produce high quality goods and services at the lowest prices? In the international marketplace, Japan and other South Asian countries are succeeding whereas the USA and Canada are losing the confidence of their customers.

To maintain their market share and successfully compete internationally, Canadian firms need to change their management practices, strategies and more importantly, their corporate culture. The goal is not only to provide higher quality goods and services, but also to delight customers. In North America, one of the approaches toward improving quality and productivity being explored by many organizations since the mid 1980s, is the philosophy of Total Quality Management (TQM) (Pfau, 1989). This Japanese philosophy is the result of approximately 40 years of efforts focused on customer satisfaction, quality, service and competitive prices. Two main techniques make the basis of TQM: Just-In-Time (JIT) and Total Quality Control (TQC).

As mentioned above, this new management philosophy arrived in the mid 1980s in the USA. In 1987, a specific award, the Malcolm Baldrige National Quality Award, was created by the US Department of Commerce, making TQM a recommended model to follow in order to succeed in the current marketplace. Recently former US President George Bush declared:

"Quality Management is not just a strategy. It must be a new style of working, even a new style of thinking. A dedication to quality and excellence is more than good business. It is a way of life, giving something back to society, offering your best to others." (Malcolm Baldrige National Quality Award, 1992 Award Criteria)

A similar award, the "Quality category" of the Canada Award for Business Excellence, was developed by the Canadian Government in 1989. Several studies (ISTC, 1991; US-GAO, 1991) have investigated the awareness and degree of adoption/implementation of TQM practices in Canadian firms. Other have concentrated on critical factors in implementing TQM. More recent articles on TQM have brought to light

an important issue, the effect of TQM practices on corporate performance. Specifically a recent study from the US-GAO (General Accounting Office) concluded that there is a positive correlation between TQM practices and corporate performance. This is still an area of profound interest. Therefore, this thesis will focus on this issue.

The purpose of this thesis is first of all to describe the impact of TQM on four areas of company performance (employee relations, customer satisfaction, production, and finance) (see Chapter 4). Second, the underlying issue concerning the need for new performance measures (PMs) and methods is examined. This issue drives the thesis to study the appropriate characteristics of such PMs and methods (Chapter 5) as well as the usefulness and appropriateness of current and new PMs / methods (Chapter 6). An attempt is made in order to understand and describe the systems and procedures which keep these PMs and methods updated (Chapter 7).

Before presenting and discussing the above findings, a background and the literature review outline relevant issues for companies, consultants and Industry Science and Technology Canada. These groups have a strong interest in TQM practices, and more precisely, its cost-effectiveness and effect on corporate performance. Such interests illustrated the need for an empirical study.

The two major issues, which will develop the background (Chapter 1) are i) what is the degree of TQM awareness in Canadian companies, specifically, is quality a common theme in Canadian business (Tausz, 1991)?; and ii) to what extent is TQM understood and implemented in Canadian companies? Moreover, defining TQM and its underlying concepts as well as its benefits is also discussed in this chapter.

These issues have already been studied through government and private studies such as the Aerospace Study of ISTC in 1991, the International Quality Study (IQS) of Ernst & Young in 1992, the US-GAO study in 1991 as well as in the documents and involvement of the Malcolm Baldrige Award examiners whose aim is to promote a better understanding of the features and common principles of TQM.

These two broad issues introduced in the background will lead to a literature review (Chapter 2) on the cost-effectiveness of TQM and the need for new performances measures. Subsequently, two research objectives are identified and operationalized in several research questions listed in Chapter 3.

CHAPTER 1- BACKGROUND

TQM is a philosophy newly implemented in North America. Therefore, there is an abundance of literature to be found. Nevertheless, only a few empirical studies have been conducted in this area. The background has been developed through gathering information from the following sources: Reviewing articles and research coming from different sources such as libraries, professors, consultants in quality management and meetings on TQM. Interviewing professionals (see Appendix 1), both at the company/consultant and government levels, in the TQM field allowed a confirmation of the relevance of my present research topic. The background provides a useful insight that drives the why and what of TQM.

1.1- Quality and International Competitiveness

1.1.1- General Economic Trends Related to the Quality Issue

In the U.S.A.:

By the early 1980s, North Americans were uncomfortably aware that the Japanese were setting the world standard for high-quality manufactured goods. In 1973, the Roper Center for Public Opinion found that 12% of Americans believed that Japanese cars were better made than American cars; by 1983 that number jumped to 40% (R.Z., 1990).

The ability of the U.S. to compete has declined over the last two decades, as indicated by increasing trade deficits, the erosion in market share of American high technology industries, declining rates of return in vital manufacturing sectors, declining productivity growth rates, and stagnant real wages (Shetty, 1991). Results from a survey conducted by Shetty (1991) on U.S. competitiveness, clearly indicate that product and service quality, productivity, and rapid response in bringing products and services to market are the most critical competitive issues currently facing American business. Other

business challenges have been identified by a survey conducted by Dartmouth Research for AED Custom Training, which polled 220 senior executives in major U.S. firms. The business challenges cited the most often, in order are: quality, fewer market opportunities, higher costs of doing business, international competition, meeting market demands, business regulations, lengthy product development cycles, the need for innovation and new technologies, decreasing product life cycle, and low productivity (Fisher & Spillane, 1991).

In Canada:

Canada has enjoyed one of the world's highest standards of living for decades.

Nevertheless, prosperity can no longer be taken for granted. Since the mid-1970s, growth in real income has been steadily slowing (Cleghorn, 1991). Furthermore, growing global competition, coupled with the easing of protective tariffs, are spurring Canadian firms to participate more aggressively in the new world economy (Tausz, 1991). To prosper in the future, Canadian organizations will be required to meet world-class standards (Johnston & Daniel, 1991). The internationalization of business is both a challenge and an opportunity for Canada. Export trade makes up a quarter of Canadian GNP (Cleghorn, 1991). World trade was expected to grow from \$2 trillion in 1983 to a projected \$4 trillion in 1991. However, since 1985, Canada's share of world trade has declined from 5.1% to 3.8%, the sharpest decline of any G-7 nation (Cleghorn, 1991; Tausz, 1991).

Promoting quality products and services is becoming a national imperative for Canadian firms. A number of international studies have indicated that Canada's ranking in terms of quality of products and services is weak and getting weaker (I.S.T.C., 1992). According to the 1991 "World Competitiveness Report"¹, Canada ranked 5th overall, but with respect to quality of products, Canada's position fell to 11th place.

¹The 1991 "World Competitiveness Report" has been issued by a consortium consisting of the World Economic Forum and IMDI. The competitiveness of the national environments of 24 industrialized countries was compared.

According to Johnson (1990), Canadians are too narrowly focused on the domestic scene. The Canada-United States Free Trade Agreement has expanded the horizons of some Canadian companies, especially in terms of the United States. Recent events in the world such as the lowering of barriers between Eastern and Western Europe will also challenge Canadians to become even more outwardly oriented. International competitiveness has increased Canadian awareness of the need for quality. In order to be more competitive, the process of change within organizations needs to be revitalized. The business environment of the 1970's is no longer valid. Ross (1990) suggests the two major forces driving the transformation of corporations are: technology and the marketplace. The Canadian business community is filled with terms such as world-class technology, greater productivity, innovation, a highly skilled work force, research and development. There is one word that ties all of these elements together: *quality* (Rogers, 1991). The recession of 1982 (case of AMP of Canada, certificates of merit in the quality category of Canada Awards for Business Excellence, 1989) and the move towards a new reality, including increased customer expectations, slower business, reduced profits, tougher competition, changes in technology, and globalization of trade, has lead companies to embark on the TQM journey (Whittaker, 1991). Cleghorn (1991) postulates that, without an increased awareness of the need for quality enhancement, the Canadian standard of living and success in the marketplace will be jeopardized.

1.1.2- Quality as a Crucial Competitive Asset

1.1.2.1- Defining Quality

A broad definition of quality would be providing customers with products and services that consistently meet their needs and expectations (Loewe, 1989) but a number of other definitions, some of which are ambiguous, exist for the word quality. Garvin (1984), in an attempt to overcome some of the ambiguity and misunderstanding, has categorized five

definitions of quality: transcendent, product-based, user-based, manufacturing-based and value-based definitions (see Appendix 2). In 1987, he also defined eight dimensions of quality, i.e. performance, features, reliability, conformance, durability, serviceability, aesthetics and perceived quality (see Appendix 3). Recently, new definitions have emerged, tailored for each company that pursues Total Quality Management, so that everyone in the organization has a clear understanding (see Appendix 4). For instance, at Xerox Canada Ltd., quality means: "providing our external and internal customers with innovative products and services that fully satisfy their requirements". There are three important dimensions to this definition of quality:

- companies have both external and internal customers;
- companies provide both products and services which together determine the end user's perception of their company; and
- the primary focus is on satisfying the customer's requirements.

The question then is which, if any, of these definitions is more important or more representative than the other. The answer is that all of them are valuable, necessary, and useful to strengthen the competitive position of the firm (Noori, 1990). Moreover, these definitions underline that quality is truly a composite concept.

Finally, according to a survey conducted by Farquhar & Johnston, 1990, on the six Quality finalists of the 1989 Canada Awards for Business Excellence, some of the critical aspects of the definition of quality are the following: quality is defined by the customer and not by the supplier (82% of the definitions), quality is important in both the product and in the way the product is delivered and maintained – the service (58%), and surprisingly competitive success comes not from simply satisfying or meeting customer requirements, but rather from exceeding them (21%), in other words *delighting them*.

1.1.2.2- Quality as a Strategic Weapon

Through defining quality and the general economic trends related to the quality issue, it has emerged that firms have to focus their strategies more and more on quality. In the days following WWII, quantity was a logical focus for management. This gave logical sustenance to the philosophy of "Quality equals inspection". By the late 1950s, competition in price reigned supreme, and the ultimate corporate objective was no longer just "more at whatever cost", but swiftly became "more at less cost". Currently, the concept that quality equals inspection, and applies only to manufacturing, is no longer sufficient to satisfy the consumer at the lowest cost (Mc Bryde, 1986). Customers not only expect quantity and variety of products and services, they also look for the best quality at the lowest price. For example, Japanese firms understood a long time ago that quality is a powerful weapon to compete and as a result, enhanced their position in the foreign marketplace, especially in North America.

According to Garvin (1987) quality is not only a strategic weapon for competing in the current marketplace, but it also means pleasing consumers, not just protecting them from annoyances. Therefore, a company's specific advantage is to identify, then compete on one or more of the eight dimensions of quality, i.e. performance, features... (see Appendix 3).

Another source of competitive advantage based on customer needs is support activities primary activities account for only a portion of the total delivered values to the customer. A very effective support activity is to pay attention, in a systematic way, to customer complaints (Loewe, 1989).

Quality is of the essence: Noori (1990) stresses that competitiveness cannot be achieved but through quality. The needs for quality are fourfold: cost, competitive advantage, reputation and "staying alive" (Mc Bryde, 1986). Roches (1988) stated that a consequence of bad quality, or non quality, appears in the difference between being profitable and operating at a loss. Moreover, companies with ingrained reputations for

quality which operate at the lowest possible cost are destined for success (Mc Bryde, 1986).

A survey conducted in 1981 reported that nearly 50% of U.S. consumers believed that the quality of American products has dropped during the previous five years, more recent surveys have found that a quarter of consumers are not at all confident that U.S. industry can be relied upon to deliver reliable products (Garvin, 1987). These results demonstrate that quality should be a focal point for U.S. companies if they want to survive. In this context, the quality concept can provide competitive advantages.

1.2- Total Quality Management

1.2.1- Brief History

The roots of the quality revolution are generally traced back to Walter Shewhart of Bell Laboratories, whose ideas launched a system-oriented line of thinking about quality. In the 1930's Shewhart published his ideas about how statistics could be used to study variation in systems and created the basis for Statistical Process Control (SPC). One of Shewhart's student was Dr. Edwards Deming, a statistician. During the war of 1939-45, SPC was considered so valuable that it was classified as secret. Deming taught SPC to thousands of American engineers. Nevertheless, after the war ended, the use of SPC—and management concern about quality—declined sharply in the USA. In a booming seller's market, quality became secondary to sheer volume. In 1950, with his work discarded by U.S. industry, Deming went to Japan, and was paid by the US, under the Marshall plan, to teach the Japanese about quality. The Deming Prize, established in 1951, became the Japan's premier award for industrial excellence. In 1960, Deming was presented with the second Order of the sacred treasure by the Prime Minister of Japan. Today he is still honoured by the Japanese as one of the main architects of their economic miracle (Hutton, 1992).

Thanks to Deming and other quality experts such as Juran and Crosby, quality management principles have been introduced to Japanese industry. Therefore, in contrast to the specialized approach traditionally used in the United States, a number of Japanese companies adopted an innovative, integrated approach to achieving quality. The Union of Japanese Scientists and Engineers (JUSE), a private organization formed by engineers and scholars, provided a forum for the widespread dissemination of statistical quality control techniques. It is this group that established the Deming Prize with the intention of raising the quality levels of Japanese industry. Many of the management techniques developed since then form the foundation of the TQM principles that are gaining popularity in the United States and Canada today (US-GAO). Some of the pioneering Japanese companies have used it for 20–25 years, compared with about 10 years among the leading western companies (Hutton, 1992).

Though many U.S. manufacturing companies found themselves challenged by Japanese competition in the mid to late 1970's, at this time, none of them really understood the management philosophy and methods being used and developed in Japan. It is astounding that while Deming was revered in Japan, he remained almost unknown in the West until 1981. It was not until CBS featured him in a documentary entitled "If Japan Can, Why Can't We?" that the 81 year-old was recognized in North America and able to resume his work in the U.S. (Hutton, 1992). In other words, it took the USA and Canada 40 years to apply this quality approach, despite the fact the basic techniques of quality control were invented in U.S.A..

1.2.2- Defining TQM

As mentioned above, a holistic approach to improve quality and productivity, as well as competitiveness in the international market place, is the management philosophy of TQM (Pfau, 1989). TQM is a philosophy, not a technique. It conveys the idea of continuous

improvement (like Kaizen²) and could be also called as CWQC³ (Company-Wide Quality Control) which conveys, more precisely, total involvement.

Two types of definition have been found depending on how the quality approach is viewed; the first is customer-oriented while the second is more organizationally oriented. Loewe's (1989) definition of TQM is "a process for continuous improvement to achieve full customer satisfaction". Pfau (1989) has two more definitions; one is: "an approach for continuously improving the quality of goods and services delivered through the participation of all levels and functions of the organization". A simple definition might be: "building quality in from the beginning and making quality everyone's concern and responsibility".

Recently, TQM has been defined as the integration of management attitudes, ideas, methods and beliefs into the organizational culture in a way designed to bring about a state of continuous improvement (Hermitage, 1992). Tom Peters adds some passion to this somewhat abstract and analytical definition in his declaration that

*"TQM means eating, sleeping and breathing quality. Management obsession and persistence at all levels are essential. But the passion must be matched by a detailed process. And, always, the customer must be present as the chief definer of what is important"*⁴

Therefore, once again, like "quality", several definitions of "Total Quality Management" can be found, particularly since it is still a relatively new approach of management in North America. Nevertheless, my personal definition which has been summarized in figure 1 below, is the following: TQM is a management philosophy focused on the satisfaction of three important entities of any business in order of importance: the

²Kaizen (Continuous improvement in Japanese): A Japanese concept rooted in the philosophy that quality is not a static goal but a continuous process dictating constant pursuit and achievement of perfection. According to A. Miller, 1992, continuous improvement efforts focus on improving quality, reducing cycle time, and providing increased customer satisfaction as the means for achieving the lowest overall business cost.

³CWQC is also another term expressing the TQM philosophy. It is a systematic approach for setting and meeting quality goals throughout the company (Juran, 1988).

⁴Peters, Tom. Thriving on Chaos. (New York: Alfred A. Knopf, 1997.)

customers, the employees and the shareholders⁵. The "Total" of TQM means that these entities are indissociable. These entities seek a high level of quality, "Quality" in terms of products and services (customers want to be delighted), working conditions (employees) and corporate performance (shareholders). In order to achieve these goals, a new "Management" philosophy has to take place, based upon the following principles, concepts and values (see Figure 1):

- Customer-Driven Quality,
- Strong Quality Leadership,
- Continuous Improvement,
- Fast Response, Design Quality and Prevention,
- Long range Outlook,
- Action based on Facts, Data, and Analysis or Management by Facts,
- Employee Participation and Total Involvement,
- Partnership Development and Integration of Efforts,
- Public Responsibility,
- Error-free Attitude.

Figure 1: The TQM Philosophy

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⁵For years, American organizations forgot about the customer or took the customer for granted. For such firms, the rule of thumb was maximize shareholder wealth subject to an acceptable level of customer satisfaction, i.e. the shareholders first and then the customers. The rule now emerging is maximize customer satisfaction subject to an acceptable level of shareholder return, because the only way to stay in business is to keep the customers satisfied (H.M. Armitage, 1992).

These principles (see definitions in Appendix 5), most of which are embodied in the seven criteria of the Malcolm Baldrige National Quality Award (MBNQA) (see Appendix 6), are deemed essential to instituting successful TQM systems (US-GAO, 1991). The application of TQM may be unique to each organization, but it appears that a consensus has been formed around the attributes that are common to all TQM organizations (Johnston & Daniel, 1990; MBNQA, 1992; US-GAO, 1991).

An interesting comparison between 10 TQM principles and the traditional approach taken by U.S. business has been performed by Stephen L. Yearout, national director of operations and quality management for Ernst & Young's management consulting group (T.E. Benson, 1991):

- 1) Define Quality vs "I know it when I see it."
- 2) Customer Orientation vs Internal Focus.
- 3) Work Process Focus vs End Product Focus.
- 4) Customer/Supplier Partnerships vs We and They.
- 5) Prevention vs Reaction.
- 6) Error-free Attitude vs " That's Good Enough."
- 7) Manage by Facts vs Management by Intuition.
- 8) Employee Participation vs Theory X.
- 9) Total involvement vs " Quality is Someone Else's Problem".
- 10) Continuous Improvement vs Target Orientation.

The literature review (Andersen Consulting, 1992; T.E. Benson, 1991; Johnston & Daniel, 1991; Malcolm Baldrige National Quality award, 1992), has produced four basic management principles that must co-exist to ensure TQM which are maximizing employee potential, integration of effort (or partnership development), continuous improvement and managing by facts. Based on these principles and the other core values of TQM, several different TQM models have been drawn by Anderson Consulting (1992), Johnston & Daniel (1991), and the Malcolm Baldrige Award. Nevertheless, they all intergrate these principles in addition to: customer satisfaction as a goal, leadership as the basis of TQM

and the driving force to its implementation, and the necessity of having feedback from the customers in order to continuously improve the processes.

In the case of Johnston & Daniel's model, it clearly summarizes that the customer is both at the beginning and the end of the process leading to satisfaction. Figure 2 illustrates that the current and future customer requirements are at the bottom of the TQM pyramid and satisfied customers (vision and values too) are on the top. The senior management is responsible for designing the integrated management system based on the TQM principles, monitors its performance, improves its operation, and makes the system come alive for all employees by their active involvement. Senior management's consistent actions, commitment, and involvement will be the driving forces, as they lead by example.

Figure 2: Johnston & Daniel's TQM Model

Source: The Conference Board of Canada, "Customer Satisfaction Through Quality", by C. G. Johnston & M.J. Daniel, 1991.

As far as the Baldrige Award framework (Figure 3 below) is concerned, it is based on the four following basic elements and its seven criteria (see Appendix 6).

Driver - Senior executive leadership creates the values, goals, and systems, and guides the sustained pursuit of quality and performance objectives.

System - System comprises of a set of well-defined and well-designed processes for meeting the company's quality and performance requirements.

Measures of progress - They provide a results-oriented basis for channeling actions to delivering ever-improving customer value and company performance.

Goal - The basic aim of the quality process is the delivery of ever-improving value to customers.

Figure 3: Baldrige Award Criteria Framework: A TQM Model

Source: "1992 Award Criteria", Malcolm Baldrige National Quality Award

There is a certain consistency between these two models (MBNQA and Johnston & Daniel). Three of the four MBNQA criteria (see "system" in Figure 3) embody the four principles exhibited in Johnston & Daniel's model, more precisely "management of process quality" integrates "continuous improvement", "human resource development and management" integrates "maximization of employee potential" as well as "integration of efforts", and "information and analysis" underlies "management by facts".

One may notice that none of these models takes into account profitability as a goal. However this may be because customer satisfaction should, in theory, lead to ever-improving corporate performance.

1.2.3- The Underlying Concepts and Techniques in TQM practices

There are two main underlying concepts closely related to TQM practices: Just-In-Time (JIT) and Total Quality Control⁶ (TQC). They are closely interrelated and have both direct and indirect effects on the overall quality and performance improvements of products, services, and processes within the organization. Some of the outcomes are fewer defects, a decrease in manufacturing costs, increased work productivity and improvement in product and service quality etc. (Johnson and Manoochechri, 1990; Gaither, 1990).

JIT and TQC have been two of the strongest weapons the Japanese have used to compete with North American firms. They then integrated these philosophies to the overall organization, which resulted in the TQM philosophy. Now, they are another step ahead with the time-based factory, which aims to reduce any cycle times within the organization.

The two main techniques behind the TQC concept are SPC (Statistical Process Control) and QFD (Quality Function Deployment). SPC's tools are also known as the

⁶A high quality level is basically achieved by TQC which means:

" integrating the quality development, quality maintenance, and quality-improved efforts of various groups in an organization so as to enable marketing, engineering, production, and service at the most economical levels which allow for full customer satisfaction (Feigenbaum, 1983)".

seven basic Ishikawa tools. These tools include the following: process sequence flow charts (PSFL), checklists, histograms, pareto charts, cause and effect diagrams (fishbone diagrams), scatter diagrams, control charts. These tools as well as the seven new Q.C. (quality control) tools are discussed and defined in the Appendix 7. QFD is a planning methodology for translating customer needs and expectations into appropriate company requirements (Band & Huot, 1990; IFS Conference, 1989).

Besides the TQC and JIT concepts, quality management may also be achieved through the use of formal Quality Assurance (QA). QA is the management technique used by an organization to ensure an acceptable level of quality product or service and provide the customer with document evidence that all procedures necessary to ensure quality have been carried out. It is a planned and systematic program encompassing the entire organization by assigning responsibility and operational procedures. Given its scope, it must be fully initiated and supported by senior management. There is a strong emphasis being placed on international QA standards, particularly the ISO (International Standards Organization) 9000 series (ISTC, 1992).

1.2.4- Benefits

Examples of benefits achieved from TQM by companies around the world (Jonhston & Daniel, 1991) are:

- Decreased inventory 23% in 2 years
- Order changes halved
- Delivery time reduced from 20 to 4.5 days
- Quality teams saved \$5.6 million over 4 years
- Customer claims frequency reduced by over 40%
- Customer service response time reduced by 44%
- Lost time from injuries reduced 46%
- Cost of quality reduced from 12% to 9%
- Operating profits increased 7.4 times
- 98% first pass yield

- On-time delivery increased from 75% to 99%
- Customer complaints reduced by 78%
- \$12 million saved in 1 year in suggestion system
- 91% of employees said proud to work for the company
- Positive responses on employee attitude survey increased from 76% to 83%

These results demonstrate that a customer-driven company provides not only customer satisfaction, but also prosperity for its employees and shareholders. In some cases, according to the US-GAO (1991), the company would not be in business today if it had not started its TQM initiatives.

1.2.5- Quality Beyond the Manufacturing Department

The quality journey usually starts at the manufacturing department level because this is 'usually where the most visible improvement is needed. Nevertheless, TQM practices must be top down, so that a cascading effect occurs. Practices must be widely used throughout all functions and levels of the organization in order to succeed.

Moreover, according to a US-GAO (1991) study, the diversity of observed companies showed that Total Quality Management is useful for both small companies (not more than 500 employees) as well as large (500 or more employees) and for companies that sell services as well as companies that produce and sell manufactured products. The recent book of Puri (1992) illustrates that the same seven steps are required to implement TQM either in service or manufacturing companies.

1.3- TQM Awareness and Degree of Implementation

In this Chapter, two of the four issues stated earlier are discussed:

- i) what is the degree of TQM awareness in Canadian companies, specifically, is Quality a common theme in Canadian business (Tausz, 1991) as it should be⁷ ? and,
- ii) to what extent is TQM understood and implemented in Canadian companies?

1.3.1- In Canada

Several facts indicate that Canada is a quality-conscious country. According to the Canadian Aerospace Industry Total Quality Survey Report 1991, TQM has received considerable attention in both the private and public sectors in Canada in recent years. Moreover, TQM awareness is high in the aerospace companies surveyed (94% of the respondents are familiar with TQM). Despite the fact that TQM's importance is well recognized (89% of the respondents agreed that TQM is critical to the long term competitiveness of their businesses), TQM implementation is limited (31%). However this figure is probably optimistic because, for companies where there is a formal TQM process, only 18% indicated that they have improvement activities in all business areas, in other words a real TQM program in place. Finally, the IQS⁸, a survey conducted in 1990, shows that only 7 to 15% of Canadian companies report that 3/4 or more of their employees are involved in quality-related teams and in regular meetings about quality. Only 19% of these companies always or almost always use process cycle-time analysis or process simplification. Compared to the U.S., Canadian companies place more importance on the use of technology in meeting customer expectations (31% found it of primary importance vs 22%), and on the integration of customer satisfaction measures in strategic planning (44% vs 37%).

⁷In Quality Month of October 1991 (Tausz, 1991), the pursuit of Quality is a common theme today in Canadian business and it's not just a passing phase.

⁸The International Quality Survey (IQS), a joint research effort launched by the American Quality function (based in New York) and Ernst & Young, Cleveland, in 1990 is the first known attempt to assess the level of quality practices across industries (automotive, banking, computer, and health care) and across national borders (USA, Japan, Canada, and Germany).

Other signs of quality-awareness found are indirect, such as the creation in 1989 of the Total Quality category in the Canada Awards for Business Excellence, the Canadian Quality Month, and the Institute of Quality Assessment (IQA). These initiatives raise awareness as well as provide tools and advice to companies that want to implement TQM. Both the Canadian Quality Award and the IQA provide TQM self-assessment questionnaires, which is the best road map for the quality journey. Moreover, the awards are among the most prestigious business honours in Canada, bringing to the winners national and international recognition, enhancing prestige, and imparting a definite marketing edge (Rogers, 1991).

The Total Quality Charter is an example of the Quebec government's interest in TQM. This charter was signed in September 1991 by Premier Bourassa and more than 2,000 companies from Quebec.

Finally, Industry Science and Technology Canada and the federal government have designed their quality strategy in 1992 as the following: enhancing national effort in support of TQM based upon a national campaign involving building strong partnerships among the relevant federal and provincial government departments and agencies as well as industry and professional associations (ISTC, 1992).

1.3.2- In USA

On August 20, 1987, the President of the United States of America signed Public Law 100-107, the Malcolm Baldrige National Quality Improvement Act. This law established the Malcolm Baldrige National Quality Award, named for a former secretary of Commerce, the late Malcolm Baldrige. This award has been designed to recognize companies that have successfully implemented total quality management systems (US-GAO, 1991). This award also served as a major catalyst in promoting quality

improvements throughout US companies⁹, although, after a decade or more of quality talk, only about one-quarter of American manufacturing firms have TQM programs (Moskal, 1991). In many ways, the Canadian Quality Award is similar, especially in terms of its procedure, criteria, and examiners. Nevertheless, the Baldrige provides more materials and support than does the Canadian equivalent which in turn is more prescriptive (Harvard Business Review, 1992; ISTC, Entry Guide, 1992).

The Baldrige Award had to support recently (January 1992) several criticisms. It is considered as being too static and unchanging, not prescriptive, too costly for the applicant, and no financial¹⁰ measures are included in the criteria. All these criticisms except the last one have been taken into account to redesign the 1992 award criteria.

1.3.3- In Other Countries around the World

The total quality movement is rapidly gaining ground (Rogers, 1991). Beyond the USA and Canada, EEC countries and Japan seem to be more advanced in TQM practices. Both the EEC and Japan used widespread application of modern statistical methods in the 1950s. Organizations such as the Japanese Union of Scientists and Engineers (JUSE) and the European Foundation for Quality and Productivity promote and support quality improvement in Europe and Japan. Japan is recognized for its Deming prize and Europe for designing and developing the quality assurance¹¹ ISO 9000/1/2/3 (T.E. Benson, 1991). Other specific initiatives are found in France, Germany and Britain (ISTC, 1992).

⁹Although approximately 40 companies applied for the Baldrige award in 1990, over 100,000 copies of the criteria were distributed: many companies use the criteria as a self-assessment tool for TQM (Garvin, 1991)

¹⁰In a competitive market, being customer-driven is without doubt a company's single most important requirement. But providing the best product or service for maximum customer satisfaction without considering profitability probably would seem perverse to most management accountants (Sharman, 1992). This is one of the major criticisms that recently the Baldrige Award had to support.

¹¹The International Organization of Standardization (ISO), based in Geneva, Switzerland, first approached the subject of quality in 1980. Ninety countries thus far have adopted the ISO 9000 standards which aim to unify quality standards worldwide. Technically a series of five standards, ISO 9000

CHAPTER 2- LITERATURE REVIEW

This section will deal with the company performance measures (2.1) and the cost-effectiveness of TQM practices (2.2). The literature review will lead to two research objectives which are the prime focus of this research.

2.1- Performance Measures

The need for new performance measures better suited to the TQM environment arose from an examination of the traditional performance measures. A specific performance measures classification based on the levels and objectives of the organization has been drawn.

2.1.1- Issues with Existing Performance Measures

The issues concerning the existing performance measures are directly related to one of the TQM principles (Section 1.2.2), i.e. the management by fact. Data collection and information analysis go hand in hand with performance measurement because these are the foundation of this principle. Measuring performance is also a key step in the continuous improvement process. It permits feedback on a process and direction for improvement if necessary (see PDCA cycle or the Deming wheel presented in Appendix 8). Moreover, one of the recommendations for successfully implementing TQM is new measurement and reporting systems (Section 1.4.2).

According to this problem statement, new performance measures need to be developed in order to fit the TQM philosophy. That means fewer financially based

establishes requirements with which a qualifying company's quality-management system must comply (Benson, 1991).

performance measures and more long-term and process-oriented measures. The existing performance measures are also result-oriented measures.

Short-term measures (R-measures or result-oriented measures according to the Kaizen philosophy, Masaaki, 1986) work against continuous improvement and the overall TQM philosophy. Therefore, according to the literature, to deemphasize the cost of operations, the short term and result-orientation of the current performance measures, new performance measures should be developed. These include *on time delivery rate, percentage of defects, customer satisfaction, number of improvements of the processes by month per employee, and responsiveness of the workers to change of processes* to name a few. In other words, the outputs shouldn't be evaluated in terms of costs, direct labor hours, quota on monthly shipment dollars, capacity utilization rates, or on control overtime/rework hours which are examples of traditional performance measures.

Considering TQM as a long-term investment means that companies should abandon accounting-based performance measures of operating performance for more timely, nonfinancial performance, and these criteria are designed and monitored by employee-managed teams (Armitage, 1992).

The customer orientation of TQM must also be considered. Measuring perceived quality and eliminating all activities that do not add value to the customer (ISTC, 1992 & Armitage, 1992) are also two important new initiatives.

2.1.2- Integration of Performance Measures and TQM

According to the literature, new performance measures should integrate the TQM principles (i.e. customer-driven, continuous improvement, feedback and communication reinforcement, long term orientation and so on) to include its holistic approach and cross-functional team orientation. These measures should be dynamic, proactive and flexible to process changes. They also should be considered as tools for self-benchmarking in the company. In turn, this should lead to continuous improvement and serve as a source

of further quality improvements. Moreover, according to Cross and Lynch (1992) setting and attaining a few key performance measures will help to ensure that all levels of the organization stay on track and pull together behind the corporate engine before the competition beats them to it. Driven by customers, aligned strategically, and integrated and instituted at the business unit, division and department level, measures signal daily priorities for keeping managers and employees on track. It is no wonder that performance measurement may be the single most powerful tool to ensure success of business strategies.

Performance measures may be distinguished at 4 levels:

- *Corporate level* (profitability, strategy-oriented)
- *Organization level* (day-to-day measurement, as a basis for continuous improvement)
- *Customer driven level* (external customers) where any activities, objectives and performance measures are predominantly based upon customer satisfaction.
- *Supplier-related level* where activities and performance measures are mainly related to suppliers.

Another way to classify performance measures is viewing them in two dimensions: long term (corporate level) and short-term (day-to-day management and source of continuous improvement). This classification reappears within the performance pyramid (Figure 4) of Cross & Lynch (1992). This concept embodies almost the same classification of the performance levels mentioned above. The performance pyramid contains objectives and measures that link a company's day-to-day operations to its vision.

Figure 4: the Performance Pyramid

Source: K.F. Cross & R.L. Lynch, "For Good Measure", CMA Magazine, p.21, April 1992

At the top of the pyramid is the company's vision. The second level, business units, is comprised of the company's key results, objectives and measures based on its market and financial performance. These two levels are embodied in the upper classification of the corporate level. The business operating system (BOS) in the middle of the pyramid bridges the gap between top-level, traditional indicators and new day-to-day operational measures. At the bottom of the performance pyramid are specific measures that managers and workers are able to control on a daily basis. These last two levels represent the organizational level of my classification. The left-hand side of the pyramid contains both the customer level (according to my classification) and the long-term orientation dimension, and the right-hand side embodies the short-term dimension of the performance measures as well as its supplier level.

Based upon the classification mentioned above, one may analyze the different performance measures currently used and the need for new performance measures at each of the first three levels mentioned above.

2.1.2.1- Corporate Level

Most business units define success into two ways: reaching short-term targets of cash flow and profitability; and achieving long-term goals of growth and market position. However, businesses must change their short-term emphasis on the financial measures. They must also change the ways in which they translate these objectives into day-to-day operations, creating a balance between them and market-based measures. Therefore, like Japanese managers, North Americans should place more weight on market measures such as current market share, ratio of new products (future market share) and less weight on return-on-investment (ROI) and share price increases (Cross & Lynch, 1992). Market measures might include absolute or relative market share, or market share compared to that of the largest competitor (Cross & Lynch, 1992). Nevertheless, ROI must still be taken into account in order to assess the impact of TQM practices on corporate performance. As such, quality costs are becoming an increasingly central factor in the determination of return on investment¹², which illustrates that a positive correlation may exist between TQM and profitability. TQM practices decrease quality costs and result in a profit improvement, making the quality system one of the most attractive return on investment opportunities available (Feigenbaum, 1983).

According to the US-GAO study (1991), one of the most important financial performance indicators is market share. Companies that build market share on the basis of improved product quality and value believe it is the route to increased profitability. In fact, the US-GAO study underlines that some of the Malcolm Baldrige winners have reversed their decline and are recovering lost market share. The other financial indicators used by TQM companies are sales per employee, return on assets¹³, and return on sales¹⁴.

¹²ROI considerations deal with the establishment of the amount- in dollars- and timing- in months or years- of the return expected on the investments made in particular programs and projects by companies and plants.

¹³Return on assets is the company earnings before interest and taxes divided by average gross assets.

¹⁴Return on sales is the company's earnings before interest and taxes divided by net sales.

Caution has to be exercised when using these measures because they could be easily biased. First, in order to correctly compare from one year to another, each profitability measure must be corrected for inflation. In addition, other moderating variables (external factors) need to be taken into account such as the general state of the economy (growth/year), supply and demand conditions (price policy, quality level, average growth/year etc.) within a particular industry; and, for exporters, the relative value of the home currency (Cdn \$) in foreign markets. For example, when operating in intensely competitive conditions, a profitability increase may not be the most important indicator of success; a reverse in profit decline is better because it indicates that lost market share is recovered. Therefore, in such a case, an appropriate performance measure could be "recovered lost market share".

2.1.2.2- Organizational Level

a) Business Operating Systems Level: The operating system links department performance with company strategy and performance by measuring not just the efficiency of single departments, but the effectiveness of the entire operating system. One department may serve several business operating systems (BOS). A fabrication shop making printed circuit boards, for instance, can serve BOSs for developing and testing prototypes for new circuits, and completing production orders. Each operating system objectives, and indicators of successful performance, may radically differ. However, understanding how the major operating systems work allows the company to install effective department measures, and encourages each department to link its performance with that of the organization (Cross & Lynch, 1992). In other words, new performance measures are process-oriented and no longer results- and/or department oriented. Moreover, each activity (BOS) which does not add value to the customer satisfaction

should be eliminated (see below). The main performance indicators of operating systems are customer satisfaction, flexibility, and productivity (see Figure 5 above) as follows:

- **Customer satisfaction** indicates how customer expectations are managed (Cross & Lynch, 1992). Both in the GAO study and the Aerospace survey¹⁵, customer satisfaction is the main performance indicator used by TQM companies: 84% of the aerospace industry respondents use customer satisfaction as the most common method to assess the quality of products and services.
- **Flexibility** lies at the heart of the performance pyramid, as it defines responsiveness of the operating system. Ample evidence suggests that many Japanese manufacturers have set flexibility as their number-one priority (Cross & Lynch, 1992).
- **Production** denotes how effectively resources (including time) are managed in order to achieve the customer satisfaction and flexibility objectives (Cross & Lynch, 1992). Most of the respondents (59%) surveyed in the aerospace survey regularly measured the impact of improvement activities on operational performance.

b) At the department and work center level, the four key performance measures are focused on quality, delivery, cycle time and waste (see pyramid above). These four indicators are closely interrelated: objectives of any department or function are to increase its quality and delivery, while reducing cycle time and waste. Performance measures are either internal (cycle time and waste) and invisible to the department's customer (the next department), or external (quality and delivery) and important to the operation's customer (Cross & Lynch, 1992). Both Cross & Lynch and the aerospace survey list **quality and delivery**¹⁶ as the two main measures of *customer satisfaction*. Furthermore, the GAO

¹⁵The 1991 ISTC survey on total quality in the Canadian aerospace industry permits the assessment of actual performance measurement used in this industry. Although these measurements could be industry specific, the assumption that TQM is applicable to any type of industry, or company should be extended to the measurements.

¹⁶75% of the respondents use quality reports as a method to assess the quality of products and services. Percentage on-time delivery is the main customer service indicators (73%) (ISTC, 1991).

study not only incorporated delivery and quality as customer satisfaction indicators, but included customer retention and complaints as well¹⁷. Also, according to Farquhar & Johnston (1990), customer feedback and customer complaints are the two top quality measures identified by 1989 Canadian Quality award winners. This also illustrates that success is not measured by sales revenue alone. A few years ago, net profit was the top quality measure. Moreover, inspection (72%) is still one of the more often used methods for assessing the quality of products and services (ISTC, 1991). Regarding quality as a performance measure, measuring its cost (24% of respondents of the aerospace survey used this measurement) is important (see Appendix 9). It permits companies to manage their internal cost and shed light on how well they are doing internally as well as externally. It is one of the operating indicators used by the GAO study.

The two performance measures of productivity, according to Cross & Lynch are **cycle time and waste**. In the case of the GAO study, the organization's operating indicators measure the quality and cost of their products and services. Such indicators are cycle time (definition in Appendix 10), product lead time or order processing time, the cost of quality and cost savings, reliability, timeliness of delivery, errors or defects, and inventory turnover¹⁸. (See definitions in Appendix 10). Productivity, as well as profitability, was measured by sales per employee. In the case of the aerospace study, in the area of product and process design, the most frequently used indicators of productivity and quality are manufacturing cost (66%), product development costs (61%), and development lead time (54%). In production, the most often used productivity indicators are labour efficiency (65%), manufacturing lead time (60%), and defect rate (57%).

¹⁷In the GAO study, 1991, the customer satisfaction was defined as overall satisfaction, fewer complaints, and high customer retention. Number of complaints is one of the two more often used customer service indicators (35%) in the aerospace industry (ISTC, 1991).

¹⁸As in the case of the corporate performance measurement, these performances could be industry specific. Therefore, any result should be adjusted for industry average. Inventory turnover is especially affected by the industry demand.

Despite all these measures, cycle time is really one of the key performance measurements. Managing by cycle time provides a process for slashing costs by eliminating and streamlining the linear flow of activities across the organization. Embodied in cycle time management is the goal of continuous cycle time reduction across the whole organization; from the receipt of the order, to the shipment of the finished product to the customer (Northey, 1991).

Flexibility, measured by cycle time and delivery, is a combination of internal and external effectiveness measures.

Finally, methods for assessing quality such as profitability (30%), cost of quality (24%), employee attitudes (29%) or volume of business (24%) are not widely used according to the aerospace survey (ISTC, 1991). In summary, the cost of quality and employee attitudes should be used more because these are indirect measures of products and services quality as well as quality of work life, i.e. customer and employee satisfaction, two of the three goals of TQM. Regarding the last measure, the GAO study assessed employee relations as one of the most important features in implementing a successful TQM system because it includes attaining a highly involved and motivated work force. The Baldrige Award winners used several key indicators to measure how quality led to improvement in employee job satisfaction, attitudes, and behavior. Areas included: employee satisfaction, attendance, turnover, safety and health (see Appendix 10), and number of suggestions made to improve quality and/or lower costs. The main external factor which may bias employee-related indicators is the specific industry average. Several internal factors may exist such as, for example, concern over merger activity in the industry or the growing use of teams, rather than individuals, which may decrease employee satisfaction or participation.

2.1.2.3- Customer Level

PIMS researchers cite a company's "relative perceived product or service quality" as the single most important factor affecting a business unit's long-term performance (Armitage, 1992). Papadopoulos and Heslop (1989) also agree that changes in relative perceived quality have been found to have a far more powerful effect on market share than reductions in price or advertising.

It should be noted that quality must always be assessed from the customer's, and not the supplier's perspective. Therefore, to begin, companies need to select and agree upon criteria, and measurements for each of those criteria, and standards of performance that will be an accurate determinant of customer satisfaction (Farquhar & Johnston, 1990)

Finally, it appears that certain customer-based measures should be used in a TQM company such as overall customer satisfaction, customer retention, number of complaints, and number of compliments (i.e. positive customer feedback) (US-GAO, 1991; ISTC, 1991). Other measures such as average time for complaint resolution and average lead time to respond to service calls are specifically used to evaluate the customer service quality (ISTC, 1991).

2.1.3- Importance of Benchmarking

Benchmarking is a useful approach for any company deciding which aspect of performance to emphasize, and for creating better performance measures. According to Cross & Lynch (1992), without benchmarks, companies often set arbitrary, static goals (for example 95% on-time delivery) or accept any improvement as sufficient progress. Therefore, benchmarking is a useful activity which helps companies set goals and objectives of quality and performance measures and rates of improvement. In other words, benchmarking is a strategic weapon used to stay on track and beat the competition, by establishing aggressive and ambitious goals. Nevertheless, a breakthrough improvement, or any improvement, does not end with installation, it requires day to day operation

Without appropriate measures to encourage meaningful continuous improvement in operations, initial successes will not last. This will be called the endless spiral. This is a perfect illustration of the PDCA cycle or Deming wheel (see Appendix 8).

2.1.4- Need for New Performance Measures and Systems/Methods

2.1.4.1- Process and Value-adding Oriented Measurements

One of the key performance measures concerns waste. At the local department level, waste includes activities and resources that add no value but are incurred while meeting the other performance objectives (Cross & Lynch, 1992). The impact of TQM in this respect is potentially enormous; not only are the costs of low quality eliminated, but productivity is significantly improved by eliminating all activities that do not add value to the customer (ISTC, 1992 & Armitage, 1992; Convey, 1991, Moir, 1988). Therefore, an important underlying issue is the elimination of non-value added activities to the customer satisfaction. The purpose of value-added management accounting is to provide relevant information for decision making (McNair & Carr, 1991). Moreover, tracking no-value added activities requires a process-oriented mind-set (Atkinson, 1990) and related new performance measures. This type of measurement is even more important than measuring the cost of non-quality which is time-consuming. By placing emphasis on eliminating non-value-adding activities, the outcome is indirectly a reduction of the cost of quality, hence eliminating the roots of the costs.

According to Farquhar and Johnston (1990), quality winners of the 1989 Canada Awards for Business Excellence are providing a variety of tools to support them in improving their processes in all departments of their organizations. Employees, hesitant at first with new measurement and evaluation mechanisms, are now becoming the greatest measurement champions. For instance, the Xerox company has found that measuring the quality of the process gets people's attention, highlights success as well failure, and at any time, indicates which aspects of the process require improvement, be it manufacturing or

non-manufacturing. Moreover, internal measures of process quality (functional level quality measures) improve the organization-wide performance measures. For instance, the quality measurement of the recruitment process may identify causes of high turnover and, by refining the process, may reduce employee turnover. Nevertheless, measurements for evaluating the quality of the company and each of its individual but interrelated processes must have the following characteristics: to be valid, accurate, agreed upon and understood by all involved.

2.1.4.2- New Accounting and Profitability Measurement

The conventional approach was influenced by standard cost thinking. Its strategy was to ignore overhead costs because they were essential to running the manufacturing process and to concentrate on reducing direct material and labor costs. This traditional approach has a significant drawback: to keep the allocated costs down, managers were often forced to use cheaper labor. While this helped the profitability figures, it led to lower quality work and client dissatisfaction (Chaffman & Talbott, 1991). Moreover, this traditional approach is no longer valid. Finance can add substantially more value to the business by producing correct information, developed with insight, that can be used proactively (Sharman, 1990). Managerial accountants can play a crucial part by understanding the management by cycle time approach and emphasizing it as a company wide perspective. They can also help their manufacturing colleagues in developing a compatible cost model. For example, the Activity-Based Costing (ABC) systems are very compatible with such an approach. And, if ABC is developed into a model, it may be used to anticipate the impact of cycle time reduction on profits (Northey, 1991).

According to Beheiry (1991), ABC is a new accounting system which is better suited to the measurement of the cost of quality. In brief, ABC traces which activity absorbs which costs. It also provides information for continuous improvement and sets targets for waste elimination (Atkinson, 1990). Therefore, it makes this new tool

well-suited to the process-oriented approach and the elimination of non-value added activity by identifying, for each cost-of-quality area, the factors that are "driving" the cost of quality, i.e. its roots (Koehler, 1992).

Another major innovation that managerial accounting helped to achieve is the measurement and monitoring of profitability for each sales representative. A weekly activity and production report helps employees benchmark themselves, helps them to be more productive and highlights areas that need improvement. An indirect outcome is also the reduction of agent turnover because agents are more fairly rewarded thanks to more efficient data (Lee & Engelhard, 1992). Profitability may also be a powerful method to guide and motivate operators' quality and productivity efforts. A daily financial report may illustrate process improvements that may generate the highest returns (Harvard Business Review, 1991).

On the other hand, companies abandon accounting-based measures of operating performance for more timely, nonfinancial performance criteria which are designed and monitored by employee-managed teams (Armitage, 1992). For example, time analysis measures the amount of time employees spend on each activity. A typical study would find that only 20% of employees activities consume 80% of their total time (Sharman, 1992; Koehler, 1992).

2.1.4.3- Summary

Below we summarize what has been discussed above as well as integrate a new set of ideas not mentioned yet. Also we propose five research questions.

Weaknesses in traditional approaches to performance measurement include:

- They tend to be based on outdated company strategies;
- They are often not linked to the company's objectives;
- They tend to be inflexible and become invalid when sales or volume vary significantly;

- Financial performance measures overshadow operational performance measures,
- Traditional approaches tend to emphasize short-term results;
- Some performance measures encourage sub-optimal activities,
- Traditional approaches tend to ignore non-value-added activity costs.

The new generation of performance measurement systems, consistent with the continuous improvement philosophy of TQM, should have the following characteristics:

- The measurement system is driven from the top down to ensure that performance measures are consistent with the company's objectives and translate the company's critical success factors in both financial and non-financial terms;
- The system classifies activities as value-added and non-value-added, then focuses on integrating performance measures to encourage elimination of non-value-added activities,
- The system is flexible regarding activity levels of the organization;
- The system ensures that operational performance measures are reported with a full description of their significance to the organization;
- The system promotes a sense of ownership of continuous improvement among cost managers (Convey, 1991).

Research questions

All these issues and comments suggest that new measurement and reporting systems, not predominantly based on financial data are needed in order to more adequately measure TQM related performance. Moreover, Pfau (1989) and Puri (1992) stated that specific performance measures have to be designed in the TQM implementation process. Puri (1992) also specified that the fourth step among the 7-step TQM implementation requires the development of a measurement system to assess performance.

Therefore, the following research questions arise:

- 1) What are the characteristics of performance measures and systems/methods perceived most appropriate in a TQM environment?
- 2) To what extent are the traditional and TQM-related performance measures and systems/methods used by TQM adopters?
- 3) To what extent are the traditional and TQM-related performance measures and systems/methods perceived appropriate for assessing the impact of TQM on company performance?
- 4) How frequently are performance measures/systems reviewed and improved by TQM adopters?
- 5) What are the mechanisms used to design new performance measures/systems by TQM adopters?

2.2- The Cost-effectiveness of TQM

This subchapter is focused on showing that improving the quality of products/services, activities and processes is cost-effective and giving evidence of positive relationships between TQM practices and corporate performance.

2.2.1- The cost of Non-quality

To get things moving, top management must determine the cost of non-quality within the existing operation. Surprisingly, this cost usually runs between 10 and 40% of the sales dollar. Small part of that will fund an enormous quality improvement effort (i.e. the 20-80 Pareto rule) the rate of return on the investment running typically 10 to 1 or more (McBryde, 1986). An example of 200 % net profit increase which is achieved by elimination of waste (people's time, materials, capital not spent on activities that add value to the products or services required by the customer) equaling 20 % of sales (Loewe, 1989).

A common misconception on the part of management is that higher quality is accompanied by higher costs. Exactly the opposite is true however in a manufacturing operation. According to Oakland (1989) and as illustrated in the graphic below, quality leads to higher profits.

Figure 5: Relationship Between Direct Costs of Quality and Organizational Capability

Source: John S. Oakland, "Total Quality Management", p.53, Heinemann Professional Publishing, 1989.

This is proven by the relationship between the direct costs of quality and organizational capability. As ability is improved by modest investment in prevention and possibly appraisal, the failure costs drop, initially very steeply (see Appendix 7 for definitions of appraisal, prevention, and failure costs). Total quality related costs are thereby dropping as well.

Eliminating 10 to 40 % of the hidden root cause of non-quality increases profits, reduces costs and frees additional productive capacity (Mc Bryde, 1986). In Japan, TQM programs include continuous reductions of cost as a key objective. Teradyne's customers in Japan demand price reductions every year, which they call their CD-10 program, or Cost Down 10%. They want the learning curve to be reflected in price annually (Harvard Business Review, 1992, p. 147). The financial cost of producing non-quality products in manufacturing and process industries is generally recognized to be approximately 15-20% of revenues (Crosby, 1980). In the service sector, this cost may be even higher. These

costs include potential and, most importantly, lost business. The Quebec government has estimated that non-quality costs the Quebec economy \$24 billion annually (Tremblay, 1991). Using the same factor of 15% cost of non-quality against Canada's 1990 GDP of \$650 billions and the cost to Canada is a staggering \$100 billions per year.

A specific concern cannot be avoided any longer. The quality movement may be too costly, in two particular cases: small companies and the Baldrige Award applicants. How many businesses can afford to put 14,000 manhours into preparing an application and readying employees for a site visit or spend \$800,000 to win the award as Xerox did? In the case of Xerox, the amount invested in the Baldrige award process has already paid for itself many times over in improved quality and reduced costs (Harvard Business Review, 1992). Nevertheless, the first tangible results are generally achieved within 12-18 months of starting, and these may be quite dramatic. Moreover, most organizations seem to require at least three years to establish a solid competency in the basics, starting from the time when an informed commitment is made by senior management and a formal initiative launched (Hutton, 1992).

To conclude, even if the cost-effectiveness of TQM can be proven, a crucial question related to the long-term investment nature of the quality movement is revealed during the slow growth decade of the 1990's, as downsizing, right-sizing, and deleveraging become necessary for corporate survival, how many boards of directors are going to be patient enough to make that long term investment? (Harvard Business Review, 1992).

2.2.2- Impact of TQM Practices on Company Performance

Quality Month 1991 promoted the idea that better quality and better service lead to higher profits and improved lifestyles for Canadians. According to David A. Garvin (1992), superior quality leads to superior performance in the marketplace. More precisely, his own view is that the linkage is strong but exceedingly difficult to measure in practice. The link

between quality improvement and financial performance must be measured over a suitably long time horizon (at least 5 years) because quality is an investment. In short, there now appears to be considerable evidence that TQM is positively and highly correlated with superior operating and financial performance (Armitage, 1992). Also, the US-GAO (1991) concluded that there was a cause-and-effect relationship between the total quality management practices embodied in the Baldrige criteria and corporate performance, measured by employee relations, productivity, customer satisfaction, or profitability. Nevertheless, the study was not performed scientifically using statistical methods, and the 20 participating companies did not answer all questions. The average response was only 9 companies per question.

According to the US-GAO study (1991), four positive results have been found:

- **Better employee relations:** employees experienced more job satisfaction, there was a higher rate of attendance, and there was less turnover, absenteeism and fewer accidents. The number of employee suggestions relating to quality rose by 16.7%
- **Improved operating procedures:** companies increased the reliability (improved by an annual average of 11.3%) and on-time delivery of their products or services and reduced errors (3%), product lead time, and cost of quality.
- **Greater customer satisfaction (averaged + 2.5% annually):** there were fewer customer complaints (declined 11.6%), and a greater number of customers remained loyal to the company
- **Increased financial performance:** each company also improved its market share (An annual improvement of 13.7%) and increased profitability (yearly gains averaged 8.6% in sales per employee; 1.3% in return on assets; and 0.4% in return on sales) (US-GAO, 1991; Williams, 1991; Miller, 1991). A 1988 PIMS study concludes that firms that improved quality increased their market share five or six times faster than those whose products declined in quality; their increase was three times faster than that of companies whose quality was comparable to the firms before TQM was implemented (Shetty, 1988).

Based on the US-GAO findings and the overall understanding of TQM gained from the background and the literature review, the following model was developed:

*TQM increased productivity --> decreased Costs --> competitive advantage
increased profits --> possibility to decrease prices --> a new competitive advantage
final results = increased sales and market shares.*

This model is supported by the Deming approach to Quality. According to Deming, good quality means a predictable degree of uniformity and dependability at low cost, with the quality suited to the market (Puri, 1992). This emphasis is portrayed in Deming's famous chain reaction, given as follows:

*Improve quality ---> improve productivity ---> decrease costs ---> lower prices
capture markets ---> stay in business ---> provide jobs ---> return on investment.*

Therefore, the Deming's chain underlies that TQM has a positive impact on corporate performance. The above discussion leads to three more research questions. They are as follows:

Research Questions:

- 1) Are there tangible improvements in company performance due to TQM adoption?
- 2) Are these improvements more of a financial performance, operating performance, employee relations or customer satisfaction nature?
- 3) How long does it take for a company to realize these tangible benefits?

2.3- Total Quality Management Model: a Model Derived from the Literature Review

This model is based upon the U.S. GAO study. The different principles of TQM come mainly from the Malcolm Baldrige National Quality Award. Therefore, a model (figure 6) was developed to provide a general framework for examining the impact of TQM practices in diverse organizations.

Figure 6: Impact of TQM Practices on Corporate Performance

Source: US GAO, 'Management Practices, U.S. Companies Improve Performance Through Quality Efforts', May 1991.

This model embodies the four key measurable areas of a company's operations that may demonstrate the impact of TQM practices on corporate performance: employee relations, operating procedures, customer satisfaction, and financial performance. This model has been used as a background to the research model used in this study and described in Chapter 3.

CHAPTER 3- THE CANADIAN STUDY

3.0- Introduction

Based on the literature review and the analysis of the issues stated by different TQM-oriented people (consultants, managers of companies, managers of I S T C), several research questions came about. A research model has been conceptualized around the problem statement. A population has been chosen to respond to the research questions. The data analysis consists mainly of qualitative results because of the small size population and the depth of research available in Canada.

3.1- Research Questions and Objectives

This study has two objectives. The first objective is to understand and measure the impact of TQM on company performance. In order to achieve the above objective, the research will be focussed to answer the following questions:

- 1) Are there tangible improvements in company performance since TQM adoption ?
- 2) Are these improvements more of a financial performance, operating performance, employee relations or customer satisfaction nature ?
- 3) How long does it take for a company to realize these tangible benefits ?

The second objective is to understand and identify the new performance measures and systems needed for measuring the impact of TQM. In order to achieve this objective, the research will be focussed to answer the following questions:

- 1) What are the characteristics of performance measures and systems/methods perceived most appropriate in a TQM environment ?
- 2) To what extent are the traditional and TQM-related performance measures and systems/methods used by TQM adopters ?

- 3) To what extent are these traditional and TQM-related performance measures and systems/methods perceived appropriate for assessing the impact of TQM on company performance
- 4) How frequently are these performance measures/systems reviewed and improved by TQM adopters ?
- 5) What are the mechanisms used to design new performance measures systems by TQM adopters ?

3.2- Research Model

Figure 7 is an illustration of the model that will be used in this study. It is based on the literature and the specific model from the US-GAO study (recall Figure 6). The core of this model is based on the following assumption: according to Armitage (1992) and the US-GAO study (1991): TQM is positively and highly correlated with superior operating and financial performance. Nevertheless, the impact of TQM practices (Block 1) on company performance (Block 2) still needs to be statistically proven, particularly in the case of Canadian companies. Moreover, such impact can be affected by time (number of years after TQM adoption), the economic and the industry characteristics (Block 3). TQM demands appropriate performance measures and systems (Block 4) in order to adequately assess the impact of TQM and effectively implement successfully TQM principles. This has been shown as Block 4 in the model. Various blocks of the model are described below

Figure 7: The Research Model

Block 1- Extent of TQM practices : the practices considered here are the ones found in the Malcom Baldrige National Quality Award criteria (1991), i.e. leadership, information and analysis, strategic quality planning, human resource utilization, quality assurance and products and services, quality results, and customer satisfaction.

Block 2- Overall "company performance" : customer satisfaction, employee relations and market share are valuable indicators to assess the overall company performance. According to the "performance pyramid" (see Section 2.1.2).

Block 3- The moderating variables : affect both financial and operating performances. Some variables, however, only impact the financial performance of the company. The moderating variables which may affect the relationship between TQM and the company performance, are the following :

- **Time :** The link must be measured over a suitable time horizon because TQM is an investment (Garvin, 1992).

- **Economy :** The three important economic factors which may affect the relationship between the Blocks 1 and 2 are :
 - * inflation : in order to be comparable among years, any actual reported dollar values (sales, profits, etc) should be adjusted for inflation.
 - * general state of the company
 - * exchange rate

- **Supply and demand conditions within an industry.:**

Ordinarily, these moderating variables must be taken into account in a TQM study. Nevertheless, due to time and financial constraints, only the time element, one of the main moderating variables will be looked at, in this study.

Block 4- New performance measures and systems : As mention earlier, the nature of TQM implies the creation of new systems and measures to better assess its impact on company performance.

3.3- Methodology

3.3.1-Research Design

The study is exploratory since there is little literature available on this topic, especially regarding the second research question. Therefore, the type of research design chosen is an *ExPost Facto* design because we don't know enough about the independent variables to be able to manipulate them. Nevertheless, the literature search facilitated the design of a questionnaire. Therefore, the primary goal of the study is not only descriptive, but also predictive to a certain extent.

3.3.1.1-Data collection

A cover letter explaining the purpose of the study and the probable date for interview was mailed to individuals on the list provided by I.S.T.C.. A phone call confirmed that the visit would be possible.

Pretest

An important step was the **pretest** of the instrument and the evaluation of the **measurement scale**. This pretest permitted assesment of the accuracy and reliability of both the instrument and measurement scale even if no statistical test has been done to prove it. Before the pretest, a TQM manager from ISTC and a Quality Management consultant were interviewed. Remarks from the two previous interviews were integrated into the questionnaire. Two non-finalists were choosen for the pretest. Minor changes to the questionnaire (Appendix 12) were made as a result.

Survey Instrument (Appendix 12)

The data was collected either through in-depth personal interviews or by mail/phone using the questionnaire. The questionnaire was divided into two parts related to the 2 objectives of the study, i.e the impact of TQM practices on company perfomance and identifying new perfomance measures more appropriate for assessing this impact.

The first part contained qualitative questions that were composed of four performance measures areas : employee relations, operating procedures, customer satisfaction, and financial performance.

The second part of the instrument was divided into three sections .

- perceived characteristics of the performance measures and systems/methods which are most appropriate for assessing the impact of TQM (Q 6-7-8),
 - the extent of use and appropriateness of the traditional, current and TQM related performance measures systems (Q.9) and methods (Q 11) in a TQM environment
- New performance measures were identified through parts of Q 11 and Q.12

- The mechanisms (Q.14-15) and the update frequency of performance measures/ systems (Q.13)

The length, completeness, ease of use, relevance of questions, and adequacy of questions were ranked on a 5-point scale ranging from 1 = poor to 5 = excellent.

Table 1- Average Rating of Questionnaire Quality

Length	Completeness	Ease of use	Relevance of questions	Adequacy of questions	Clarity of questions	Overall quality
3.47	4.00**	3.47*	3.85**	4.00**	3.40	3.73**

t-test with * $\alpha = 0.05$ or ** $\alpha = 0.01$

H₀: no differences between the mid-point of the scale (3) and the mean rating.

Thanks to the quality assessment of the questionnaire, it is proven that the overall quality is good, due to its completeness, its ease of use, and the relevance and adequacy of questions. However, it should be noted that future questionnaires on this topic should be shorter and questions should be clearer. The interviewees that expressed more clarity of the questions had a mail-questionnaire. Nevertheless, the clarity is judged acceptable and not expected to have an impact on the relevance of the data or the findings.

3.3.1.2-Population and Sample

Population and sampling are considered at two levels: organizational and individual. All companies were finalists (winners and certificates of merit) in the "Total Quality" category of Canada Award Business for Excellence. These firms are already at an advanced stage of TQM adoption. There are only 17 firms who have been recognized¹⁹ since 1989. Individuals are a sub population of the organizational population. They include personnel who are part of TQM implementation in the companies selected.

¹⁹ The "Total Quality" category was created as part of the Canada Awards in 1988

ORGANIZATIONAL :

Population

- Element:** Finalists in the Total Quality category of Canada Awards for Business Excellence (19). TQM practices must have been implemented for at least 5 years.
- Sampling unit:** Same as above.
- Extent:** Canada
- Collection period:** Winter 1992/1993

Sampling

A list (sampling frame) of the 19 firms is provided by I.S.T.C. (see Appendix 11) Fifteen of them were randomly selected (a probability design as a sample design). As a rule of thumb, the eight selected companies within the Toronto Montreal region were interviewed in person, and the others (seven) were surveyed by mail-questionnaire.

INDIVIDUAL :

Population

- Element:** Any senior officials and managers familiar with the company's TQM program.
- Sample unit:** In all firms in the organizational sample
- Extent:** Within the firm.
- Collection period:** Winter 1992/1993

Sampling

A list of CEOs and the contact name listed for the Canada Awards including phone numbers and addresses had been obtained from I S T C (Appendix 11) One manager/senior executive was surveyed in each firm

The CHARACTERISTICS OF THE SAMPLE are as follow:

Despite the small sample size (14), it is highly representative of the population studied (19) and reflects a very high response rate of 93.5 % (14 out 15).

Types of companies:

Manufacturing companies were predominant: 12 out of the 14 companies that responded were in this sector. They include raw material industries, chemical industries, parts & engines industries, automotive industries and high-tech industries. The remainder of the sample consists of companies in the service sector.

Country of ownership:

The companies interviewed are predominantly American-owned (69.2%). Consequently, two thirds of companies have less than 50% domestic sales turnover. According to ISTC (1991), companies with a majority of their sales in foreign markets are more likely to practice TQM principle in a number of the key areas than companies who serve primarily the domestic market.

Table 2 - Percentage of Company's Domestic Total Sales

% of domestic sales	0-25%	26-50%	51-75%	76-100%
Frequency (n=12)	33.3% (n=4)	33.3% (n=4)	7.7% (n=1)	23.1% (n=3)

Eight out of thirteen companies offered information on their annual sales. The average annual sales for the responding sample was \$ Cdn 519 million, with a minimum of \$ Cdn 16 and a maximum of \$ Cdn 1,800 million.

Total number of employees was used as a second measure of size. The average workforce was 2,047 employees with a minimum of 150 and a maximum of 7,000 employees. According to ISTC (1991), having large companies increase the likelihood that

- first, they are more familiar with TQM than the small ones (which is the case for the sample), and
- second, they tend to believe more strongly that TQM can generate significant benefits and that these benefits will more than outweigh implementation costs

3.3.2-Fieldwork plan

Although the data was collected through a personal interview, a mailing was sent two weeks prior to the expected interview date. This mailing included a cover letter explaining the purpose of the study ; confidentiality was assured as well as the possibility of getting valuable conclusions and recommendations used as a benchmark.

The second step was to make a phone call a few days later to get the appointment of the interviewees (CEO or a manager in charge of the quality program). If they rejected the interview, another company was randomly selected among the residual population (i.e. non-selected). These predispositions increased the response rate as well as the quality of the data gathered. Moreover, a company tour was requested showing my interest in TQM and the company interviewed.

The interview usually lasted at least one hour. Half a day was allocated for both the interview and the expected company tour at each firm.

Finally, a letter of thanks was sent after each interview. A brief report of the main conclusions and recommendations will be sent as well

3.3.3-Data Analysis

Basically, descriptive statistical techniques such as mean and standard deviation and relative/absolute frequencies by category are used. According to the number of observations (14 companies) and the type of scales (mainly ordinal), non-parametric statistics are applied.

Coefficient of variations are reported for each variable to confirm the reliability of the measure. As a rule of thumb, the coefficient should be less than 0.3 to confirm the existence of a true mean among the sample.

Cronbach's-alpha were calculated for each set of criteria used for measuring the impact of TQM on the company performance, for example between the four criteria related to customer satisfaction. As an internal consistency technique, this method assesses the homogeneity of a set of items. The basic rationale of such a technique rests on the fact that items in a scale should behave similarly. Cronbach's-alpha, in essence, computes the mean reliability coefficient estimates for all possible ways of splitting a set of items in half. One limitation in the use of Cronbach's-alpha is its assumption that the items in the scale are at least interval in nature.

t-statistic tests are made to determine the extent of change experienced by companies resulting from TQM adoption. The null hypothesis is:

H₀: no differences between the mid-point of the scale (3) and the mean rating.

CHAPTER 4- IMPACT OF TQM ON COMPANY PERFORMANCE

Before analyzing any data, one should note the importance and the relevance of TQM in developed countries such as Canada. Twelve out of the fourteen companies interviewed did assess the competitive environment. Eleven out of twelve (91.7%) perceived the environment as competitive to extremely competitive, only one found it neutral

This is consistent with the latest findings of I.S.C. (1993) on the subject "successful businesses are increasingly recognizing quality management (QM) as a key element of their competitiveness in 1990's."

4.1- Introduction:

Several studies (US-GAO, 1991; I.S.T.C., 1991) reported that TQM has a positive impact on company performance. The aim of this chapter is to measure the impact of TQM on company performance in four domains: employee relations, productivity, customer satisfaction and profitability, by recognized TQM adopters such as CAGE winners

By using the same criteria as the US-GAO study, comparisons between the US and the Canadian studies are made. This thesis research gives us a better understanding of which of the four domains has better improved.

Before reporting the findings of this study, it is necessary to have a clear picture of the time frame of the TQM implementation. For example, the prerequisites for a company to be eligible for such a study that is has to be a finalist or a winner of CAGE. It implies that the firm has been involved in a quality program for at least 3 years

Time Frame Before First Positive Outcomes After TQM Adoption

TQM is not a simple process. The time frame has been broken down into three steps: *first TQM initiatives* (INIT), *first quality improvement plan and policy* (POLI), *implementation of this plan and policy* (IMPL). As a result, *first outcomes* (OUT) should

follow. The average time span between each step has been calculated. The time to reach the step of the first quality improvement plan & policy is defined as **POLIT**; **IMPLT** is the time between plan and policy and their implementation. **FOUTT** is the time between the implementation of plan and policy and the first outcomes. Finally, the total time (**TOTALT**) measures the duration between first initiatives and first outcomes.

Figure 8- TQM adoption: Three Basic Steps (average time)

Table 3- Time Frame of TQM Adoption

Time span between TQM's adoption stages	Average Time (months)	Standard Deviation	Coefficient of variation	Minimum	Maximum
POLIT (INIT-POLI)	10.5	11.28	1.07	0	37
IMPLT (POLI-IMPL)	7.9	9.57	1.21	0	25
FOUTT (IMPL-FOUT)	14.9	12.60	0.85	3	48
TOTALT (INIT-FOUT)	33.3	26.83	0.81	6	96

On average, companies waited 33.3 months, before noticing the *first outcomes after TQM adoption* (**TOTALT**), with a minimum of 6 months to a maximum of 96 months or 8 years. This finding is consistent with the literature which states that first outcomes do not show up before 1 to 3 years after the first TQM initiatives (Hutton, 1992)

The *first quality improvement policy and plan* took place after a maximum of 37 months in the companies surveyed. On average, the time span was 10.5 months after the first TQM initiatives. These *policies and plans were implemented* within a maximum of 25 months (average time = 7.9 months) which resulted in positive outcomes after a maximum of 48 months (average time = 14.9 months). In other words, companies started to be involved in a quality program between 1978 to 1987 and saw their first positive outcomes between 1983 to 1991.

There is a high variability for the time span between TQM stages within each step especially the first two. The coefficient of variation is close to and even higher than 1 for each variable. Two reasons can be thought of: internal differences may be a result of the different industries in the sample (Services, Manufacturing, High Technology industries), and the TQM adoption steps is based only on the literature and not at all on empirical researchs. Therefore a gap between the conceptualization of the researcher and the reality is possible.

Regarding the last point, one hypothesis can be drawn from the results: *"TQM adopters start the first two adoption-steps (INIT & POLI) simultaneously"*.

4.2- Analysis of Qualitative results

Several statistics have been used in this chapter. First, the means were ranked from the best to the worst (lowest to highest). Second, the standard deviation was used to calculate the coefficient of variation (std. dev / mean); it is usually around 0.30. In order to complete the descriptive statistics given by the mean, the percentage of respondents who felt that TQM helped (2) to helped very much (1) has been calculated and shown in each table. Finally, the Student t-test²⁰ was calculated, it shows if the mean is statistically different from the mid-point of the scale, i.e. if one indicator has really been improved as a

²⁰ t-test is calculated as follows:

$$t = |\text{mean} - \text{mid-point}| / s/\sqrt{n}$$

result of TQM. The scale used is as follow: (1) Helped very much to (6) Made worse. Since no responses of 6 were given, the scale is assumed to be understood as a 5-point scale and the mid-point used is 3.

Table 4- Overall Indicators

INDICATORS	RANKING BY MEAN	MEAN	Standard Deviation	Coef. of variation	Helped (2) to Helped very much (1) in %
Overall Customer Satisfaction	1	1.33**	.49	.37	100
Overall Employee Relations	2	1.62**	.51	.31	100
Overall Operating Procedures	3	2.08**	.51	.25	83.3
Overall Financial Performance	4	2.17*	.72	.33	66.7

Six-point scale used: 1=Helped very much to 6=Made worse

* $\alpha = 0.05$

** $\alpha = 0.01$

Respondents were asked to rate four TQM indicators, which are overall statements of a group of indicators. For example, in the case of indicators measuring customer satisfaction, the overall statement is : "To what extent implementing TQM helped your company improving overall customer satisfaction (CUSTSAT)". *Overall employee relations* (EMPL), *overall operating procedures* (OPER), and *overall financial performances* (FINANC) were measured as well.

In general terms, TQM helped improve the four overall indicators, especially customer satisfaction, employee relations and operation (t-test is significant at 0.01).

According to I.S.C. (1993), companies that used a balanced approach to quality by adopting practices from each of the four categories as being part of QM (leadership, employee involvement, process improvement, and customer focus) were more likely to experience productivity growth. Larger firms (>200 employees), which is the case for the respondents of this study, used a higher average number of practices than small and medium-sized enterprises. Industry sector also appeared to have an influence on the use of QM practices especially in the high-tech and high-tariff sectors²¹.

²¹ **High-tech sector** defined as, according to the I.S.C. (1993), companies in the following industry groups: Rubber products (15), Plastic Products (16), Machinery (31), Transportation Equipment (52), Electrical & Electronic Products (33), Chemicals & Chemical Products (37).

4.2.1- Better Employee Relations

Table 5- Employee-Related Indicators

INDICATORS	RANKING BY MEAN	MEAN	Standard deviation	Coef. of variation	Helped (2) to Helped very much (1) in %	Cronbach- α 0.7429
Participation	1	1.36**	0.50	.37	100	
Morale	2	1.71**	0.471	.28	100	
Absenteeism	3	2.67**	0.07	.03	50	
Accidents	4	2.70	0.95	.35	50	
Turnover	5	2.75	1.06	.39	42	
Overall Relations		1.62**	0.51	.31	100	

Six-point scale used: 1=Helped very much to 6=Made worse

** $\alpha = 0.01$

In general terms, *overall employee relations* (EMPL) were improved as a result of TQM. The mean response for TQM's impact on improvement of *overall employee relations* was 1.62. As shown in Table 2.1, the impact of TQM practices on employee relations has especially improved *employee participation* (PART) (1.36) as well as *employee morale* (MORAL)(1.71). In both cases, 100% of the respondents felt TQM helped to helped very much improving performances in these matters. Moreover, the t-test is highly significant (0.01). *Employee absenteeism* (ABS) can also be considered as being significantly improved thanks to TQM (t-test significant at 0.01) despite a mean fairly close to the neutral point (2.67). A *reduction in accident* (ACC) and *employee turnover* (TURN) were felt to have improved less as a result of TQM and these were not significant.

Findings showed that employee participation was the most affected indicator by TQM adoption. This is consistent with the US-GAO study (1991) which reported that employee suggestions, therefore participation, was the employee-related indicator which most illustrated the impact of TQM.

There was not much difference between the means of all the components of employee-relations. In fact, the Cronbach-alpha confirmed that the components of

and **High-tariff sector** includes Primary Textiles (18), Furniture & Fixtures (26), Textile Products (19) Clothing (24).

employee relations were all related ($\alpha=0.7429$). This confirms the homogeneity of the set of criteria used to measure employee relations. This also confirms that a reduction in absenteeism, employee turnover and accidents, and an improvement in employee participation and morale indeed measure overall employee relations.

4.2.2- Improved Operating Procedures

Table 6- Operating Indicators

VARIABLES	RANKING BY MEAN	MEAN	Standard deviation	Coef. of variation	Helped (2) to Helped very much (1) in %	Cronbach - α 0.7523 ²²
Prod & serv Quality	1	1.54**	.52	.34	100	
Errors / Defects	2	1.58**	.51	.32	100	
Total Quality Cost	3	1.67**	.65	.39	91.7	
Processes	4	1.69**	.48	.28	100	
Productivity	5	1.86**	.36	.19	100	
Inventory Turnover	6	2.0**	1.18	.59	71.4	
Product Lead Time	7	2.07**	.73	.35	71.4	
WIP Inventory	8	2.15*	1.14	.53	69.2	
Cost Savings	9	2.25*	.97	.43	58.3	
Order Processing-time	10	2.36*	.93	.39	50	
Overall Oper. Proced		2.08**	.51	.25	83.3	

Six-point scale used 1=Helped very much to 6=Made worse

* $\alpha = 0.05$

** $\alpha = 0.01$

In terms of operating procedures, an overall improvement of the ten related indicators can be seen ($1.54 < \text{MEAN} < 2.36$). Five indicators have improved statistically ($\alpha = 0.01$) more than the worst ranking items: *Better products & Services Quality* (BETPSQ) (1.54), *number of errors defects* (DEF) (1.58), the *reduction of Total Quality Costs* (TQCOST) (1.67), *better processes* (BETPROC) (1.69) and *productivity* (PROD) (1.86). These five items were felt to be improved thanks to TQM in almost 100 % of cases. The only result contradictory with the US-GAO study is the *order-processing time* (ORDER) (2.36)

²² The cronbach-alpha was calculated without BETPROC and COSTSAV because these variables had too many missing values to be included. Thus the sample was reduced to 11 respondents in the calculation. Alpha is quite high (.7523), given the number of items (more difficult to find an high number of items correlated than a small one)

which was the best improved indicator in the USA, yet it was ranked the least improved by our sample

4.2.3- Greater Customer Satisfaction

Table 7- Customer Satisfaction Indicators

INDICATORS	RANKING BY MEAN	MEAN	Standard Deviation	Coef. of variation	Helped (2) to Helped very much (1) in %	Cronbach- α 0.8044
Complaints	1	1.62**	.65	.40	92.3	
Retention	2	1.92**	.79	.41	75	
% On-Time Delivery	2	1.92*	1.12	.58	84.6	
Compliments	3	2.31*	1.03	.45	46.2	
Overall Satisfaction		1.33**	.49	.37	100	

Six-point scale used: 1=Helped very much to 6=Made worse

* α 0.05 ** α 0.01

According to the companies surveyed, the *overall customer satisfaction* (CUSTSAT) turned out to be the performance-related indicator which had most improvement (1.33) due to TQM practices.

The adoption of TQM practices especially helped to *decrease the number of customer complaints* (COMPLA) (1.62) and to *increase the customer retention* (RETENT) (1.92). These improvements are significant at the 99% level. The *number of compliments* (COMPLI) are not as often or well tracked as the number of complaints. Therefore, it is not surprising to find less improvement, although this is still significant at 95% level. *Percentage of on-time delivery* (DELIV) also improved significantly. This is one of the first areas where improvement can be seen rapidly after TQM adoption. Yet, the improvement becomes marginal, after time. These results are consistent with US-GAO study.

The four customer satisfaction-related indicators are related (Cronbach-alpha=.80), i.e. measuring the same concept. COMPLA and RETENT are highly correlated (Squared multiple correlation is higher than .80).

4.2.4- Increased Financial Performance

Table 8- Financial Performance Indicators

INDICATORS	RANKING BY MEAN	MEAN	Standard Deviation	Coef. of variation	Helped (2) to Helped very much (1) in %	Cronbach - α 0.7114
Profitability	1	1.92**	.67	.35	83.3	
Sales per employee	2	2.17**	.58	.27	75	
Market share	2	2.17*	.94	.43	66.7	
Return On Sales	3	2.25*	.75	.33	58.3	
Return On Assets	4	2.42*	.79	.33	41.7	
Overall Fin. perform.		2.17*	.72	.33	66.7	

Six-point scale used: 1=Helped very much to 6=Made worse

* $\alpha = 0.05$

** $\alpha = 0.01$

The improvement of the *overall financial performance* (FINANC) is the least improved of the four areas of performance measured (2.17). Out of the five financial indicators, the most improved indicator was *profitability* (PROFITA, 1.92), the least improved were *return on sales* (R.O.S., 2.25) and *return on assets* (R.O.A., 2.42).

The *market share* (MARK, 2.17) had not greatly improved probably because, today, maintaining one's level of market share is already a victory. In its latest survey, I S C. (1993) recognized that among firms which make moderate to extensive use of customer focus practices, an above-average proportion of these firms experienced an increase in market share. As a matter of fact, it is believed that market share can only be sustained and increased through the provision of products which meet the needs and expectations of customers. Here we find one of the fundamental objectives of QM, i.e. business development through customer satisfaction.

A better indicator would have been "market share recovered". Market share was used as a financial performance indicator in the US-GAO study, but it appeared, as it was expected, not to be among the same group of performance indicators. As a matter of fact, the Cronbach-alpha which is, nevertheless quite high (.7114) rose to .7727 when MARK was deleted. More precisely, the squared multiple correlation coefficient which is part of the Cronbach-alpha calculation, is the lowest (.0927) for MARK compared to the other

items that ranked between .5802 to .8569. The same remark is valid for *sales per employee* (SEMPLE) which should not be part of the financial indicators since Cronbach-alpha rose to .9218 when its participation was deleted

4.3- Summary and Benefits for Other Studies

Table 9- Best Impacts on Company Performances

INDICATORS	RANKING BY MEAN	MEAN	Standard deviation	Coef. of variation	Helped (2) to Helped very much (1) in %
Participation	1	1.36**	0.50	37	100
Morale	2	1.71**	0.471	28	100
Prod. & serv. Quality	1	1.54**	.52	34	100
Errors / Defects	2	1.58**	.51	32	100
Processes	4	1.69**	.48	28	100
Productivity	5	1.86**	.36	19	100
Complaints	1	1.62**	.65	40	92.3
Profitability	1	1.92**	.67	35	83.3

Six-point scale used: 1=Helped very much to 6=Made worse

* α 0.05

** α 0.01

After five to fifteen years of involvement in TQM and a positive impact on company performance seen for one to nine years, the best impacts of TQM (100% of companies felt that TQM helped to helped very much) on company performance reported an average mean ranking between 1.36 and 1.92 significant at 99% level. *Employee participation, better products & services quality, decrease in defects/errors and less complaints* are the best positive impacts of TQM.

There is no real breakthrough compared to the US-GAO study, i.e. improved customer satisfaction, improved employee relations, improved operating procedures and better financial performance. The only indicator that did not turn out to get the expected result, i.e. one of the best improved indicators, is *order-processing time*.

Regarding the homogeneity of the set of items used to measure each of the four company performance domains, it is generally reliable, especially for customer satisfaction, operating procedures and employee relations. For further research, one suggestion would

be to suppress *market share* and *sales per employee* for assessing the financial performance. It seems, thanks to the Cronbach-alpha test, that these items do not integrate the set of financial indicators.

CHAPTER 5- CHARACTERISTICS OF PERFORMANCE MEASURES, METHODS AND SYSTEMS.

Throughout this chapter, the appropriateness of perceived performance measures (PMs) and systems (PMS) are reported. First, TQM principles are analysed in regard to their adequacy with PMs & PMS. A distinction is made between the appropriateness of TQM-related PMs or PMS and the traditional²³ ones.

5.1- TQM Principles

Table 10- Link between TQM's Principles and Performance measures.

PRINCIPLES	RANKING BY MEAN	MEAN	Standard deviation	Coef. of variation	Agreed (2) to strongly agreed (1) in %
Continuous improvement	1	1.36**	.50	.37	100
Feedback	2	1.50**	.52	.35	100
Management by fact	3	1.79**	.89	.50	85.7
Error free attitude	4	1.93**	.73	.38	78.6

Five-point scale used: 1=Strongly agree to 5=Strongly disagree.

** $\alpha = 0.01$

In general terms, performance measures most appropriate to a TQM environment were felt to contribute positively to the application of the four TQM's principles, i.e. continuous improvement, feedback, management by fact, and error-free attitude. This positive contribution is significant at a 99% level. More precisely, all the respondents (100%) agreed or agreed strongly that performance measures lead to further improvements, i.e. *continuous improvements* (CONTIN), and *reinforce feedback and communication* (FEEDB). To a certain extent (>75% respondents), these people also agreed that such performance measures track the roots of defectiveness, i.e. *management by fact* (BYFACT), and *reinforce error-free attitude* (ERFREE).

²³ Traditional PMs & PMS are the current one in place and used in any organization up to the 1980s, which are mainly based on financial criteria and result-oriented.

These findings are consistent with the literature review presented in Chapter 2. It is stated that the performance measures in a TQM environment should be directly related to the management by fact. Data collection and information analysis go hand in hand with performance measurement because these are the foundation of management by fact. Measuring performance is also a key step in the continuous improvement process. It permits feedback on a process and direction for improvement if necessary. This concept has been discussed in PDCA cycle or the Deming wheel shown in Appendix 8.

5.2- Perceived Characteristics of Performance Measures

Table 11- Perceived Characteristics of Performance Measures

VARIABLES	RANKING BY MEAN	MEAN	Standard deviation	Cocf. of variation	% of appropriateness 1 or 2
Addressing companys' objectives	1	1.50**	.85	.57	92.9
Flexible	2	1.69**	.63	.37	92.3
Dynamic to the process changes	3	1.71**	.61	.36	92.9
Cross Functional Team based	4	1.75**	.75	.43	83.3
Proactive to the domain changes	5	1.85**	.55	.30	92.3
Process-orientation	6	1.86**	.86	.46	85.7
Result-orientation	7	2.08*	.86	.41	61.5
Long-term orientation	8	2.29*	1.07	.47	64.3

Five-point scale used: 1=Very appropriate to 5=Not at all appropriate. * $\alpha = 0.05$ * $\alpha = 0.01$

In general terms, PMs characteristics are felt very appropriate or appropriate in a TQM environment. More precisely, 83.3 to 92.9 % of the respondents perceived the following PMs characteristics appropriate to very appropriate in a TQM environment:

- *Addressing company's objectives (OBJ)*, e.g. market share, profitability, customer satisfaction
- *Flexible (FLEX)*, e.g. still remains valid when sales or volumes vary significantly.
- *Dynamic to the process changes (DYN)*.
- *Cross Functional Team based (CFTEAM)*.
- *Proactive to the domain changes (PROAC)*.
- *Process- oriented (PROCESS)*, e.g. on-time delivery, costs saving.

All these characteristics are perceived appropriate at a 99% significance level (SL).

Two characteristics did not get the expected ratings based on the results of US-GAO. The *long-term orientation* (LTERM) should have been one of the very appropriate characteristic in a TQM environment. Yet only 64.3% found this characteristic appropriate or very appropriate. This item received the lowest appropriateness rating among all characteristics. Similarly, the *result-orientation* (RESULT) should have had a lower mean rating than LTERM variable because any traditional result variable does not comply with TQM practices. In fact, although rated in a different way than expected, these two characteristics are both perceived appropriate at a 95% significance level (SI.) which, in turn, means that PMs need to have, to a certain extent, a result-orientation, even in a TQM environment.

5.3- Perceived Characteristics of Performance Measurement System/Method

Table 12- Perceived Characteristics of Performance Measurement System/Method

CHARACTERISTICS	RANKING BY MEAN	MEA N	Standard Deviation	Coef. of variation	% of appropriateness 1+2
TQM-oriented characteristics					
Quality work and client satisfaction	1	1.29**	.47	36	100
Correct information	2	1.50**	.85	57	92.9
Elimination of non-value-added activities	3	1.57**	.64	41	92.9
Congruent with company's objectives	4	1.57**	.65	41	85.7
Both financial and non-financial	5	1.62**	.63	39	92.9
Proactive to process changes	6	1.77**	.44	25	100
Dynamic to process changes	7	2.00**	.58	29	84.6
Ensuring a full significance of PMs	8	2.00*	.96	48	71.4
Flexible to activities	9	2.14*	1.03	48	78.6
Value-added classification	10	2.31*	1.03	45	61.5
Driven from top down	12	2.50	1.34	54	64.3
Only non-financial	14	3.79*	1.12	30	21.4
Traditional characteristics					
Helping profitability figures	11	2.33*	.78	33	66.7
Keeping allocated costs down	13	2.77	1.17	42	38.5
Only financial	15	3.79*	1.25	33	14.3
Permitting to use cheaper labor	16	3.83*	1.12	29	8.3

Five-point scale used: 1=Very appropriate to 5=Not at all appropriate * α = 0.05 ** α = 0.01

The characteristics of performance measurement system/method (PMS) can be clustered into two groups, the TQM-oriented characteristics and the traditional ones. As expected, the items of the first group did rate a better score (1.29 to 2.31) than the second group (2.33 to 3.83), except *driven from top down* (TOP) (2.50) and *Only non-financial* (ONNOFIN) (3.79). This confirms that these characteristics are considered by firm in a TQM environment as appropriate to very appropriate in at least 61.5% of the cases. The seven best items (more than 85% of sample rated variable appropriate or very appropriate) rated appropriate at a 99% significance level are:

- *takes into account quality work and client satisfaction* (QWORK).
- *produces correct information* (CORINFO)
- *focuses on integrating performance measures to encourage elimination of non-value-added activities* (ELIMNVA).
- *is congruent with company's objectives* (SOBJ).
- *translates company's critical success factors into both financial and non-financial terms* (BOTH).
- *is proactive to process changes* (SPROAC).
- *is dynamic to process changes* (SDYN).

Regarding the *driven from top down* (TOP) (2.50), it is a core principle of TQM, it should have been significantly appropriate. The last TQM-oriented PMS characteristic is *translating the company's critical success factors into only non-financial terms* (ONNOFIN). This characteristic was not felt appropriate in a TQM environment (SL 95%)

The traditional PMS, as expected, had a mean rating greater than 3, i.e. towards the not appropriate side of the scale. Most of the respondents did place these PMS characteristics in either neutral, not appropriate or not at all appropriate categories. More precisely, as expected, the *use of cheaper labor* (CHEAP) and *translating the company's critical success factors into only financial terms* (ONFIN) were felt to be characteristics not at all appropriate in a TQM environment (SL 95%). So, PMS characteristics as

translating the company's critical success factors into only non-financial terms (ONNOFIN) and *only financial terms* (ONFIN) are not appropriate, but measuring them in terms of *both financial and non-financial* criteria (BOTII) is appropriate. *Keeping the allocated costs down* (ALLOC) was expected to be significantly inappropriate, and it leans towards the not-appropriate end of the scale, however, this result is not statistically significant. To finish with traditional PMS, *helping the profitability* (SPROFIT) should have been on the not-appropriate side of the scale yet was rated significantly appropriate (95%).

5.4- DISCUSSION

At this stage of the discussion, we should recall that, in general terms, these findings are consistent with previous findings, i.e. the expected TQM-oriented characteristics of PMs and PMS are perceived appropriate and the traditional ones are not felt appropriate. In other words, PMs & PMS are less financially and more process-oriented in a TQM environment.

Nevertheless, some findings contradict previous findings. Namely, *driven from top down* (TOP) variable was expected to be felt very appropriate. *Helping the profitability figures* (SPROFIT) should have been on the not-appropriate side of the scale, and it seems that *translating the company's critical success factors into only financial terms* (ONFIN) is not appropriate too. These results did not turn out as expected.

One of the recommendations for successfully implementing TQM is new measurement and reporting systems (see Section 1.4.2). Some respondents gave us interesting comments on this issue. They pointed out that due to TQM adoption, the following changes appeared.

- *Harmonization of PMs with that of the corporation*
- *New measurement tools introduced*
- *Overall focus linked to continuous improvement versus specific goals*
- *Development of many new process measures as well as results measures.*

CHAPTER 6- PERFORMANCE MEASURES, METHODS AND SYSTEMS IN A TQM ENVIRONMENT

The extent of use and the appropriateness of methods and measures was assessed by descriptive statistics:

- the mean rating,
- the frequency of respondents who always (1) to never (5) used the measures or methods,
- the frequency of respondents who found them very (1) to not at all (5) appropriate,
- a t-test on the mean compared to the mid-point of the scale (3).

To summarize and compare the findings, two indices were used.

Index of use (Iu) and index of appropriateness (Ia) where index refers to the percentage of respondents who rate item to be always (1) to often (2) used or appropriate (2) to very appropriate (1).

6.1- Extent of use of Performance Measures (PMs) and Systems/Methods (PMS) favoured by TQM adopters

In this section, the extent of use of PMs and their associated methods favoured by TQM adopters are reported. PMs and PMS were studied in eight domains. These are

- *Employee relations*
- *Production*
- *Productivity*
- *Finance*
- *Market*
- *Customer satisfaction*
- *Quality of products & services*
- *Quality of suppliers' products & services*

6.1.1.- Extent of use of TQM related systems by TQM adopters

Table 13- Extent of use of TQM related systems by TQM adopters

DESCRIPTION	Ranking by mean	Mean	Std dev	Coef. of variation	% of respondents who use these PM and PMS 1 or 2
Management by cycle time	1	2.42	1.00	.41	66.7
Value-added mngt accounting	2	2.77	1.17	.42	38.5
Activity-based costing system	3	3.55	1.04	.29	18.2

Five-point scale used: 1=Always to 5=Never.

Table 14- Future use of TQM related systems by TQM adopters

DESCRIPTION	Ranking by mean	Mean	Std dev	Coef. of variation	% of respondents who use these PM and PMS 1 or 2
Activity-based costing system	1	1.90*	1.10	0.58	70
Management by cycle time	2	2.58*	.67	0.26	50
Value-added mngt accounting	3	2.62	.65	0.25	46.2

Four-point scale: 1=start to use, 2=continue to use, 3=expand its use, 4=don't plan to use* $\alpha = 0.05$

In theory, these three systems should be often used by TQM adopters. Results show that the mean ratings centered around the mid-point of the scale (3= sometimes), i.e. 2.42 to 3.55. *Management by cycle time* (MCTUSE) and *value-added management accounting* (VAMUSE) were the most popular TQM systems, as defined by frequency of use. *Activity-Based Costing system* (ABCUSE) was not frequently used: its mean score is slightly towards the not-used side of the scale. Although some differences can be seen in the extent of use between these three systems, none of them are either significantly used or not used ($\alpha > 0.05$) ($Iu = 18.2\%$).

We noted that TQM adopters have plans to start using ABC in 70% of cases (Table 6.1.1 b). One of the respondents planned to have ABC fully implemented within a few weeks after this survey was done. Moreover, ABC should become more and more used by TQM adopters since this new accounting system is well-suited to the measurement of the cost of quality (Beheiry, 1991). Also, it provides information for continuous improvements and sets targets for waste elimination (Atkinson, 1990). It is also surprising that *management by cycle time* is always or often practiced by two-thirds

of the respondents. MCT has reported to be not often applied in the literature (ISIC, 1991).

6.1.2- Extent of use of employee-related measures and methods by TQM adopters

Table 15- Extent of use of employee-related measures and methods by TQM adopters

DESCRIPTION	Ranking by mean	Mean	Std dev	Coef of variation	% of respondents who use these PM and PMS 1 or 2
EMPLOYEE-ORIENTED METHODS					
Employee attitude survey	1	2.10	1.45	0.69	70
Time-analysis method	2	3.58	1.08	0.30	16.7
EMPLOYEE-ORIENTED MEASURES					
# of accidents	1	1.50**	.71	0.47	90
Employee satisfaction	2	1.54**	.66	0.43	92.3
# of lost work days	3	1.60**	.52	0.33	100
Morale	4	1.85**	.90	0.49	69.2
Turnover	5	2.33	1.23	0.53	66.7
# of employee suggestions	6	2.38	1.19	0.50	61.5
Absenteeism	7	2.54	1.33	0.52	53.8

Five-point scale used: 1=Always to 5=Never.

** $\alpha < 0.01$

The *employee attitude survey* is the most often used method (mean = 2.10, in 70%) for measuring employee-related issues. *Time analysis method* is not very well known or widespread because it is still a new method introduced only in the 1990's. It measures the amount of time employees spend on each activity, usually only 20% of employee activities consume 80% of their total time (Sharman, 1992; Koehler, 1992). Moreover, both of these methods are not measuring the same concept (Cronbach-alpha = 0.617). Yet, the Cronbach-alpha may be sensitive to the small number of variables (2) used for this category of measures. Friedman two-way ANOVA shows no significant differences ($p > 0.1$) between them. Finally, other employee-related methods mentioned by respondents include: suggestion programs; focus-groups; capacity model (time-analysis method); annual employee assessment based on continuous improvement; and performance coaching (setting very specific objectives and providing tools to achieve these objectives).

Four of the employee-related measures have a high frequency of use (70 to 100%) with a mean rating significantly turned towards the used-side of the scale ($\alpha = 0.01$). These are: *number of accidents*, *employee satisfaction*, *number of lost work days* and *morale*. The employee-related measures are not closely related (Cronbach alpha = .3631). Friedman two-way ANOVA denies that there are significant differences between the most popular and least used measure ($p > 0.1$).

6.1.3- Extent of use of production-oriented measures and methods by TQM adopters

Table 16- Extent of use of production-oriented measures and methods by TQM adopters

DESCRIPTION	Ranking by mean	Mean	Std dev	Coef. of variation	% of respondents who use these PM and PMS 1 or 2
PRODUCTION-ORIENTED METHODS					
SPC	1	2.08*	1.26	0.61	69.2
Pareto chart	1	2.08*	1.26	0.61	76.9
Checklists	1	2.08**	.76	0.37	69.2
Cause and effect diagram	2	2.23*	.83	0.37	69.2
Histogram	3	2.31	1.18	0.51	69.2
Control charts	5	2.38	1.26	0.53	53.8
Process Sequence Flow Charts	6	2.54	.97	0.38	53.8
Scatter diagram	7	3.00	.91	0.30	30.8
Just-in-time	4	2.33*	.89	0.38	58.3
Quality Function Deployment	8	3.08	1.24	0.40	25
PRODUCTION-ORIENTED MEASURES					
Conformance to quality	1	1.58**	1.00	0.63	83.3
Defect rate	2	1.62**	.77	0.48	84.6
Inventory turnover	3	1.92*	1.00	0.52	75
Cycle time (from design to mfg)	4	2.27*	.65	0.29	81.8
Work-in-process inventory	5	2.33	1.37	0.59	66.7
Machine downtime	6	2.36*	.92	0.39	72.7
Order-processing time	7	2.42*	.67	0.28	50
Set-up time	8	2.58	1.00	0.39	50
Cost of quality	9	2.77	1.36	0.49	38.5
Cost savings per employee	10	3.46	.97	0.28	15.4

Five-point scale used: 1 - Always to 5 - Never

* $\alpha = 0.05$

** $\alpha = 0.01$

In the area of production, a number of measures as well as methods were studied. There are three main TQM-related methods when speaking of Quality at the production level:

- Statistical Production Control (SPC)
- Just-in-time (JIT)
- Quality Function Deployment (QFD)

SPC is composed of the seven following tools:

- Pareto chart
- Checklists
- Cause and effect diagram
- Histogram
- Control charts
- Process Sequence Flow Charts
- Scatter diagram

The results confirm that the use of SPC tools (mean rating = 2.08) are perceived to be very important ($\alpha \leq 0.05$) by TQM adopters, especially *Pareto charts*, *checklists* and *cause and effect diagrams* (fishbone diagrams). It is not so surprising to find that the 3 simplest tools of SPC are the most often used (76-77% used them always or often). JIT was also considered very appropriate ($\alpha = 0.05$). QFD is a relatively new concept which only appeared in the early 90's (Chapter II, 2.3). Only 25 % of TQM adopters used it always to often (mean rating = 3.08). This result confirms the trend found in the Aerospace study (ISTC, 1991) which reported that only a minority (36%) of the respondents had heard of the term and those who had less than half (39%) were familiar with it. Finally, respondents also mentioned Taguchi methods as "other methods used".

Although, there are discrepancies between the degree of use of these methods and tools, they are actually measuring the same concept (Cronbach-alpha = 0.8414). There is also no doubt that these methods are used to different degrees, particularly SPC compared with QFD. The Friedman two-way ANOVA test confirmed significant differences between these methods at a significance level of 95 %.

Regarding the production-related measures used by TQM adopters, *conformance to quality, defect rate, inventory turnover and cycle time from design to manufacturing* are the most often used ($\alpha \leq 0.05$) measures (mean ratings ranging from 1.58 to 2.27), the index of use for these four measures ranges from 75 to 85 %. This is consistent with Cross & Lynch (1992) who believe that at the department level, the four key performance measures focus on quality, delivery, cycle time and waste. Moreover, according to ISTC (1991), the most often used indicators in production are manufacturing lead time (60%), and defect rate (60%). It should be noted that *cost savings per employee* and *cost of quality* are not used very often with an index of use of 15.4% and 38.5%, respectively. These weak results are due to the fact that quality is difficult to measure and its impact on production costs, hard to capture. So, in our study, it was expected to find low lu. Nevertheless, in the case of the GAO study, aside from cycle time, defect rate, timeliness of delivery, and inventory turnover, the cost of quality and cost savings were considered to be the important operating measures which focus on the quality and cost of products and services.

As in the case of methods, all these measures are very closely related (Cronbach-alpha = .8272). Nevertheless, significant differences exist between them (level 98 %)

6.1.4- Extent of use of productivity-based measures by TQM adopters

Table 17- Extent of use of productivity-based measures by TQM adopters

DESCRIPTION	Ranking by mean	Mean	Std dev	Coef. of variation	% of respondents who use these PM and PMS 1 or 2
Capacity utilization rate	1	2.36*	.92	0.39	72.7
Overtime hours	2	2.42	1.31	0.54	66.7
Rework hours	3	2.55	.93	0.36	54.5
Quota on monthly shipments \$	4	2.89	1.36	0.47	33.3

Five-point scale used: 1- Always to 5- Never

* $\alpha = 0.05$

Traditional company performance measures commonly refer to measures related to shop-floor (factory) productivity. Although these measures are not expected to be appropriate in a TQM environment (because they are result and short-term oriented), some such as *capacity utilization rate* (73%) and *overtime hours* (57%) are often used. No significant differences ($p>0.1$) can be distinguished between these four productivity measures, but they are not at all related as Cronbach alpha is very low (.1926).

6.1.5- Extent of use of finance-based measures by TQM adopters

Table 18- Extent of use of finance-based measures by TQM adopters

DESCRIPTION	Ranking by mean	Mean	Std dev	Coef. of variation	% of respondents who use these PM and PMS 1 or 2
Profits before tax	1	1.50**	1.17	0.78	91.7
Return-on-investment	2	1.62**	1.12	0.69	92.3
Revenue growth	3	1.67**	.89	0.53	91.7
Return-on-assets	4	1.69**	1.11	0.66	92.3
Volume of business (in \$)	5	1.73**	.65	0.38	90.9
Return-on-sales	6	1.83**	.94	0.51	83.3
Net profit	7	1.92*	1.16	0.60	83.3
Cost based on direct labor hours	8	2.36	1.29	0.55	63.6
Sales per employee	9	2.67	1.23	0.46	50
Sales revenue alone	10	2.75	1.36	0.49	50

Five-point scale used: 1=Always to 5=Never

* $\alpha = 0.05$

** $\alpha = 0.01$

It is acknowledged in the literature that finance-based measures must be used carefully by TQM adopters because their short-term orientation might underestimate the positive impact of TQM on the overall company performance. Nevertheless, some of these finance-based measures are more appropriate in a TQM environment since they are longer-term oriented. These are *Return On Investments (ROI)*, *Return On Assets (ROA)*, *Return On Sales (ROS)*, *volume of business (in \$)* and *revenue growth*. The literature states that measures based on direct labour-hours, as done for production costs and profits (net or before tax) should not be used as primary indicators for determining the success or failure of a company performance.

In this study, aside from *cost based on direct labour hours*, *sales per employee* and *sales revenue alone*, all the finance-based measures, are significantly ($\alpha \geq 0.05$) always to very often-used (83 to 92 % of respondents) especially *profits before tax*, *ROI*, *ROA*, *revenue growth and volume of business* and return-on-sales mean rating, ranging from 1.50 to 1.83).

Note that all these measures are measuring the same concept (Cronbach-alpha = .8683). Nevertheless, two items do not fit: ROS and Revenue growth (respectively, corrected item - total correlation : .0633 and -.1132). These two items have a negative impact on the overall Cronbach alpha, which goes up to .9227 when ROS and Revenue growth are deleted from the analysis. Although all finance-based measures of TQM measure the same concept, they are used with different frequency (lu ranges from 50 to 92% and mean from 1.50 to 2.75). *Profits before tax*, *ROI*, *revenue growth*, *ROA*, *volume of business*, *ROS* and *net profit* are more common measures than *cost based on direct labour-hours*, *sales per employee* and *sales revenue alone*.

6.1.6- Extent of use of market-based measures by TQM adopters

Table 19- Extent of use of market-based measures by TQM adopters

DESCRIPTION	Ranking by mean	Mean	Std dev	Coef. of variation	% of respondents who use these PM and PMS 1 or 2
Future market share	1	1.92*	1.16	0.60	83.3
Relative market share to largest competitors	2	2.08*	.79	0.38	66.7
Absolute market share	2	2.08*	.90	0.43	75
% of sales from new products	3	2.09*	.94	0.45	72.7

Five-point scale used 1=Always to 5=Never

* $\alpha = 0.05$

As a preamble to this section, we report two meaningful comments of respondents about market share

- the quality movement is the new management tool for gaining market share and remaining market leader, and

- TQM is a mean to achieve goals of customer satisfaction and hence, market share

Market-based measures are quite often used (index ranging from 67 to 83 %). According to the US-GAO study (1991), market-share is classified as a financial performance indicator. It is even one of the most important financial performance indicator and it reported that companies that build market share on the basis of improved product quality and value, believe to be the route to increased profitability. It should be noticed that a respondent highlighted that absolute market share is perceived to be quite difficult to measure. The four measures consistently measure market-based criteria (Cronbach-alpha = .7030). One can notice the specific long term vision of TQM adopters which primarily use *Future market share*. No differences in the extent of use can be distinguished (Friedman test; $p > 0.1$).

6.1.7- Extent of use of customer-based measures by TQM adopters

Table 20- Extent of use of customer-based measures by TQM adopters

DESCRIPTION	Ranking by mean	Mean	Std dev	Coeff. of variation	% of respondents who use these PM and PMS (1 or 2)
# of complaints	1	1.15**	.55	0.48	92.3
% on-time delivery	2	1.33**	.65	0.49	91.7
Overall customer satisfaction	3	1.46**	.78	0.53	84.6
Average time for complaint resolution	4	1.69*	1.18	0.70	84.6
Average lead time to respond to service calls	5	1.77**	1.01	0.57	76.9
Customer retention	6	1.92*	1.24	0.65	75
# of compliments	7	2.33	1.23	0.53	66.7

Five-point scale used: 1=Always to 5=Never

* $\alpha = 0.05$

** $\alpha = 0.01$

The measures listed in Table 20 are the core measures of TQM adopters. All these customer-based measures are used always to very often at a significance level greater than 0.05 (lu ranging from 75 to 93%) except *number of compliments*. *Number of compliments* is not so often used (lu = 67%) because most of the TQM-oriented organizations focused

on other measures (*overall customer satisfaction, number of complaints or percent of on-time delivery*) before *number of compliments*. It is understandable that one company has to primarily detect the unsatisfaction of its clients such as *on-time delivery*, resolve these problems and apply corrections before being able to receive compliments. Knowing this process, it is understandable to find *number of compliments* used less frequently. In this context, it is also very encouraging to find a high frequency of use for this measure, demonstrating that the respondents are really in an advanced stage of TQM implementation.

As reported ISTC (1991), the number of complaints and percent of on-time delivery are the most frequently used indicators of service quality. According to a respondent, "customer complaints have to be addressed within two hours". Another respondent reported "he does not measure customer retention" which tends to think that this is not the most appropriate or widest used indicator for customer satisfaction. To finish with this section, two methods could have been added to the questionnaire since it was mentioned by respondents.

- customer delight index, which measures the degree of delightedness of customers. Let us remember that today, customers not only want to be satisfied but also delighted.
- "Five Why theory" which permits the increase of satisfaction by decreasing sources of dissatisfaction

Although no significant differences between the extent of their use have been found ($p > 0.1$), no evidence of a relationship between these measures was found (Cronbach-alpha = 0.683).

6.1.8- Extent of use of quality of products/services-related methods by TQM adopters

Table 21- Extent of use of quality of products/services-related methods by TQM adopters

DESCRIPTION	Ranking by mean	Mean	Std dev	Coef of variation	% of respondents who use these PM and PMS 1 or 2
Market research/customer survey	1	1.67**	.98	0.59	83.3
Inspections	2	1.83**	.94	0.51	83.3
Quality reports	3	1.92*	1.26	0.66	69.2
External quality audits	4	2.15*	.99	0.46	76.9
ISO 9000 Certification	5	2.45	1.29	0.53	54.5

Five-point scale used: 1=Always to 5=Never

* $\alpha = 0.05$

** $\alpha = 0.01$

Apart from *ISO 9000 certification*, the quality of products & services -related methods are significantly ($\alpha \geq 0.05$) used very often (lu ranging from 83 to 77 %) *ISO 9000* certification will become more important in the near future if a company wants to export and/or be a supplier of European companies. Frequently, it is a process which is implemented a considerable time after a Total Quality involvement. It is therefore, not surprising to find *ISO* as the least used method in this category. One result is contradictory with a TQM environment: *Inspections* have a 83 % index of use. A TQM adopter should not use such a program, which is considered unnecessary if the concept of quality at source is applied, i.e. continuous quality control by the employees and suppliers.

According to *ISTC* (1991), besides customer satisfaction and customer complaints, quality reports and inspections are the most often used methods for assessing the quality of products & services. This is consistent with these findings.

When *market research/customer survey* (MRES) is not considered, the Cronbach alpha goes up from .6445 to .8277. As a matter of fact, MRES has a square multiple correlation of .1680. It is understandable that MRES should not be in this category of measures. No significant differences in the extent of use of these measures appeared ($p > 0.1$).

6.1.9- Extent of use of methods related to quality of suppliers' products/services by TQM adopters

Table 22- Extent of use of methods related to quality of suppliers' products/services by TQM adopters

DESCRIPTION	Ranking by mean	Mean	Std dev	Cocf. of variation	% of respondents who use these PM and PMS 1 or 2
Supplier certification	1	2.17*	1.11	0.51	75
Supplier audits/appraisals	2	2.27*	.90	0.40	63.6
Random sampling	3	2.45	.93	0.38	63.6
ISO 9000 certification	4	3.00	1.28	0.43	41.7
International sampling plans	5	3.57	1.40	0.39	28.6
At source inspection	6	3.64	1.21	0.33	18.2
100% inspection	7	3.73*	.65	0.17	0

Five-point scale used: 1- Always to 5=Never

* $\alpha = 0.05$

In general terms, the methods related to quality of suppliers' products & services are used less often than methods related to the quality of products & services. Among the methods listed in Table 22, *supplier certification* (SUPCUSE) and *audits/appraisal* (SUPAUSE) were found to be significantly ($\alpha = 0.05$) used (index of 75 and 64%). At stake, is decreasing the number of suppliers by certifying them and reinforcing the partnership. One of the respondents decreased suppliers from 14000 to 4600 in five years. *International sampling plans* and *100% inspection* ($\alpha = 0.05$) are not very often used, more precisely their means are on the not-used side of the scale. According to the literature, *random sampling* (RSAMPUSE) and *At source inspection* (SOURCUSE) should have had opposite results. The fact that this category is composed of TQM-oriented and traditional methods has an impact on the Cronbach-alpha which is low (.4255), i.e. these methods do not measure the same concept. This result confirms that traditional and TQM-oriented methods are really different. As a matter of fact, one can notice that SOURCUSE, SUPAUSE and SUPCUSE were closely related (squared multiple correlation ranging between .7136 to .8877). Finally, as mentioned earlier, *ISO 9000* is still a new step in the TQM movement. Therefore it is at a neutral point on the scale (3).

Regarding the wide range of mean ratings (2.17 to 3.73), it is not surprising to find that significant differences ($p < 0.005$) do exist in the extent of use of these methods

6.1.10- Extent of use of methods for tracking continuous improvement of employees by TQM adopters

Table 23- Extent of use of methods for tracking continuous improvement of employees by TQM adopters

DESCRIPTION	Ranking by mean	Mean	Std dev	Coef. of variation	% of respondents who use these PM and PMS 1 or 2
Monthly report	1	2.92	1.32	0.45	46.2
weekly report	2	3.77	1.30	0.34	15.4
daily report	3	4.31*	1.18	0.27	7.7

Five-point scale used: 1=Always to 5=Never

* $\alpha = 0.05$

With an index of use less than 50 %, none of the methods for tracking continuous improvement of employees are used. It is possible that other methods exist but none have been mentioned by the respondents.

6.2- Appropriateness of Performance Measures (PMs) and Systems/methods (PMS) favoured by TQM adopters

In this section, the appropriateness of PMs and their associated methods favoured by TQM adopters are reported. After looking at the appropriateness of TQM-related systems, eight domains of PMs and methods were studied. These are:

- *Employee relations*
- *Production*
- *Productivity*
- *Finance*
- *Market*
- *Customer satisfaction*
- *Quality of products & services*
- *Quality of suppliers' products & services*

6.2.1- Appropriateness of TQM related systems by TQM adopters

Table 24- Appropriateness of TQM related systems by TQM adopters

Description	Ranking by mean	Mean	Std dev	Coef. of variation	% of appropriateness 1 or 2
Management by cycle time	1	2.00*	.89	0.45	81.8
Value-added mngt accounting	2	2.33*	1.07	0.46	66.7
Activity-based costing system	3	2.70	.82	0.30	50

Five-point scale used: 1=Very appropriate to 5=Not at all appropriate

* $\alpha = 0.05$

These three systems should be considered appropriate for TQM adopters. Aside from *activity-based costing systems (ABCAPP)*, *management by cycle time* and *value-added management accounting* are considered particularly for ABCAPP, which is a new tool well-suited to the process-oriented approach and the elimination of non-value added activity (Koehler, 1992)

6.2.2- Appropriateness of employee-related measures by TQM adopters

Table 25- Appropriateness of employee-related measures by TQM adopters

DESCRIPTION	Ranking by mean	Mean	Std dev	Coef. of variation	% of appropriateness 1 or 2
EMPLOYEE-ORIENTED METHODS					
Employee attitude survey	1	1.70*	1.06	0.62	80
Time-analysis method	2	3.67	1.15	0.31	8.3
EMPLOYEE-ORIENTED MEASURES					
Employee satisfaction	1	1.31**	.48	0.37	100
Morale	2	1.62**	.77	0.48	84.6
# of employee suggestions	2	1.62**	.77	0.48	84.6
# of lost work days	3	1.70**	.67	0.39	90
# of accidents	4	1.80**	.63	0.35	90
Absenteeism	5	1.91**	.70	0.37	81.8
Turnover	6	2.00*	.95	0.48	75

Five-point scale used: 1= Very appropriate to 5=Not at all appropriate

* $\alpha = 0.05$

** $\alpha = 0.01$

As discussed in 6.1.3, the two employee-related methods mentioned have completely different indices of appropriateness and use. *Time-analysis method* is new, if is not

considered as being an employee-related method (Cronbach-alpha = 0.2344). In that case, significant differences between the extent of appropriateness did appear ($p = 0.03$) for these two methods. This result is not consistent with the expected process-orientation of the *time-analysis method*.

In terms of employee-related measures, all of them as listed in Table 6.2.2 are considered appropriate (index between 75 and 100%) with an emphasis on employee satisfaction (mean rating = 1.31, index = 100%). As in the case of the extent of use, these measures are not measuring the same concept since the Cronbach-alpha is low (0.3182). If some measures should be considered apart, they are *morale* and *number of employee suggestions*.

6.2.3- Appropriateness of production-oriented measures and methods by TQM adopters

Table 26- Appropriateness of production-oriented measures and methods by TQM adopters

DESCRIPTION	Ranking by mean	Mean	Std dev	Coef. of variation	% of appropriateness 1 or 2
PRODUCTION-ORIENTED METHODS					
SPC	3	1.85*	1.14	0.62	76.9
Process Sequence Flow Charts	1	1.62**	.65	0.40	92.3
Pareto chart	2	1.69**	.63	0.37	92.3
Cause and effect diagram	2	1.69**	.63	0.37	92.3
Histogram	3	1.85**	.69	0.37	84.6
Checklists	4	1.92**	.76	0.40	76.9
Control charts	6	2.98*	1.32	0.63	69.2
Scatter diagram	7	2.50*	.80	0.32	50
Just-in-time	4	1.92**	.79	0.41	75
Quality Function Deployment	5	2.00*	.95	0.48	75
PRODUCTION-ORIENTED MEASURES					
Defect rate	1	1.46**	.66	0.45	92.3
Conformance to quality	2	1.50**	.80	0.53	83.3
Cycle time (from design to mfg)	3	1.73*	1.01	0.58	81.8
Inventory turnover	4	2.00**	.74	0.37	75
Cost of quality	5	2.18*	.98	0.45	63.6
Order-processing time	6	2.25*	.87	0.39	50
Machine downtime	7	2.27*	.90	0.40	81.8
Set-up time	8	2.33*	.98	0.42	66.7
Work-in-process inventory	9	2.58	1.16	0.45	66.7
Cost savings per employee	10	3.18	.75	0.24	18.2

Five-point scale used: 1=Very appropriate to 5=Not at all appropriate * $\alpha = 0.05$ ** $\alpha = 0.01$

Distinguishing the three main production-related methods (SPC, JIT and QFD) in a TQM environment from the 7 tools associated with one of these methods (SPC), one might notice that these methods have about the same index of appropriateness (75%). And in the case of the extent of use, four of the 7 SPC tools (*pareto charts*, *cause and effect diagrams* (*fishbones*), *histograms* and *checklists*) are not only used more than the others, but all considered more appropriate ($\alpha = 0.05$). The interesting point is regarding Process Sequence Flow Charts (PSFL) which is considered as the most appropriate (index of 92%) SPC-tools, although it is not yet very often used (index of 54% in section 6.1.3.)

Besides SPC, JIT and QFD are felt significantly ($\alpha = 0.05$) appropriate (la = 75%) as expected

These methods and tools are quite related (Cronbach alpha = .8371) and no real differences ($p > 0.1$) can be distinguished. The Friedman test also confirmed the relatedness of the three methods ($p > 0.1$) and the 7 SPC tools ($p > 0.10$).

Regarding the measures, most of the respondents (75 to 92%) found *defect rate*, *conformance to quality*, *cycle time from design to manufacturing*, *machine downtime* and *inventory turnover* appropriate to very appropriate ($\alpha > 0.05$) in a TQI.1 environment. The same measures, aside from *machine downtime* were used often to very often with the same frequency. The only measure not considered appropriate (index = 18%) and which is also almost never used, is *cost savings per employee*. As mentioned before (6.1.2), this result is probably due to the difficulty to measure cost savings derived from quality improvements although it should be appropriate.

In general terms, all these measures are pretty well measuring the same concept (Cronbach alpha = .6557) and no significant differences appear ($p = 0.85$). But *conformance to quality*, *cycle time* and *Order-processing time* have a negative impact on the overall reliability of this category. If they were deleted, Cronbach-alpha increases to .8455, and then significant differences appear between these measures regarding the degree of appropriateness at a significance level of 1.8%. To conclude, the measures which are really measuring the use of production-oriented measures are

Defect rate
Conformance to quality

and to a certain extent (Cronbach-alpha increases without these measures = .8873)

Cycle time
Inventory turnover
Machine downtime
Set-up time

A resolution test chart featuring several groups of horizontal and vertical lines of varying thicknesses. Each group is accompanied by a numerical value indicating the resolution level. The values include 1.0, 1.1, 1.25, 1.4, 1.6, 1.8, 2.0, 2.2, 2.5, 2.8, 3.2, 3.6, 4.0, 4.5, and 5.0. The chart is used to measure the resolving power of imaging systems.

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS
STANDARD REFERENCE MATERIAL 1010a
(ANSI and ISO TEST CHART No. 2)

Cost of quality
Order-processing time.

6.2.4- Appropriateness of productivity-based measures by TQM adopters

Table 27- Appropriateness of productivity-based measures by TQM adopters

DESCRIPTION	Ranking by mean	Mean	Std dev	Coef. of variation	% of appropriateness 1 or 2
Overtime hours	1	1.92**	.79	0.41	75
Rework hours	2	2.00**	.63	0.32	81.8
Capacity utilization rate	3	2.64	1.12	0.42	54.5
Quota on monthly shipments \$	4	3.00	1.41	0.47	33.3

Five-point scale used: 1=Very appropriate to 5=Not at all appropriate

** $\alpha = 0.01$

The results regarding the appropriateness of the productivity-based measures in a TQM environment are somewhat different from those found in the case of extent of use. More precisely, *capacity utilization rate* is not as appropriate ($\alpha = 55\%$) as it is used ($\alpha = 73\%$) and *rework hours* is more appropriate ($\alpha = 0.01$) ($\alpha = 82\%$) than it is used ($\alpha = 55\%$). These results are contradictory with the expected not-appropriateness of these traditional productivity-based measures. No real differences appeared at this level either for *overtime hours* (quite used and appropriate) or *quota on monthly shipments dollars* (neither used nor appropriate).

Cronbach-alpha is better in this case of appropriateness (.5806) compared to the Cronbach-alpha in the case of the extent of use (.1926). This better result means that these four measures are reliable regarding productivity-based measures.

6.2.5- Appropriateness of finance-based measures by TQM adopters

Table 28- Appropriateness of finance-based measures by TQM adopters

DESCRIPTION	Ranking by mean	Mean	Std dev	Cocf. of variation	% of appropriateness 1 or 2
Volume of business	1	1.64**	.50	0.30	100
Net profit	2	1.67**	.89	0.53	75
Profits before tax	2	1.67*	1.15	0.69	91.7
Return-on-investment	3	1.69**	.75	0.44	84.6
Revenue growth	4	1.75**	.62	0.35	91.7
Return-on-sales	5	1.83**	.58	0.32	91.7
Return-on-assets	6	2.00**	.71	0.36	76.9
Sales per employee	7	2.17**	.58	0.27	75
Cost based on direct labor hours	8	2.27	1.19	0.52	63.6
Sales revenue alone	9	2.42	1.24	0	58.3

Five-point scale used. 1=Very appropriate to 5=Not at all appropriate 0.05 ** $\alpha = 0.01$

As stated in section 6.1.5., long-term oriented finance measures such as *Return On Investments (ROI)*, *Return On Assets (ROA)*, *Return On Sales (ROS)*, *volume of business* and *revenue growth*, are more appropriate in a TQM environment ($\alpha = 0.01$). In addition being used to a large extent ($83\% < I_u < 93\%$), they are considered very appropriate ($77\% < I_a < 100\%$) in a TQM environment. Nevertheless, some short-term oriented finance measures are also used and considered appropriate in a TQM environment. These are *profits before tax* ($I_a = I_u = 92\%$) and *net profit* ($I_a = 75\%$, $I_u = 83\%$). These results are consistent with the perceived characteristics of TQM performance measures, which should be based on both financial and non-financial measures. *Sales per employee* was a financial indicator used in the US-GAC study. It is also used as a productivity indicator according to US-GAO. In that study, this indicator was considered appropriate as it is in this study.

Most of these measures seem to be related. Cronbach-alpha is somewhat high (.6852). It becomes even higher (.7993) when keeping for the analysis *Profits before tax*, *Return-on-investment*, *Revenue growth*, *Return-on-assets*, *Cost based on direct labor hours*.

6.2.6- Appropriateness of market-based measures by TQM adopters

Table 29- Appropriateness of market-based measures by TQM adopters

DESCRIPTION	Ranking by mean	Mean	Std dev	Coef. of variation	% of appropriateness 1 or 2
% of sales from new products	1	1.64**	.81	0.49	81.8
Absolute market share	2	1.92**	.79	0.41	75
Future market share	3	2.00*	1.21	0.61	75
Relative market share to largest competitors	4	2.08*	1.00	0.48	66.7

Five-point scale used: 1=Very appropriate to 5=Not at all appropriate * $\alpha = 0.05$ ** $\alpha = 0.01$

In general terms, the market-based measures are considered significantly appropriate ($\alpha \geq 0.05$) ($67\% < I_a < 82\%$). The *percent of sales from new products* is considered more appropriate ($I_a = 82\%$) than it is used ($I_u = 73\%$), which in a sense, is encouraging since it is still a new measure. The *absolute market share* seems to be considered appropriate as well.

Market-based measures could be summarized into two distinct groups of measures: one with *future market share* and *percent of sales from new products* (long-term and dynamic oriented), and second, *absolute market share* and *relative market share to largest competitors* (results and short-term oriented). As a matter of fact, Cronbach-alpha goes up from .6867 to .80 when the first group is not considered in the analysis.

Finally, no differences ($p > 0.1$) exist between the degree of appropriateness of these measures.

6.2.7- Appropriateness of customer-based measures by TQM adopters

Table 30- Appropriateness of customer-based measures by TQM adopters

DESCRIPTION	Ranking by mean	Mean	Std dev	Coef. of variation	% of appropriateness 1 or 2
Overall customer satisfaction	1	1.08**	.28	0.26	100
# of complaints	2	1.15**	.38	0.33	100
% on-time delivery	3	1.25**	.62	0.50	91.7
Average time for complaint resolution	4	1.31**	.48	0.37	100
Customer retention	5	1.42**	.79	0.56	83.3
Ave. lead time to respond to serv. calls	6	1.46**	.88	0.60	92.3
# of compliments	7	1.92*	.90	0.47	66.7

Five-point scale used: 1=Very appropriate to 5=Not at all appropriate * $\alpha = 0.05$ ** $\alpha = 0.01$

As in the case of the extent of use, all these measures are considered to be very appropriate (except number of compliments) depending on the degree of TQM implementation. These are the primary measures of performance and achievement for TQM adopters. It is no surprise to find the highest mean ratings (as low as 1.08) as well as index of appropriateness (100 %). The four main customer-based measures are either in terms of use or appropriateness. These are: *overall customer satisfaction, number of complaints, percent of on-time delivery, and Average time for complaint resolution.*

Contrary to the use (Cronbach-alpha = .1683), in the case of the appropriateness, these measures are quite related (Cronbach-alpha = .6284). Of course, no differences at all ($p < 0.1$) have been found in terms of appropriateness.

6.2.8- Appropriateness of quality of products/services-related methods by TQM adopters

Table 31- Appropriateness of quality of products/services-related methods by TQM adopters

DESCRIPTION	Ranking by mean	Mean	Std dev	Coef. of variation	% of appropriateness 1 or 2
Market research/customer survey	1	1.58**	.90	0.57	75
Quality reports	2	1.77*	1.17	0.66	84.6
Inspections	3	1.92*	1.00	0.52	75
External quality audits	3	1.92*	1.12	0.58	84.6
ISO 9000 Certification	4	2.00*	.94	0.47	60

Five-point scale used: 1=Very appropriate to 5=Not at all appropriate * $\alpha = 0.05$ ** $\alpha = 0.01$

Similar to the extent of use of these measures, aside from *ISO 9000 certification*, the index of appropriateness is high ($75\% < Ia < 85\%$). Nevertheless, all these methods are appropriate ($\alpha \geq 0.05$). Even ISO 9000 is considered appropriate although it is not very often used being a new standard in North America. And *external quality audits* is also considered very appropriate. It is understood that ISO 9000 is necessary to export to Europe and also a key factor of differentiation.

These measures are basically measuring the same thing (Cronbach-alpha = .9950) and no differences ($p > 0.1$) exist in term of appropriateness.

6.2.9- Appropriateness of use of methods related to quality of suppliers' products/services by TQM adopters

Table 32- Appropriateness of use of methods related to quality of suppliers' products/services by TQM adopters

DESCRIPTION	Ranking by mean	Mean	Std dev	Coef. of variation	% of appropriateness 1 or 2
Supplier audits/appraisals	1	1.82*	.98	0.54	81.8
Supplier certification	2	1.83*	1.11	0.61	91.7
ISO 9000 certification	3	2.08*	1.08	0.52	83.3
Random sampling	4	2.64	.92	0.35	45.5
International sampling plans	5	3.18	1.17	0.37	28.6
At source inspection	6	3.55	1.21	0.34	27.3
100% inspection	7	3.57	1.27	0.36	27.3

Five-point scale used: 1=Very appropriate to 5=Not at all appropriate

* $\alpha = 0.05$

Aside from *at source inspection*, the other three expected appropriate measures are felt very appropriate by TQM adopters. These are *supplier certification*, *ISO 9000 certification*, and *supplier audits/appraisals* ($82\% < I_a < 92\%$). Note that, although not often used now ($I_u = 42\%$), *ISO 9000 certification* is felt very appropriate ($I_a = 84\%$). And *random sampling*, which is used ($I_u = 64\%$) is not felt appropriate ($I_a = 45\%$).

Cronbach-alpha indicates that these methods for ensuring quality of suppliers' products/services are somewhat related ($\alpha = .5401$ without ISPAPP). Significant differences in terms of mean ratings have been found ($p < 0.01$) between these methods

6.2.10- Appropriateness of methods for tracking continuous improvement of employees by TQM adopters

Table 33- Appropriateness of methods for tracking continuous improvement of employees by TQM adopters

DESCRIPTION	Ranking by mean	Mean	Std dev	Coef. of variation	% of appropriateness 1 or 2
Monthly report	1	2.62	1.39	0.53	76.9
weekly report	2	3.62	1.50	0.41	30.8
daily report	3	3.85	1.46	0.38	23.1

Five-point scale used: 1=Very appropriate to 5=Not at all appropriate

$\alpha = 0.05$

As mentioned in 6.1.10, the only method considered appropriate for tracking continuous improvement of employees is *monthly reports* (1a-77%). Aside from that conclusion, these methods are related (Cronbach-alpha = .8780) and no significant differences have been found ($p=0.07$).

6.3- Continuous Improvement and Need for new PMs and PMS

92.3% (12 out of 13) of the respondents designed measures to assess failures/successes which encouraged meaningful continuous improvement in their organization. The following are the comments given by respondents.

- Measures have been established around the top 6 objectives of the company, as a whole. Site objectives, team goals, individual performance goals are methods used to stimulate continuous improvement.
- We (a service company) developed objectives and quality standards in each team.
- We (a manufacturing company) have 156 goals and strategies identified across all aspects of business.
- Measures can be based on vision indications by site & department, excellence models, qualitative lists of key actions.
- Some examples of such measures and methods are

in the domain of services: number of ideas implemented, customer satisfaction, turnover, re-work, capacity index, productivity, cost-of non-conformance, financial progress, excellence in team presentations, implemented good ideas for improving processes, customer retention and performance coaching.

in the domain of manufacturing: 6 sigma goal, A/P goal, supplier certification, customer certification, and measures related to customer satisfaction such as lead time, cycle time, inventory, ppm, scrap, % of on-time delivery, lead-time reduction, Taguchi methods, 5 Why theory, and hours of training / year / employee,

To conclude on performance measures and methods, a key denominator is the focus on customer satisfaction. According to a respondent, it is important to identify key measures then change them when necessary. Finally, another respondent reported that more important is the need to change goal/benchmark every year rather than changing measures and having key appropriate measures in non-production areas.

6.4- Link between usefulness and appropriateness

Table 34- Usefulness versus Appropriateness of PMs & PMS

DESCRIPTION	Mean for use	Mean appropriateness	% of respondents who use these PM and PMS (1 or 2)	% of appropriateness (1 or 2)
# of accidents	1.50**	1.80**	90	90
Employee satisfaction	1.54**	1.31**	92.3	100
# of lost work days	1.60**	1.70**	100	90
Conformance to quality	1.58**	1.50**	83.3	83.3
Defect rate	1.62**	1.46**	84.6	92.3
Profits before tax	1.50**	1.67**	91.7	91.7
Return-on-investment	1.62**	1.69**	92.3	84.6
# of complaints	1.15**	1.15**	92.3	100
% on-time delivery	1.33**	1.25**	91.7	91.7
Overall customer satisfaction	1.46**	1.08**	84.6	100
Market research/customer survey	1.67**	1.58**	83.3	75
Process Sequence Flow charts	2.54	1.62**	53.8	92.3
Pareto chart	2.08*	1.69**	76.9	92.3
Cause and effect diagram	2.23*	1.69**	69.2	92.3
Net profit	1.92*	1.67**	83.3	75
% of sales from new products	2.09*	1.64**	72.7	81.8
Absolute market share	2.08*	1.92**	75	75
Average time for complaint resolution	1.69*	1.31**	84.6	100

* $\alpha = 0.05$

** $\alpha = 0.01$

The five favored measures of TQM adopters are: *number of complaints, % on-time-delivery, overall customer satisfaction, profits before tax and number of accidents*. These PMs are mainly customer- and employee-oriented although somehow finance-oriented.

The five PMs considered most appropriate in a TQM environment are: *overall customer satisfaction, number of complaints, % on-time-delivery, average time for complaint resolution and employee satisfaction*. As the most used PMs, the appropriate PMs are customer- and employee-oriented. The degree of appropriateness for these measures was more than the degree of actual use. Other measures are also felt more appropriate than they are used. These are in the order from the most appropriate to the least: *conformance to quality, defect rate, market research/customer survey, process sequence flow charts, pareto chart, cause and effect diagram, net profit, % of sales from new products and absolute market share*.

Among often used PMs, although they are significantly used ($\alpha = 0.01$), they are felt less appropriate than used *number of accidents, number of lost work days, profits before tax, return-on-investment*.

6.5- Summary and benefits for other studies

PMS and PMs used and considered appropriate by TQM adopters are predominantly process-, long-term-, and customer-oriented. Financial PMs are still very often used and that is not necessarily contradictory with the TQM philosophy. As was noted in the PMS characteristics (Section 5.3), in a TQM environment, a balance must be maintained between financial and non-financial indicators.

CHAPTER 7- CONTINUOUS IMPROVEMENT OF PERFORMANCE MEASURES

A quality movement is never ending. As one of the steps of the TQM cycle, measures have to change and evolve over time. Therefore, the aim of this chapter is to understand the systems and the procedures which keep these PMs and PMS updated. More precisely, frequency of improvements are reported as well as the mechanisms of improvements, i.e. monitors, creators and updaters of PMs.

7.1- Frequency of improvements

Table 35- Frequency of updating measures related to the following domain:

Domain	Population	Quarterly	Half-yearly	Yearly	Every 2-3 years	Never
Quality of products/services	12	16.7%	16.7%	66.7%	0	0
Quality of suppliers' products/services	12	8.3%	16.7%	33.3%	33.3%	8.3%
Production-related	12	25.0%	16.7%	50.0%	8.3%	0
Employee-related	12	16.7%	16.7%	50.0%	8.3%	8.3%
Cost-based	12	8.3%	33.3%	41.7%	8.3%	8.3%
Productivity-based	11	18.2%	27.3%	36.4%	18.2%	0
Financial-based	11	18.2%	18.2%	36.4%	27.3%	0
Market-based	11	27.3%	27.3%	18.2%	27.3%	0
Customer-based	12	33.3%	25.0%	41.7%	0	0
Tracking continuous improvement	11	27.3%	18.2%	36.4%	9.1%	9.1%

Among ten identified areas where TQM has an impact, eight are updated yearly (36.4 to 66.7%). The most frequently updated are the domains of quality of products/services (66.7%), production (50%) and employee-relations (50%). The domain most frequently updated is the customer-related one. 100% of the respondents who answered (n=12) are either updating the customer-related indicators quarterly, half-yearly or yearly. On the contrary, improvements for quality measures of suppliers' products/services is from 1 to 3 years.

7.2- Mechanisms of improvements

In this section, we analyze as to who is responsible in creating, updating and monitoring such performance measures. The role of employee participation and training is analysed as well

Table 36- Monitors of performance measures

Monitor	Population	Yes
Middle management	13	92.3% (n=12)
Upper management	13	84.6% (n=11)
Supervisor	13	76.9% (n=10)
Employee	13	69.2% (n=9)
Cross-functional team	13	61.5% (n=8)
Employee-managed team	13	46.2% (n=6)
Specific department	13	38.5% (n=5)
Director of quality	13	38.5% (n=5)

The most frequent monitors are, by descending order, middle management (92.3%), upper management (84.6%), supervisors, employees, and cross-functional teams. It may be noted that the director of quality is in very few cases (38.5%) involved as a monitor. The same is true for specific departments and employee-managed teams.

Table 37- Creators/updaters of performance measures

Creators/updaters	Population	Yes
Middle management	13	92.3% (n=12)
Director of quality	13	61.5% (n=8)
Upper management	13	61.5% (n=8)
Cross-functional team	13	53.8% (n=7)
Supervisor	13	46.2% (n=6)
Specific department	13	46.2% (n=6)
Employee	13	38.5% (n=5)
Employee-managed team	13	38.5% (n=5)
Consultant	13	0

One group of creators/updaters is predominant: middle management. Although general monitors, upper management has less important role as creator/updater (61.5%). The director of quality is more involved (61.5%) as a monitor. A consultant is not at all considered as a creator/updater, nor are employees (38.5%), employee-managed teams

(38.5%), a specific department (46.2%) or supervisors (46.2%). Nevertheless, a manufacturing company underlined that natural workgroups or should identify quality & process indicators in order to improve continuously the overall quality of its products and services.

Three conclusions may be drawn:

- Middle management is a key player as creator/updater and monitor of performance measures. In the literature, it is stated that middle management is one of the barrier of TQM implementation. A succesful TQM implementation is dependent on the adherence of this level of management
- Upper management is also fairly predominant as both monitors and creators/updaters
- One could have expected a better score for the participation and role of employees and employee-managed teams as creators/updaters. However, the monitoring of performance measures is fairly decentralized at the employee level, and as one of the respondents reported, *"everyone of the work groups are involved in the updating process"*

Table 38- Employee participation and training in PMs

	Ranking by mean	Mean	Std dev	Coef. of variation	Agreed (2) to strongly agreed (4) in %
Employees participate in the maintenance of performance measures	1	1.69**	0.75	0.44	84.6
Training has resulted in creation of new performance methods/measures	2	1.77**	0.83	0.47	92.3
Training has resulted in creation of new performance indicators	3	1.92*	1.12	0.58	76.9

Five-point scale used: 1=Strongly agree to 5=Strongly disagree

* $\alpha = 0.05$

** $\alpha = 0.01$

Training is felt as a determinant factor for the creation ($\alpha = 0.05$) and maintenance ($\alpha = 0.01$) of performance measures. Although, employees are not always as involved as creators/updaters, it can be said that they to participate in the maintenance of performance measures ($\alpha = 0.01$).

As an example of quality training used by TQM adopters, one company enrolled its senior executives in Phil Crosby College, Florida in order that they understand the new mindset of TQM. This was followed by a 18-24 month training period by the Juran Quality Institute program at the business level managers which, then, began trainers of trainers, as a cascading effect. At the employee level, SPC training was used by the same company; this practice is consistent with the findings of the Aerospace study (ISTC, 1991) where SPC was cited as the most popular area for which training was planned. Finally, such a training program linked with programs for employee involvement, was considered by this company as an investment of 20 to 40 hours/employee/year. Also as ISTC (1991) reported, training encourages employee involvement by motivating and enabling employees to continuously improve. It was also noted in ISTC study that there was a strong need to increase the level of training in the industry and this lack of training is a major obstacle to quality improvement.

CHAPTER 8- DISCUSSION AND IMPLICATION FOR FURTHER RESEARCHS

8.1- Discussion

This thesis had two objectives. The first objective was to understand and measure the impact of TQM on company performance. Three research questions associated with this objective was : 1) Are there tangible improvements in company performance since TQM adoption ? 2) Are these improvements more of a financial performance, operating performance, employee relations or customer satisfaction nature ? 3) How long does it take for a company to realize these tangible benefits ? The second objective was to understand and identify the new performance measures and systems needed for measuring the impact of TQM. Five research questions were proposed to respond to this second objective : 1) What are the characteristics of performance measures and systems/methods that are perceived as most appropriate in a TQM environment? 2) To what extent are the traditional and TQM-related performance measures and systems/methods used by TQM adopters? 3) To what extent are these traditional and TQM-related performance measures and systems/methods perceived appropriate for assessing the impact of TQM on company performance? 4) How frequently are these performance measures/systems reviewed and improved upon by TQM adopters? 5) What are the mechanisms used to design new performance measures systems by TQM adopters? In general terms, the two objectives have been achieved. More precisely, a response to each research question was obtained

First, regarding the four domains of company performance studied, all of them were improved and, by decreasing order, better employee relations (improved employee participation and morale), improved operating procedures (improved products & services quality, processes and productivity, and reduced errors/defects), greater customer satisfaction (reducing customer complaints), and better financial results (increased profitability). These findings are consistent with an assumption of both Armitage (1992) and the US-GAO study (1991): *TQM is positively and highly correlated with superior*

operating and financial performance. Third, these tangible benefits were felt, on average, 33.3 months *after TQM adoption*, with a minimum of 6 months to a maximum of 96 months. This finding is consistent with the literature which states that first outcomes do not show up before 1 to 3 years after the first TQM initiatives (Hutton, 1992).

Regarding the second objective the findings reported that the expected TQM-oriented characteristics of PMs and PMS are perceived appropriate and the traditional ones are not felt appropriate. In other words, PMs & PMS are less financially and more process-oriented in a TQM environment. For example, it seems that *translating the company's critical success factors into only financial terms* is not appropriate, what is appropriate is to have *both financial and non-financial indicators*. Nevertheless, some findings contradict previous literature. Namely, characteristics *driven from the top down* were expected to be felt very appropriate and they were not. Regarding the extent of use and appropriateness of the traditional and TQM-related performance measures and systems/methods found in a TQM environment, the findings reported that PMS and PMs used and appropriate by TQM adopters are predominantly process-oriented (*process sequence flow charts, pareto chart, cause and effect diagram*), long-term-oriented (*market research/customer survey, % of sales from new products and absolute market share*), and customer-oriented (*number of complaints, % on-time-delivery, overall customer satisfaction*). Financial PMs (*profits before tax*) are still very often used which is not necessarily in contradiction with the TQM philosophy. As was underlined in the PMS characteristics, in a TQM environment, a balance must be found between financial and non-financial indicators.

These performance measures/systems are reviewed and improved by TQM adopters, in most cases, on an yearly basis, especially in the areas of quality of products/services, production and employee-relations. The area most frequently updated (quarterly to yearly) is the customer-related one. Contrary to this domain, the frequency of

improvements for quality measures of suppliers' products/services is mainly yearly to 2-3 years.

The mechanisms used to design new performance measures and systems by TQM adopters are based on employee training and employee involvement, since they are involved as monitors and, in some cases, as creators/updaters of PMs. Concurrent with the literature, middle management is a key player as creators/updaters and monitors of performance measures. They are crucial to a successful implementation. It should be reiterated that this level of management is also considered to be one of the barriers of TQM implementation (Gander M.J. and Hossain N., 1991). Upper management is also fairly predominant as both monitors and creators/updaters.

To finish with PMs, almost every company (84.6%, 11 out of 13) confirmed that there is still a need for new performance measures. The reasons cited are:

- The system is dynamic; the need for "change" is constant. Measurement may be required to change.
- Need to update appears as system matures.
- Utility of measures changes over time, toward needs for greater details and process emphasis.
- As the customer requests it. As the requirements change, so will measures.

As a simple affirmation of the need for new performance measures, a service company made the following remark: *"if you can't measure it, you can't improve it"*

Other comments about performance measures in a TQM environment were also made by respondents. For example, although measures are part of the TQM cycle (what gets measured gets done), a pitfall to be avoided is *overmeasure*. Hence, key indicators need to be designed. It is also important that measures/indicators be flexible and used for feedback and reinforcing. They are always evolving and never perfect. Also, a key as to how performance measures fit into the broader TQM picture is to have them focus on

employees. Second, awards such as the Canada Business Excellence Award, International Award or the International Quality Award seem to be important to companies as a way to be recognized as Quality-oriented and leaders in their business.

8.2- Further Research Implications

Regarding the impact of TQM on company performance, it is now proven in qualitative terms that TQM has a positive impact on customer satisfaction, employee relations, operating procedures and financial results. There is still an important area of research regarding quantitative impacts. A survey of key indicators on each domain of performance should be undertaken over a suitably long time period, i.e five years, to include before and after TQM adoption.

In this study, most of the respondents were from manufacturing. Therefore, conclusions are especially valid for manufacturing industry. However, a similar study might be done making a comparison between manufacturing and service companies in terms of use and appropriateness of PMs and PMS studied in this thesis.

CONCLUSION

This study provides hard facts on the positive impact of TQM on company performance. The extent of use and the appropriateness of most performance indicators either traditional or TQM-oriented are known. These conclusions provide a useful insight on the practices in terms of performance measures by the most recognized TQM adopters in Canada (Xerox, Northern Telecom, Texas Instrument, Avco Financial services to name a few). These findings will help academics, consultants, federal departments such as ISTC and firms alike to support and promote TQM in Canada.

Regarding limitations, one might notice the small size of the sample. This is only small when speaking of real numbers. Yet, 14 from a population of 19 TQM finalists from the Canada Awards for Business Excellence is large, i.e. a 74% of the population has been studied. The only limitation is the generalizability to any company in Canada. The results of this study are only valid for TQM adopters and give an indication of what performance can be achieved by companies that embark on a successful TQM program.

Finally, the researcher feels that other studies such as a longitudinal one on the impact of TQM on company performance or a comparative study of PMs & PMS between manufacturing and service companies will be undertaken.

REFERENCES

Andersen Consulting, "Quality Management, Winning in the 1990's", 1992.

Armitage Howard M., "Quality Pays", CGA Accounting, pp. 30-37, January 1992.

Ashton and Cook, "Time to Reform Job Shop Manufacturing", Harvard Business Review, pp. 106-111, March-April 1989.

Atkinson A.A., "Accounting system for quality", CMA Magazine, p 15, Vol 64 n° 1, February 1990.

Atkinson A.A., "Activity costing and efficiency", CMA Magazine, p 8, Vol 64 n° 5, June 1990.

Atkinson A.A., "Special Quality Control Tools", CMA Magazine, p 25, Vol 64 n° 9, November 1990.

Badiry A.B., "A System Approach to Total Quality Management", Industrial Engineering, pp. 33-35, March 1990.

Band W. & Huor R., "Quality & Functionality Equal satisfaction", Sales & Marketing Management in Canada, pp. 4-5, Vol 31 n° 3, March 1990.

Beheiry Mohamed F., "New Thoughts on an Old Concept: The Cost of Quality", CMA Magazine, pp. 24-25, June 1991.

Benson Tracy E., "The Gestalt of Total Quality Management", Industry Week, pp. 30-32, Vol 240, July 1, 1991.

Benson Tracy E., "Quality Goes International", Industry Week, pp. 54-56, Vol 240, August 19, 1991.

Benson Tracy E., "Challenging Global Myths", Industry Week, pp. 13-24, Vol 240, October 7, 1991.

Chaffman B.M. & Talbott J., "Activity-Based Costing, in a service organization", CMA Magazine, pp. 15-18, Vol 64 n° 10, December/January 1991.

Chao-Hsien Chu, "Pervasive Elements of Total Quality Control", Industrial Management, pp. 30-32, Sept/Oct 1988.

Cleghorn J. H., "A Nation At Risk", Canadian Business review, pp. 28-30, Autumn 1991.

Convey S., "Eliminating Unproductive Activities and Processes", CMA Magazine, pp.20-24, Vol 65 n° 9, November 1991.

Crosby Philip, "Quality is Free", Mc Graw Hill, 1980.

Cross K.F. & Lynch R.L., "For Good Measure", CMA Magazine, pp. 20-23, Vol 66 n° 3, April 1992.

Derrick F.W. and al., "Survey shows Employees at Different Organizational Levels Defines Quality Differently", Industrial Engineering, pp. 22-27, April 1989.

Farquhar Carolyn R. & Johnston Catharine G., "Total Quality Management: A Competitive Imperative", The Conference Board of Canada Report, October 1990.

Feigenbaum, A.V. , "Total Quality Control", Mc Graw-Hill, New York, third edition, 1983.

Fisher K. & Spillane J.A., "Quality and Competitiveness: Behind the Technology, it is People Who Bring about Real Quality Improvement", Training And Development, pp.19-24, Vol 45 n° 9, September 1991.

Gaither Norman, "Production and Operations Management, a problem-solving and decision-making approach", 4th edition, p. 527, 1990.

Gander M.J. and Hossain N., Winona State University, "The Transformation to Total Quality Management: Issues and Problems", The Production/Operations Management Society Annual Meeting, New York City, Nov. 1991.

Garvin, D.A., "What does 'Product Quality' Really Mean", Sloan Management Review, Fall, pp. 25-43, 1984.

Garvin A. David, "Competing on the Eight Dimensions of Quality", Harvard Business Review, pp. 101-109, Nov/Dec 1987.

Garvin A. David, "How the Baldrige Award Really Works", Harvard Business Review, Vol 69, pp. 80-93, November-December 1991.

Garvin A. David, "David A. Garvin Responds: The Article Is The Real Rorschach Test", Harvard Business Review, Vol 70, pp. 128-129, January-February 1992.

Gerwin D., "Do's and don'ts of computerized manufacturing", Harvard Business Review, pp. 107-116, March-April 1982.

Green F.E., "When Just-In-Time Breaks Down On The Line", Industrial Management, pp. 26-29, January-February 1989.

Grenier Ann C., "Quality Counts", Technology Review, pp. 19-20, Vol 93 n° 5, July 1990.

Harrington and Rieker W.S., "Quality Control Circles", the journal of quality and participation, p.8, March 1988.

Harvard Business Review, "How One Company used a Daily financial Report to Improve Quality", Harvard Business Review, p. 78, Vol 70, January-February 1991.

Harvard Business Review, "Does the Baldrige Award Really Work ?", Harvard Business Review, Vol 70, pp. 126-147, January-February 1992.

Hutton W. David, "A Quality Approach: An Introduction to Modern Strategies for Improving Quality, Service and Productivity.", A briefing paper for the Prosperity Initiative Quality Conference, 22-23 June 1992.

IFS Conferences, "Tools and Techniques for TOM, Proceedings of the 1st conference," edited by Dr. B.G. Dale, IFS Ltd, November 1989.

I.S.T.C. (Industry, Science and Technology Canada), "Canadian Aerospace Industry Total Quality Survey Report 1991", 1991."

I.S.T.C., "ISTC Quality Strategy", January 1992.

I.S.T.C., "Entry Guide 1992", Canada awards for Business Excellence.

Johnson T.W. and Manoocheheri G.H., "Adopting JIT; Implications for Worker Roles and Human Resource Management", Industrial Management, pp. 2-6, May/June 1990.

Johnston C.G., "Globalization: Canadian Companies Compete", Conference Board of Canada Report, February 1990.

Johnston C.G. & Daniel M. J., "Customer Satisfaction Through Quality. An International Perspective", Conference Board of Canada Report, October 1991.

Johnston C.G. & Daniel M. J., "Quality: An International Perspective. Customer Satisfaction Through Quality", Canadian Business Review, pp. 12-15, Winter 1991.

Juran J.M., "Juran's Quality Control handbook", Fourth edition, Mc Graw Hill Company, 1988.

Juran J.M., "Juran on Planning for Quality", The free Press, New York, 1988.

Kochler K.G., "Quality Cost Less", CMA Magazine, p. 26, Vol 64 n° 8, October 1990.

Kochler K.G., "Time Cost Analysis", CMA Magazine, p. 16, Vol 66 n° 4, May 1992.

Lee J.Y. & Engehard S L., "Motivating and measuring service performance", CMA Magazine, pp. 30-33, Vol 66 n° 1, February 1992.

Loewe D.A., "Quality Management at Weyerhaeuser", Management Accounting, pp. 36-41, August 1989.

Malcolm Baldrige National Quality Award, "1992 Award criteria", 1992.

Masaaki Imai, "KAIZEN, The Key to Japan's Competitive Success", Mc Graw-Hill, 1986.

Main Jeremy, "Is the Baldrige Overblown?", Fortune, pp.62-65, Vol. 124, July 1, 1991.

Mc Bride V.E., "In Today's Market, Quality is Best Focus for Upper Management.", Industrial Engineering, pp. 50-55, July 1986.

McNair C.J. & Carr L., "Toward Value-added management accounting", CMA Magazine, pp. 26-28, Vol 65 n° 3, April 1991.

Miller John A., "Tools and Techniques -A Current Responsibility", CMA Magazine, p. 34, Vol 66 n° 1, February 1992.

Miller John A., "The new activity performance measures", CMA Magazine, p. 34, Vol 66 n° 3, April 1992.

Miller William H., "Quality Pays! GAO study confirms it -with convincing numbers", Industry Week, Vol. 240, p. 96, June 17, 1991.

Moir P.E., "Profit by Quality, The essentials of industry Survival", Hellis Horwood Ltd, 1988.

Moskal Brian S., "Mysteries Remain for Management", Industry Week, p. 53, Vol 240, July 15, 1991.

Noori H., "Competitiveness Through Quality", from "Managing the Dynamics of New Technology", pp 173-188, 1990.

Noori and Radford, "Reading 3.1- The Strategic Advantages of New Manufacturing Technologies for Small Firms", from "Readings and Cases in The Management of New Technology, An Operation Perspective", pp. 81-89, 1990.

Noori and Radford, "Reading 3.2- Technology Transfer: Challenges Facing Smaller Companies", from "Readings and Cases in The Management of New Technology, An Operation Perspective", pp. 91-97, 1990.

Northey P., "Cut total costs with cycle time reduction", CMA Magazine, pp.19-22, Vol 65 n° 1, February 1991.

Oakland J.S., "Total Quality Management", Heinemann Professional Publishing, 1989.

Papadopoulos N. & Heslop L., "The Image of Canadian Products Abroad", Canadian Business Review, Winter 1989.

Pfau L.D., "Total Quality Management Gives Companies A Way To Enhance Position In Global Marketplace", Industrial Engineering, pp. 17-18, April 1989.

Puri Subhash C., "ISO 9000 Certification and Total Quality Management", Standards-Quality Management Group, Ottawa and Washington D.C., 1992.

R.Z., "Cost of Quality: Yes, You Can Measure It", Training, pp. 62-63, Vol 27 n° 8, August 1990.

Revelle, Jack B., "Training Programs Ensure Improvements in Quality Levels", Industrial Engineering, p.68, July 1986.

Roches L., "Zero Defects Program Ensures Total Product Quality for Consumer Electronics Manufacturer", Industrial Engineering, pp 32-33, February 1988.

Rogers H.G., "Quality: An International Perspective. Practicing What We Preach", Canadian Business review, pp. 16-18, Winter 1991.

Ross Gerry, "The Revolution in Management Control", CMA Magazine, pp. 8-13, Vol 64 n° 8, October 1990.

Schonberger R., "Japanese Manufacturing Techniques", the Free Press, 1982.

Sharman Paul, "A Practical look at activity-based costing", CMA Magazine, pp.8-12, Vol 64 n° 1, February 1990.

Sharman Paul, "A Tool kit for Continuous Improvement", CMA Magazine, pp.17-20, Vol 66 n° 4, May 1992.

Shetty Y.K., "Product Quality and Comparative Strategy", Inside Guide, p. 37, Spring 1988.

Shetty Y.K., "Strategies for U.S. Competitiveness: A Survey of business Leaders", Business horizons, Vol 34, pp.43-47, November-december 1991.

Tausz Andrew, "Quality Canada", Canadian Banker, Vol. 99 n° 5, pp. 22-24, September-October 1991.

Tremblay Gerald, "Minister of Industry & Commerce", Le Devoir, April 13, 1991.

United States General Accounting Office (US GAO), "Management Practices. U.S. Companies Improve Performance Through Quality Efforts", National security and International Affairs Division, May 1991.

William Kathy, "TQM Improves Companies' Performance", Management Accounting, p. 14, August 1991.

Whittaker B., "Quality: An International Perspective. The Path To Excellence", Canadian Business Review, pp. 19-21, Winter 1991.

Young Andrew, "Conference on TQM and JIT", Best Western Barons Hotel, Ottawa., June 12, 1992.

Young Andrew, Personal Interview at Northern Telecom, Ottawa, June 15, 1992.

APPENDIX 1

THESIS MEETINGS

INTERVIEWS ALREADY DONE (July 31,1992) :

Montréal:

-Dr Joseph KELADA, Directeur du centre sur la qualité totale, Hautes Etudes Commerciales (HEC), Université de Montréal.

-Andersen Conseil: Annie Sébastien, Consultant in Quality Management.

Ottawa:

-I.S.T.C. , Sandra Scissons: Business Awards officer, Canada Awards for Business Excellence, Services to Business Branch.

Jean Régnier: Manager, Innovation Services, Services to Business Branch.

Mr. Smith, Director, Services to Business Branch.

-Ernst & Young: M. Laren Stadelman, Management Consultant.

-David Hutton & Associates: David W Hutton, Consultancy in Quality Management. Institute For Quality Assessment's Member.

INTERVIEWS SCHEDULED (August 1992):

Montréal:

-Association Québécoise de la Qualité.
-Centre de la Qualité Totale, HEC.

Ottawa:

-I.S.T.C.

Darlene Cherry: Manager, Canada Awards for Business Excellence, Services to Business Branch.

-Consultant in TQM....

Napanee, Ontario:

-Good Year: Terry Graber, Quality Service Manager.

APPENDIX 2

Garvin (1984), in an attempt to overcome some of the ambiguity and misunderstanding, has categorized five definitions of quality:

1. **Transcendent Definition:** Quality (like beauty) cannot be precisely defined; it is a universally recognized concept pertaining to excellence.
2. **Product-Based Definition:** Quality refers to the degree or quantity of some attribute contained within the product.
3. **User-Based Definition:** Quality refers to the degree to which a product satisfies customer wants.
4. **Manufacturing-Based Definition:** Quality means conformance to the required specifications.
5. **Value-Based Definition:** Quality refers to providing a product with acceptable quality at a reasonable price.

APPENDIX 3

The eight dimensions of quality according to Garvin (1987) are:

1. **Performance:** Refers to a product's primary operating characteristics. In service businesses, performance often means prompt service. This dimension of quality involves measurable attributes.
2. **Features:** This second dimension of quality is often a secondary aspect of performance. Features are those characteristics that supplement their basic functioning, they involve again objective and measurable attributes; objective individual needs, not prejudices, affect their translation into quality differences.
3. **Reliability:** This dimension reflects the probability of a product malfunctioning or failing within a specified time period.
4. **Conformance:** A related dimension of quality is conformance, or the degree to which a product's design and operating characteristics meet established standards. Specifications are normally expressed as a target or "center"; deviance from the center is permitted within a specified range, or tolerance band. therefore, there is little interest in whether specifications have been met exactly.
5. **Durability:** A measure of product life, durability has both economic and technical dimensions. It may be defined as the amount of use one gets from a product before it breaks down and replacement is preferable to continued repair.
6. **Serviceability:** The speed, courtesy, competence, and ease of repair.

The final two dimension of quality are the more subjective:

7. **Aesthetics:** How a product looks, feels, sounds, tastes, or smells- is clearly a matter of personal judgement and a reflection of individual preference. On this dimension, it is impossible to please everyone.

8. Perceived quality: Consumers do not always have complete information about a product's or service's attributes; indirect measures may be their only basis for comparing brands. Reputation is the primary stuff of perceived quality.

APPENDIX 4

DEFINITIONS OF QUALITY according to the Quality finalists of the 1989 Canada awards for Business Excellence.

AMP of Canada, Ltd.	To provide error-free products and services on time
Avco Financial Services Canada	Quality= People + Attitude
B.C. Tel	Quality is meeting the requirements and expectations of our customers. This means: <ul style="list-style-type: none">- doing right things right the first time- doing it promptly- doing it competently- doing it with a positive attitude- doing it better than the competition
Nexus Engineering Corp.	Measures the quality of its manufactured head end products by the annual average percentage of products returned by customers to Nexus for repairs.
Reimer Express Lines Ltd.	To provide error-free services to our customers by meeting requirements and performing our tasks right the first time.
Xerox Canada Ltd.	To provide our internal and external customers with innovative products and services that fully satisfy their requirements.

APPENDIX 5

TQM principles, core values and concepts (Malcolm Baldrige National Quality Award, 1992)

* **Customer-Driven Quality:** An essential attribute of TQM is the general understanding that the customer is the final arbitrator of quality. TQM is based on the premise that quality is driven by and defined by the customer. Product and service attributes that create a perception of quality on the part of the customer will increase customer satisfaction and, ultimately, increase customer demand.

* **Strong Quality Leadership:** It is the key attribute of TQM. Many of the management practices and principles that are required in a TQM environment may be contrary to long-standing practice. Only a strong leadership team focused on quality improvement can overcome the inevitable inertia and resistance to change by creating clear quality goals and developing the systems and methods for achieving these goals.

* **Continuous Improvement,** a fundamental attribute of TQM, arises from a philosophy that all business operations and work activities can be done more efficiently. It requires the development of a management approach that encourages identifying and seizing on-going opportunities to improve. A useful model for quality improvement activity (suggested by Deming) is the Plan-Do-Check-Act (PDCA) cycle or the Deming wheel (see appendix 7). This suggests following a sequence of events to improve the end-result and then to ensure continued improvement (Moir, 1988).

* **Fast Response:** Meeting customer requirements and expectations and success in competitive markets increasingly demand ever shorter product and service introduction cycles and more rapid response to customers.

* **Design Quality and Prevention:** Excellent design quality may lead to major reductions in "downstream" waste, problems, and associated costs. Also, the strategy for eliminating error and waste is based upon prevention rather than detection.

* **Long Range Outlook:** achieving quality and market leadership requires a future orientation and long-term commitments to customers, employees, stockholders, and suppliers. a key part of the long-term commitment is regular review and assessment of progress relative to long-term plans.

* **Action Based on Facts, Data, and Analysis or Management by Facts:** Another important attribute is a willingness to measure quality constantly and to identify and correct conditions causing poor quality. TQM is predicated on decision-making that uses reliable information and analysis. A number of statistical techniques have been adopted to support this process.

* **Employee Participation and Total Involvement:** TQM environments allow all employees to participate in helping achieve organizational quality goals. All employees are held accountable for quality and are given tools and training to fulfill this responsibility. TQM is based on the assumption that the employees closest to a particular organization's daily operating procedures are in the best position to understand and improve the quality of those procedures (i.e. quality at the source).

* **Partnership Development and Integration of Effort.** The product a customer receives is the result of many separate processes strung together in a complex chain (i.e internal customers). the interconnected nature of processes means that no part of the process can work in isolation by simply handing off the result to the next stage (Johnston & Daniel, 1990). Companies should seek to build internal and external partnerships, serving mutual and larger community interests .

*** Public Responsibility:** TQM promotes public responsibility. This approach rejects the notion that companies exist only to make profit, and that their actions in pursuit of profit should be constrained only by the law. Rather, a company -any organizations- is seen as a part of society, with important responsibilities to its employees, customers, suppliers, and the communities in which it operates, as well as shareholders.

APPENDIX 6

Malcolm Baldrige National Quality Award Criteria (1992)

The core values and concepts (see appendix 11) are embodied in seven categories, each category differently weighted according to its importance to TQM as follows:

- Leadership (9%)
- Information and Analysis (8%)
- Strategic Quality Planning (6%)
- Human Resource Development and Management (15%)
- Management of Process Quality (14%)
- Quality and Operational Results (18%)
- Customer Focus and Satisfaction (30%)

*** Leadership (90 points)**

The leadership category examines senior executives' personal leadership involvement in creating and sustaining a customer focus and clear and visible quality values. Also examined is how the quality values are integrated into the company's management system and reflected in the manner in which the company addresses its public responsibilities.

*** Information and Analysis (80 points)**

The information and analysis category examines the scope, validity, analysis, management, and use of data and information to drive quality excellence and improve competitive performance. Also examined is the adequacy of the company's data, information, and analysis system to support improvement of the company's customer focus, products, services, and internal operations.

*** Strategic Quality Planning (60 points)**

The strategic quality planning category examines the company's planning process and how all key quality requirements are integrated into overall business planning. Also examined are the company's short- and longer-term plans and how quality and performance requirements are deployed to all work units.

*** Human Resource Development and Management (150 points)**

This category examines the key elements of how the company develops and realizes the full potential of the work force to pursue the company's quality and performance objectives. Also examined are the company's efforts to build and maintain an environment for quality excellence conducive to full participation and personal and organizational growth.

*** Management of Process Quality (140 points)**

This category examines the systematic processes the company uses to pursue ever-higher quality and company performance. Examined are the key elements of process management, including design, management of process quality for all work units and suppliers, systematic quality improvement, and quality assessment.

*** Quality and Operational Results (180 points)**

This category examines the company's quality levels and improvement trends in quality, company operational performance, and supplier quality. Also examined are current quality and performance levels relative to those of competitors.

*** Customer Focus and Satisfaction (300 points)**

This category examines the company's relationships with the customers and its knowledge of customer requirements and the key quality factors that determine marketplace competitiveness. Also examined are the company's methods to determine customer satisfaction, current trends and levels of satisfaction, and these results relative to competitors.

APPENDIX 7

SPC's TOOLS (from IFS Conferences, 1989.)

1) The basic tools of SPC.

Aim: understanding a process such that it can be improved in a systematic way. Seven Ishikawa tools have to be used in this order:

* **Process Sequence Flow Charts (PSFL):** What is the process, i.e. not what we think or what somebody tells us - but fact; if we don't know all the stages of a process, how can we begin to improve it?.

* **Checklists:** How are we doing at each of the stages of the process? Use a simple data collection technique to tell us how often what goes wrong - again we need the facts.

* **Histogram.** How can we get a meaningful picture of all this data? Numerical data alone does not highlight important aspects of the data. A histogram displays the spread of the data.

* **Pareto chart.** Which problem should we work on first? the pareto chart allows us to separate the vital few from the trivial many, sometimes called the 80/20 rule.

* **Cause and effect diagram** (also called the fishbone diagram). Using the brainstorming principle and teamwork approach let's ask what factors may possibly be causing the problem? Also related to the 5 whys.

* **Scatter diagram.** It may be used to verify suspected relationships i.e. confirm whether there is or not any relationship.

* **Control charts** may be used to monitor the output from a process.

Results: The capability of the process may be increased as special cause disturbance factors disappear and random cause variability is reduced.

2) The seven new Q.C. tools.

Aim: Become proactive rather than reactive in order to predict latent customer needs and then, in response, not only meet them but exceed them.

* **The relations Diagram method:** This is a technique to endeavor to logically relate complex cause and effect relationships. (Similitude to fishbone diagram)

* **K J method / affinity diagram:** This technique attempts to give some order to verbal data by collation into similar categories, such that it may then be analyzed systematically.

* **The systematic diagram method:** This technique enables the most appropriate and effective means of planning to accomplish given objectives. It may also be referred as a Systems Flow or Tree Diagram.

* **The matrix diagram method:** This technique clarifies spots through multidimensional thinking. It identifies corresponding elements involved in a problem situation or event. These elements are arranged in rows and columns on a chart that shows the presence or absence of

relationships among collected pairs of elements (i.e. tasks, functions or characteristics).

* **Matrix data-analysis method:** It arranges the data presented in a matrix diagram so that the large array of numbers can be easily seen and comprehended. this representation shows clearly the strength of relationships between variables.

* **PDPC (Process decision Program Chart):** This method helps us select the best processes to use to obtain desired results, by evaluating the progress of events and various conceivable outcomes.

* **The arrow diagram method:** This method establishes the most suitable daily plan for a project and monitors its progress efficiently.

Figure- A relationship between TQC, Quality System and Application of Various Quality Techniques

Source: Noori H., "Managing the Dynamics of New Technology, p.187, 1990.

Behind the TQC concept (see figure above) which is software-oriented, specific techniques have been developed and applied by Japanese firms such as Statistical Process Control (SPC), Quality Circles (QC), Taguchi Methods (TM), Quality Function Development (QFD), Constant Growth Inspection (CGI), Quality Loss Function (QLF), and Quality of Work Life (QWL). (Noori, 1990). At the TQM level, self-directed team works is also an other important tool (Benson, 1991).

The two main techniques behind the TQC concept are SPC and QFD. Statistical quality

control (SQC) methods¹ include both statistical and non-statistical tools (SPC). For example a statistical tool is the acceptance sampling which is used to accept or reject a finished lot of production (Revelle, 1986; Atkinson, 1990). This tool is less and less used. SPC's tools are also known as the seven basic Ishikawa tools of Cause and effect diagrams, histograms, pareto analysis, Checklists, scatter and control graphs (IFS Conferences, 1989) which aim to trace problems to their roots and eliminate them (Grenier, 1990). Therefore, those tools permit to prevent quality defects and improve the quality level. These tools have been the favorites of Quality Control staff as well as of Quality Control circle members, largely because there are easy to understand. No one doubts that these tools will continue to be used extensively. There are also the seven new Quality Control tools of affinity diagram, relations diagram, tree/systems diagram, matrix data analysis, process decision program chart, arrow diagram, to the more advanced tools such as design of experiment and Taguchi methods. These tools promote a new more creative and effective approach to quality planning and project management. Nevertheless the seven new tools should not be seen as better than the original seven tools and there is a possibility of creating a new fad if their true usage is not understood. Nevertheless, there is a need for these more advanced tools because Quality Control has entered a new era of development. These new tools will permit quality thinking to be pro-active rather than re-active as far as, now, it is necessary to predict latent customer needs and then, in response, not only meet them but exceed them (IFS Conferences, 1989). Brief definitions of these tools are provided below.

QFD, Quality Function Deployment is a planning methodology for translating customer needs and expectations into appropriate company requirements. It aims to improve customer satisfaction with the quality and functionality of the company's product designs. The intent of QFD is to incorporate the "voice of the customer" into all phases of the product development cycle (from research and development to engineering, manufacturing, marketing, sales and distribution) through production and into the market place. QFD is also referred as the "house of quality" (Band & Huot R., 1990; IFS Conferences, 1989).

¹ It is useful to distinguish 'Methodologies' from 'Tools'. Methodologies can be defined as a series of sequenced steps which translate the 'What is to be achieved' in a quality strategy in 'How to Achieve it'. Generally tools are used to facilitate the 'Hows defined by a methodology (IFS Conferences, 1989).

APPENDIX 8 **PDCA CYCLE OR DEMING WHEEL.**

Moran² (1991) stated that the PDCA cycle (Plan, Do, Check, and Act) is used to make a plan to change the process, do it, check it, and act if further corrections are needed.

Once you have made a successful change, you standardize it with the SDCA cycle to hold onto the gains.

² Moran John W., Jr., "Leading the Organization to Perfection Through Daily Management", *National Productivity Review*, pp. 369-378, Summer 1991.

APPENDIX 9

QUALITY COST MEASUREMENT

In order to facilitate an awareness of the importance of Quality, it is essential to understand the costs involved in achieving (or more notably, not achieving) perfect quality. Quality costs are typically broken down into four categories (Juran, 1988;Oakland, 1989;Noori, 1990):

1. Prevention costs: these are costs incurred in an effort to minimize future quality planning and management, training, quality information systems, and process controls.

2. Appraisal costs: These are the costs incurred to determine the quality level of a product, the bulk of which include inspection and testing costs.

3. Internal failure costs: These are the costs incurred when substandard quality products are produced but are discovered before being shipped to the customer. These costs include scrap, rework, repair, and retest costs.

4. External failure costs: These are the costs incurred after a defective product has been shipped to the customer, including the costs of answering complaints, returns, warranty charges, product liability charges, and most important, the future cost of lost business.

These costs have been summarize in the exhibit below which represents a classification of these costs according to direct or indirect costs and quantifiable or nonquantifiable costs. Moreover, measuring the true cost of quality is very difficult. In practice, while many of the cost (for example, the labor and material components of rework and scrap) are quantifiable, others such as the poor image and loss of business associated with selling inferior products are difficult to quantify.

	Direct	Indirect
Quantifiable	Ineffective capacity utilization Scrap and rework Price discounts Training programs Returned products Complaints handling Lawsuits Value analyses and audits Resources expended testing competitors' products	Returning material to suppliers Idle Time Downtime Inefficient system Resources expended to improve firm's low quality image Insurance premiums Effects of faulty inputs
Nonquantifiable	Lower motivation Subcontracting Lost sales Lower product flexibility Poor product design Poor process design No information sharing Diverting resources to counteract lower quality	Poor choice of suppliers High inventory Lower prestige Organizational restructuring Planning/scheduling changes Lower borrowing power Lower entry barriers

Source: Adapted from Kaeling, 1987 IIE Integrated Systems Conference. Copyright, Institute of Industrial Engineers, (Noori, 1990)

APPENDIX 10

OPERATING PERFORMANCE INDICATORS

(Definitions and measurements according to the U.S. GAO study)

Reliability of products and services refers to their freedom from error or breakdown while in use by the customer. Reliability is measured by the number of claims filed or recalls on an annual basis or by other indicators unique to a particular industry.

Timeliness of delivery is defined as the percentage of on-time delivery.

Order-processing time measures the amount of time required to respond to a customer's request or order.

Errors or defects identified during the "production" of the product or service usually are measured by companies in parts per thousand or million units or other measures unique to their industry.

Product lead time (also known as cycle time) is defined as the period of time in years from design of a new product or service until it is available to the customer.

Inventory turnover is defined as the cost of goods sold divided by the average yearly inventory (average of 5 times a year).

The costs of quality are essentially the cost of quality failure or defects (lost profits, rework, and scrap) or the cost of trying to avoid them (inspection, testing, and training). See appendix 5 above.

Cost savings from quality improvement efforts mainly come from suggestions to improve products and services to satisfy customers. In the case of the Baldrige winners, in USA, the average annual cost savings attributed to employees' suggestions ranged from \$1.3 million to \$116 million per year.

EMPLOYEE-RELATED INDICATORS

Employee satisfaction is measured by periodic company survey of employee attitudes toward their work. Each company survey devised a satisfaction index.

Employee turnover is defined as voluntary separations as a percentage of total employment.

Safety and health rates are measured by lost work days due to occupational injury and illness per 100 full-time employees and number of accidents.

APPENDIX 11

List of the Quality Winners and Quality Certificates of Merit of the Canada Awards for Business Excellence, ISTC.

The list includes information about the population sample for the present study, both at the organizational and individual level.

Winners

1992

General Motors of Canada Ltd.
Windsor Trim Plant
1600 Lauzon Road
Windsor, Ontario
N9A 6R9
Plant Manager:
Wayne Strong
Tel: (519) 251-1211
Fax: (519) 251-1278
Contact: As above

Texas Instrument Canada Ltd.
Materials and Controls Group
280 Centre Street East
Richmond Hill, Ontario
L4C 1B1
Managing Director:
Richard D. Dane Jr.
Tel: (416) 770-2260
Fax:
Contact: G.W. Kingma
Chief Technical Officer
Tel: (416) 770-2256
Fax: (416) 884-7739

Certificates of Merit

Cadet Uniform Services
3370 Dundas Street West
Toronto, Ontario
M6S 2S2
President & Director:
Quentin Whal
Tel: (416) 763-4400
Fax:
Contact: Gloria Irwin

Ford Electronics
Manufacturing Corporation
7455 Birchmount Road
Markham, Ontario
L3R 5C2
Plant Manager:
John Barkley
Tel: (416) 474-4201 or -3244
Fax: (416) 470-3225
Contact: John Barkley

Allied-Signal Aerospace Canada
Garret Canada
A division of Allied-Signal Canada Inc.
255 Attwell Drive
Rexdale, Ontario
M9W 6L7
President & Director:

Tel: (416) 798-6770
Fax:
Contact: Fred Mbalire
Acting Director, Quality Assurance
Tel: (416) 798-6740
Fax: (416) 675-4021

1991

Chrysler Canada Ltd.
Windsor Mini-Van Assembly
Plant
Windsor, Ontario
of employees: 4 518
Sales: \$2.59 billion
Tel: (519) 973-2550
Fax: (519) 973-2744
Contact: D.E. Kreibich
Plant Manager

Linamar Machine Ltd
Guelph, Ontario
Number of employees: 1321
Sales: \$128.6 million
Tel: (519) 836-7550
Fax: (519) 824-8479

Contact: Larry Pearson
President

Garrett Canada
A division of Allied-
Signed Canada Inc.
Rexdale, Ontario

Tel:
Fax:
Contact:

**Texas Instrument
Canada Ltd.**
Materials & Controls
Group
Richmond Hill, Ontario
Tel:
Fax:
Contact:

1990

Northern Telecom Canada Ltd
Digital Switching and Customer
Service Divisions
Brampton, Ontario
of employees: 5078
Sales: \$6.1 billion
Tel: (416) 452-2782
Fax: (416) 452-4281
Contact: M. Unger
Vice-President and
General Manager, Switching

IBM Canada Ltd.
Technology Manufacturing Plant
Bromont, Quebec
of employees: 1 576
Sales: not disclosed
Tel: (514) 534-6386
Fax: (514) 534-6773
Contact: M. Wung
Plant Manager

Milliken Industries of Canada Ltd.
Deseronto, Ontario
of associates: 85
Sales: not disclosed
Tel: (613) 396-3421
Fax: (613) 396-2349
Contact: Brian Stagg
Process Improvement

British Columbia Telephone Co.

Burnaby, B. C.

Tel:
Fax:
Contact:

Dow Chemical Canada Inc.
Western Canada
Division
Fort Saskatchewan,
Alberta
Tel:
Fax:
Contact:

**Laurentian Life
Insurance Company Inc.**
Quebec, Quebec

Tel:
Fax:
Contact:

1989

Xerox Canada Inc.
5650 Yonge street
North York, Ontario
M2M 4G7
President & CEO:
David R. McCamus
of employees: 5,108
Sales: \$1.1 Billion
Tel: (416) 733-6630
Fax: (416) 229-6826
Contact: Michel Desjardins
Vice Pres., Quality Office

Uniroyal Chemical Ltd.
25 Erb Street
Elmira, Ontario
N3B 3A3
General Manager:
Walter K. Ruck
of employees: 402
Sales: \$130 million
Tel: (519) 669-1671
Fax: (519) 669-1679
Contact: Ken W. Jessop
Quality Assurance Manager

Reimer Express Lines Ltd.
1400 Inkster Blvd
Winnipeg, Manitoba
R2X 1R1
Chairman, President & CEO:
D.S. Reimer
of employees: 1,800
Sales: \$200 million
Tel: (204) 633-8151
Fax: (204) 633-1507
Contact: J.W. Perry, Vice Pres.
Training & Quality Development
Tel: (416) 566-1515
Fax: (416) 897-926

AMP of Canada, Ltd.

Markham, Ontario

President & CEO:

Tel:
Fax:
Contact:

**AVCO Financial Services
Canada Ltd.**
London, Ontario

President & CEO:

Tel:
Fax:
Contact:

Nexus Engineering Corp.

Burnaby, B.C.

President & CEO:

Tel:
Fax:
Contact:

APPENDIX 12

**COVER LETTER
&
QUESTIONNAIRE**

Carleton University
Ottawa, Canada K1S 5B6

Ottawa, November 16, 1992

Mr. XXXXXX
Senior executive/manager
Xerox Canada Inc.
North York, Ontario.

Dear Mr. XXXXXX,

Re: TQM study

I am presently conducting a study on the impact of TQM practices on the performance of Canadian companies. This is part of my Master in Management Studies program at Carleton. I also intend to identify performance measures and methods which are most appropriate for assessing the impact of TQM on company performance. ISTC officials have also shown a strong interest in this study. The expected results will be a valuable benchmark for company like yours. The empirical evidence collected will help firms promote TQM to suppliers/clients and other divisions. You will receive a copy of the report.

Your cooperation in this study will be very helpful specially since your company is a winner of the "Total Quality" category of the Canada Awards for Business Excellence. I would like to interview you and/or one to three other senior executives/managers. These interviews will permit me to gather empirical evidence necessary to test my assumptions. It will take approximately one hour to answer all the questions. All material provided will be kept confidential. No attribution will be made either to the person interviewed or to the corporation. My interest lies in the aggregate results of the research and not in the specific facts of particular decisions.

You may expect a phone call from me in the next few days to arrange an appointment.

I hope to speak to you soon. If necessary, I can be reached at (613) 225 2807. Thank you.

Sincerely yours,

Franck Choisine, MBA.

QUESTIONNAIRE

Firm # _____

Activities _____

Name of interviewee _____ Function _____

Phone # _____ Fax # _____

Your competitive environment is: Extremely competitive Not at all competitive

1 2 3 4 5

PART 1- IMPACT OF TQM PRACTICES

Section 1- EFFECT OF TIME

1- When did you start the following TQM's adoption stages (indicate the month if possible)

a) your first TQM initiatives _____ 19__

b) first quality improvement policy & plan _____ 19__

c) implementation of above policy & plan _____ 19__

d) first positive outcomes due to TQM _____ 19__

Section 2- PERCEPTIONS OF THE IMPACT

2- To what extent implementing TQM helped your company in the following:

	Helped very much				Helped not at all Made worse	
	1	2	3	4	5	6
i) <u>improving overall employee relations</u>						
a) reducing absenteeism	1	2	3	4	5	6
b) reducing turnover	1	2	3	4	5	6
c) reducing accidents	1	2	3	4	5	6
d) improving employee participation	1	2	3	4	5	6
e) improving employee morale	1	2	3	4	5	6

	Helped very much				Helped not at all	Made worse
e) improving employee morale	1	2	3	4	5	6
ii) <u>improving overall operating procedures</u>	1	2	3	4	5	6
a) improving productivity	1	2	3	4	5	6
b) reducing product lead time (cycle time)	1	2	3	4	5	6
c) reducing order-processing time	1	2	3	4	5	6
d) increasing inventory turnover	1	2	3	4	5	6
e) reducing work in process inventory	1	2	3	4	5	6
f) reducing errors/defects (manufacturing)	1	2	3	4	5	6
g) reducing the total quality costs (manuf.)	1	2	3	4	5	6
h) increasing cost savings due to employee suggestion	1	2	3	4	5	6
i) improving processes	1	2	3	4	5	6
j) improving products & services quality	1	2	3	4	5	6
iii) <u>improving overall customer satisfaction</u>	1	2	3	4	5	6
a) reducing customer complaints	1	2	3	4	5	6
b) improving customer retention	1	2	3	4	5	6
c) improving # of compliments	1	2	3	4	5	6
d) improving on-time delivery	1	2	3	4	5	6
iv) <u>improving overall financial performance</u>	1	2	3	4	5	6
a) improving profitability	1	2	3	4	5	6
b) improving return on assets	1	2	3	4	5	6
c) improving return on sales	1	2	3	4	5	6
d) improving sales/employee	1	2	3	4	5	6
v) <u>improving market share</u>	1	2	3	4	5	6

2 bis- Do you have any comments regarding any negative impacts of TQM practices on the performance of your company? _____

PART II- NEW PERFORMANCE MEASURES AND METHODS

5- Did your performance measures change when you adopted TQM? YES NO

If so, in what way? _____

Section 1- PERCEIVED CHARACTERISTICS OF PERFORMANCE MEASURES and SYSTEMS/METHODS

6- To what extent do you agree that performance measures most appropriate to a TQM environment contribute to the following?

	Strongly agree		Neutral		Strongly disagree		Don't know
a) track the roots of defectiveness (i.e. management by fact)	1	2	3	4	5		9
b) lead to further improvements (i.e. continuous improvement)	1	2	3	4	5		9
c) reinforce feedback & communication	1	2	3	4	5		9
d) reinforce error-free attitude	1	2	3	4	5		9

7- Could you rate the appropriateness of the following characteristics of performance measures in a TQM environment?

	Most appropriate					Not at all appropriate	Don't know
a) Long-term orientation (e.g. % market share, competitiveness)	1	2	3	4	5		9
b) Process-orientation (e.g. % on-time delivery, costs saving)	1	2	3	4	5		9
c) Result-orientation (e.g. capacity utilization rate)	1	2	3	4	5		9
d) Addressing company's objectives (e.g. market share, profitability, customer satisfaction)	1	2	3	4	5		9

e) Flexible (e.g. still remains valid when sales or volumes vary significantly)	1	2	3	4	5	9
f) based on cross functional team	1	2	3	4	5	9
g) dynamic to the process changes	1	2	3	4	5	9
h) proactive to the process changes	1	2	3	4	5	9
i) Other (specify)_____	1	2	3	4	5	9

8- Could you rate the appropriateness of the following characteristics of a performance measurement system/method in a TQM environment?

	Most appropriate					Not at all appropriate	Don't know
a) translate the company's critical success factors into both financial and non-financial terms	1	2	3	4	5		9
b) translates the company's critical success factors into only financial terms	1	2	3	4	5		9
c) translate the company's critical success factors into only non-financial terms	1	2	3	4	5		9
d) is driven from the top down	1	2	3	4	5		9
e) is congruent with company's objectives	1	2	3	4	5		9
f) classifies activities as value-added and non-value-added	1	2	3	4	5		9
g) focuses on integrating performance measures to encourage elimination of non-value-added activities	1	2	3	4	5		9
h) is flexible regarding activity levels of the organization	1	2	3	4	5		9
i) ensures that operational performance measures are reported with a full description of their significance to the organization	1	2	3	4	5		9
j) keeps the allocated costs down	1	2	3	4	5		9
k) permits to use cheaper labor	1	2	3	4	5		9
l) helps the profitability figures	1	2	3	4	5		9

m) takes into account quality work and

client satisfaction

1 2 3 4 5 9

n) produces correct information

1 2 3 4 5 9

o) is proactive to process changes

1 2 3 4 5 9

p) is dynamic to process changes

1 2 3 4 5 9

Section 2- EXTENT OF USE/APPROPRIATENESS OF PERFORMANCE MEASURES/METHODS AND SYSTEMS FAVOURED BY TQM ADOPTERS

New systems

9- To what extent are the following systems used and appropriate in a TQM environment?

Extent of use

Always Often Some- Seldom Never
times

1 2 3 4 5

Appropriateness

Very not at all
appropriate appropriate

1 2 3 4 5

Extent of use

appropriateness

Always

Never

Very

Not at all

a) Activity-Based Costing

system (ABC)

1 2 3 4 5 1 2 3 4 5

b) Management by cycle

time approach

1 2 3 4 5 1 2 3 4 5

c) Value-added management

accounting

1 2 3 4 5 1 2 3 4 5

d) Others (specify)____

1 2 3 4 5 1 2 3 4 5

10- What are your plans regarding the future use of these systems/methods?

	Start to use	Continue to use	Expand its use	Don't plan to use
a) Activity-Based Costing system (ABC)	1	2	3	4
b) Management by cycle time approach	1	2	3	4
c) Value-added management accounting	1	2	3	4
d) Others (specify) _____	1	2	3	4

Performance measures

11- To what extent are the following measures and methods used as appropriate for assessing the impact of TQM on company performance?

Extent of use	Always	Often	Some-times	Seldom	Never
	1	2	3	4	5
Appropriateness	Very appropriate				not at all appropriate
	1	2	3	4	5

Extent of use					appropriateness				
Always		Never			Very		Not at all		
1	2	3	4	5	1	2	3	4	5

A- Production-related

- Methods

a) JIT	1	2	3	4	5	1	2	3	4	5
b) QFD	1	2	3	4	5	1	2	3	4	5
c) SPC	1	2	3	4	5	1	2	3	4	5
d) Process Sequence										
Flow Charts (PSFL)	1	2	3	4	5	1	2	3	4	5
e) Checklists	1	2	3	4	5	1	2	3	4	5
d) Histogram	1	2	3	4	5	1	2	3	4	5
f) Pareto chart	1	2	3	4	5	1	2	3	4	5

	Extent of use					appropriateness				
	Always				Never	Very			Not at all	
g) Cause and effect diagram	1	2	3	4	5	1	2	3	4	5
h) Scatter diagram	1	2	3	4	5	1	2	3	4	5
i) Control charts	1	2	3	4	5	1	2	3	4	5
Other (specify) _____	1	2	3	4	5	1	2	3	4	5

- Measures

a) cycle time (design to manufacturing)	1	2	3	4	5	1	2	3	4	5
b) order-processing time	1	2	3	4	5	1	2	3	4	5
c) costs of quality	1	2	3	4	5	1	2	3	4	5
d) cost savings per employee	1	2	3	4	5	1	2	3	4	5
e) work-in-process inventory	1	2	3	4	5	1	2	3	4	5
f) inventory turnover	1	2	3	4	5	1	2	3	4	5
g) defect-rate	1	2	3	4	5	1	2	3	4	5
h) set-up time	1	2	3	4	5	1	2	3	4	5
i) machine downtime	1	2	3	4	5	1	2	3	4	5
j) conformance to quality	1	2	3	4	5	1	2	3	4	5
Other (specify) _____	1	2	3	4	5	1	2	3	4	5
-----	1	2	3	4	5	1	2	3	4	5

B- employee-related

- Methods

a) Time-analysis method	1	2	3	4	5	1	2	3	4	5
b) Employee attitude Survey	1	2	3	4	5	1	2	3	4	5

- Measures

a) employee satisfaction	1	2	3	4	5	1	2	3	4	5
b) absenteeism	1	2	3	4	5	1	2	3	4	5
c) turnover	1	2	3	4	5	1	2	3	4	5
d) # of accidents	1	2	3	4	5	1	2	3	4	5
e) # of lost work days	1	2	3	4	5	1	2	3	4	5
f) morale	1	2	3	4	5	1	2	3	4	5

	Extent of use					appropriateness				
	Always				Never	Very			Not at all	
g) # of employee suggestions	1	2	3	4	5	1	2	3	4	5
Other (specify) _____	1	2	3	4	5	1	2	3	4	5
-----	1	2	3	4	5	1	2	3	4	5
C- Cost-based										
a) based on direct labor hours	1	2	3	4	5	1	2	3	4	5
Other _____	1	2	3	4	5	1	2	3	4	5
D- Productivity-based										
a) quota on monthly shipment \$	1	2	3	4	5	1	2	3	4	5
b) capacity utilization rates	1	2	3	4	5	1	2	3	4	5
c) overtime hours	1	2	3	4	5	1	2	3	4	5
e) rework hours	1	2	3	4	5	1	2	3	4	5
Other (specify) _____	1	2	3	4	5	1	2	3	4	5
-----	1	2	3	4	5	1	2	3	4	5
E- Finance-based										
a) sales per employee	1	2	3	4	5	1	2	3	4	5
b) Return on assets	1	2	3	4	5	1	2	3	4	5
c) Return on sales	1	2	3	4	5	1	2	3	4	5
d) ROI	1	2	3	4	5	1	2	3	4	5
e) profits before tax	1	2	3	4	5	1	2	3	4	5
f) revenue growth	1	2	3	4	5	1	2	3	4	5
Other (specify) _____	1	2	3	4	5	1	2	3	4	5
F- Market-based										
a) absolute market share	1	2	3	4	5	1	2	3	4	5
b) relative market share to										
the largest competitors	1	2	3	4	5	1	2	3	4	5
c) future market share	1	2	3	4	5	1	2	3	4	5
d) % of sales from new products	1	2	3	4	5	1	2	3	4	5
Other (specify) _____	1	2	3	4	5	1	2	3	4	5
-----	1	2	3	4	5	1	2	3	4	5

	Extent of use					appropriateness				
	Always				Never	Very			Not at all	
G- Customer-based										
a) % on-time delivery	1	2	3	4	5	1	2	3	4	5
c) overall customer satisfaction	1	2	3	4	5	1	2	3	4	5
d) customer retention	1	2	3	4	5	1	2	3	4	5
e) number of complaints	1	2	3	4	5	1	2	3	4	5
f) number of compliments	1	2	3	4	5	1	2	3	4	5
d) Average time for complaint resolution	1	2	3	4	5	1	2	3	4	5
e) Average lead time to respond to service calls	1	2	3	4	5	1	2	3	4	5
Other (specify) _____	1	2	3	4	5	1	2	3	4	5
-----	1	2	3	4	5	1	2	3	4	5
H- <u>Quality of products/services</u>										
- Methods										
a) quality reports	1	2	3	4	5	1	2	3	4	5
b) inspections	1	2	3	4	5	1	2	3	4	5
c) external quality audits	1	2	3	4	5	1	2	3	4	5
d) market research/customer surveys	1	2	3	4	5	1	2	3	4	5
Other (specify) _____	1	2	3	4	5	1	2	3	4	5
-----	1	2	3	4	5	1	2	3	4	5
- Measures										
a) sales revenue alone	1	2	3	4	5	1	2	3	4	5
b) net profit	1	2	3	4	5	1	2	3	4	5
c) volume of business	1	2	3	4	5	1	2	3	4	5
d) ISO 9000 Certification	1	2	3	4	5	1	2	3	4	5
Other (specify) _____	1	2	3	4	5	1	2	3	4	5
-----	1	2	3	4	5	1	2	3	4	5

	Extent of use					appropriateness				
	Always		3	4	Never	Very	Not at all			
	1	2					1	2	3	4
<u>I- Quality of your suppliers' products/services</u>										
- Methods										
a) 100% inspection	1	2	3	4	5	1	2	3	4	5
b) Random sampling	1	2	3	4	5	1	2	3	4	5
c) At source inspection	1	2	3	4	5	1	2	3	4	5
d) Supplier audits/appraisals	1	2	3	4	5	1	2	3	4	5
e) Supplier certification	1	2	3	4	5	1	2	3	4	5
f) ISO 9000 Certification	1	2	3	4	5	1	2	3	4	5
g) International sampling plans	1	2	3	4	5	1	2	3	4	5
Others (specify)_____	1	2	3	4	5	1	2	3	4	5
-----	1	2	3	4	5	1	2	3	4	5
J- Tracking continuous improvement of your employees										
a) daily report	1	2	3	4	5	1	2	3	4	5
b) weekly report	1	2	3	4	5	1	2	3	4	5
c) monthly report	1	2	3	4	5	1	2	3	4	5
Other (specify)_____	1	2	3	4	5	1	2	3	4	5
	1	2	3	4	5	1	2	3	4	5

12- Did you design appropriate measures to assess failures/successes which encourage meaningful continuous improvement in your organization? YES NO

If yes, what are they? _____

Section 3- Mechanisms to design new performance measures/methods and their update frequency

13- In general, how frequently are the measures related to the following domain updated?

	Quarterly	Half- yearly	Yearly	Every 2-3 years or more	Never
	1	2	3	4	X
A- Quality of products/services	1	2	3	4	X
B- Quality of suppliers' prod/serv	1	2	3	4	X
C- Production-related	1	2	3	4	X
D- employee-related	1	2	3	4	X
E- Cost-based	1	2	3	4	X
F- Productivity-based	1	2	3	4	X
G- Financial-based	1	2	3	4	X
H- Market-based	1	2	3	4	X
I- Customer-based	1	2	3	4	X
J- Tracking continuous improvmt	1	2	3	4	X
Other (specify) _____	1	2	3	4	X

14a- Are the above performance measures/methods monitored primarily by the following?
(check more than one if appropriate).

☐ Upper management	☐ Cross-functional teams	☐ Director of quality
☐ Middle management	☐ Employee-managed teams	☐ Consultants
☐ Supervisor(s)	☐ Specific department	☐ Other (specify)
☐ Employee(s)		

14b- Are the above performance measures/methods reviewed/created primarily by the following? (check more than one if appropriate).

☐ Upper management	☐ Cross-functional teams	☐ Director of quality
☐ Middle management	☐ Employee-managed teams	☐ Consultants
☐ Supervisor(s)	☐ Specific department	☐ Other (specify)
☐ Employee(s)		

15- To what extent do you agree with the following?

	Strongly agree		Neutral		Strongly disagree		Don't know
a) Training has resulted in creation of new performance indicators	1	2	3	4	5		9
b) Training has resulted in creation of new performance methods/systems	1	2	3	4	5		9
c) Employees are allowed to participate in the maintenance of performance measures	1	2	3	4	5		9

16- Do you still feel the need of new performance measures? YES NO

(If yes, please explain) _____

17- Would you like to add any other comments about performance measurement in TQM environment?

CHARACTERISTICS OF THE COMPANY

Total annual sales for your company/division \$ _____ 19__

Total number of employees at your company/division _____ 19__

including _____ executives (middle and upper management levels)

What percentage of your company's/divisions' sales are domestic?

0-25% ___ 26-50% ___ 51-75% ___ 76-100% ___

Is your company Canadian-owned? YES NO _____

(Country of ownership)

YOUR SUGGESTIONS FOR IMPROVEMENT

We would appreciate any suggestions you may have for making this questionnaire clearer or easier to answer. For instance, were any of the questions confusing?

Why? _____

Would you rate this questionnaire on each of the following?

	Very poor	poor	Fair	Good	Excellent
Length	1	2	3	4	5
Completeness	1	2	3	4	5
Ease of use	1	2	3	4	5
Relevance of questions	1	2	3	4	5
Adequacy of questions	1	2	3	4	5
clarity of questions	1	2	3	4	5
Overall quality	1	2	3	4	5

CONCERNING THIS RESEARCH

How would you rate the usefulness of this study and its upcoming conclusions & recommendations?

Very	useful	Somewhat	Useless
useful		useful	
1	2	3	4

Would you like to have a summary of the conclusions & recommendations? YES NO

Thank you for your cooperation.

END

0 8 - 1 1 - 9 4

FIN