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# Development of an instrument to measure the levels of Total Quality Management (TQM) implementation in manufacturing organizations

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# Development of an instrument to measure the levels of Total Quality Management (TQM) implementation in manufacturing organizations

by

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# CHAPTER I. INTRODUCTION

The Total Quality Management (TQM) approach has been used with tremendous success by Japanese manufacturing organizations to gain their current place in the world market (Tobin, 1990). In the past 10 years, United States manufacturing organizations have been playing catch-up in the areas of quality and productivity. Aly, Maytubby, and Elshennawy (1991, p. 43) pointed out that "the problem in the U.S. has been the misdirection of quality and improvement programs and the lack of total management commitment."

Moskal (1991) found that only about 1/4 of the U.S. manufacturing organizations have Total Quality Management programs. In spite of this foundation, most of these organizations have increasingly seen the benefits that TQM brings to their operations. These benefits include greater customer satisfaction, increased productivity, lower costs, and an improved competitive position of the firm. To achieve these benefits, organizations should implement a process that is long-term and continuous, in which all workers participate in establishing continuous improvement initiatives throughout the organization.

A number of successfully implemented TQM cases have

been published and analyzed by various scholars. In 1991, the General Accounting Office (GAO) released a report noting that companies involved with TQM practice have been able to improve customer satisfaction, financial performance, employee relations, and operating procedures. Caudron (1991) indicated that to build employee support for the quality effort some organizations dropped their pyramid hierarchy of management in favor of a flatter structure and more participative management approach. Schneider, Schneider, and Riley (1991) suggested strongly that a quality education and training program should be developed, not only to serve as a common language, but also to give employees the empowerment they desired.

Spiker (1991) pointed out that "TQM is not a system but a state of mind that must become corporate culture if it is to succeed." He also indicated that TQM shifts the focus of management to satisfying internal and external customer needs, and holds that changes are inevitable within the organization.

Research sponsored by the Construction Industry Institute and published in 1989, concluded that "Companies which do not implement Total Quality Management in their firms will not be competitive in the national and international market within the next five to ten years" (Matthews and Burati, 1989, p. 75). The successful

implementation of TQM can be considered a strategic business issue for industries of all types in the 1990s.

Several models exist which can be used to guide the assessment of the TQM implementation scheme. One of the most popular evaluation frameworks is the Kirkpatrick Model which was developed in 1959. The model consists of four levels. These include 1) Level 1-Reaction, 2) Level 2-Learning, 3) Level 3-Behavior, and 4) Level 4-Results (Kirkpatrick, 1959). Carnevale and Schulz (1990) summarized these four levels as follows:

| | | |
|---|---|---|
| Level 1 | Reaction: | How well did participants like the program? |
| Level 2 | Learning: | What knowledge (principles, facts, and techniques) did participants gain from the program? |
| Level 3 | Behavior: | What positive changes in participants' job behavior stemmed from the program? |
| Level 4 | Results : | What were the program's organizational effects in terms of reduced costs, improved quality of work, increased quantity of work, and so forth? |

Most manufacturing organizations evaluate their programs (e.g., training programs) by emphasizing one or more of the model's four levels. In these days, most organizations evaluate their programs at the reaction level. Carnevale and Schulz (1990) pointed out that evaluation at the reaction level is commonly called the "happiness test," because participants' favorable reactions are very important

to a program's success.

At the learning level, different types of instruments are used to measure knowledge, skills, or attitudes gained during the program by the participants. The next level, behavior, deals with problems that exist in the progress between learning and changes in behavior on the job. According to Kirkpatrick (1959), it is necessary to have a rigorous scientific approach and many factors must be considered to evaluate this level of evaluation. The last level of the model is the results level. This is the highest level of difficulty, and usually is stated in organizational terms such as reduction of costs, reduction of turnover, increased quality of production, and improved morale.

Most of the evaluation models these days measure the effectiveness of training programs (Osigweh, 1988; Morrall, 1987), Human Resource Development (HRD) programs (Brinkerhoff, 1988), employee performance evaluation systems (Goodrough, 1990), staffing assessment programs (Erickson, 1990), etc. None of these models have been used to assess the employees' knowledge and attitude toward the TQM program.

The reliability of an instrument which can measure employees' knowledge and attitude toward a TQM program are important considerations. Reliability refers to the

accuracy, consistency, and stability of measurement by a test. There are three different techniques to estimate the reliability of instrument. These are : 1) coefficient of equivalence, 2) coefficient of stability, and 3) coefficient of internal consistency. Each technique has distinctive characteristics for different research purposes. The coefficient of equivalence (i.e., alternative form) technique is used where two or more parallel forms of an instrument are available (Borg and Gall, 1983). The coefficient of stability (i.e., test-retest) method is used when there are no alternative forms of the instrument available. Finally, the coefficient of internal consistency can be calculated using several different methods, such as split-half, KR-20, and Cronbach's Coefficient Alpha (Borg and Gall, 1983).

## Need for the Study

No reliable instrument has been developed to determine the levels of implementation of the Total Quality Management approach in manufacturing organizations.

## Statement of the Problem

The problem of this study was to develop an instrument that can be shown to yield reliable data for measuring the current and ideal status of TQM implementation among the

companies with known degrees of TQM implementation.

## Purpose of the Study

To date, it appears that no instrumentation has been developed for researchers to measure the progress toward Total Quality Management within the organization and how much progress the organization has made towards implementing Total Quality Management concepts. By developing an instrument, researchers will be able to make comparisons among companies, among groups within the same organization, and among different types of implementation plans to determine which procedure is the most effective at implementing TQM.

Therefore, the purpose of this research was four-fold. These purposes were as follows:

1) Develop an instrument.
2) Establish reliability by using one of the reliability estimating methods.
3) Use the instrument to compare the results of responses among small-, medium- and large-size companies.
4) Use the instrument to comparing the results of responses among the two known groups;

   Group A - Implemented TQM less than 23 months, and

Group B - Implemented TQM equal to or more than 23 months.

## Assumptions of the Study

This study was based upon the following assumptions:

1. The subjects who complete the attitudinal instrument would respond accurately and honestly, and would interpret the instrument items correctly.
2. The instrument that would be developed to measure employees' attitudes and perceptions was reliable.
3. The procedure for selecting the research subjects was valid and the results could be generalized to the general population.
4. Any uncontrolled variables of the study were randomly distributed over the entire sample.

## Limitations of the Study

This study was conducted under the following limitations:

1. The scope of this study was limited to small, medium, and large manufacturing organizations in Iowa.
2. The generalization of this study was limited to manufacturing industries.

## Hypotheses of the Study

Hypotheses 1-2:

There is no significant difference between mean responses to items on the TQMP regarding current and ideal TQM practices among small, medium, and large companies.

Hypotheses 3-4:

There is no significant difference between mean responses to items on the TQMP regarding current and ideal TQM practices for two different levels of TQM implementation.

Hypotheses 5-7:

There is no significant difference between mean responses to items on the TQMP regarding current TQM practices among small, medium, and large companies which have experienced different levels of implementation.

Hypotheses 8-10:

There is no significant difference between mean responses to items on the TQMP regarding ideal TQM practices among small, medium, and large companies which have experienced different levels of implementation.

Hypotheses 11-16:

There is no significant difference between mean responses to current practices regarding six dimensions--leadership, customer, employees involvement, continuous improvement efforts, statistical methods, and relationship

with suppliers--on the TQMP between companies experiencing two different levels of implementation.

Hypotheses 17-22:

There is no significant difference between mean responses to ideal practices regarding six dimensions--leadership, customer, employees involvement, continuous improvement efforts, statistical methods, and relationship with suppliers--on the TQMP between companies experiencing two different levels of implementation.

## Procedure of the Study

This study was conducted according to the following procedure:

1. A thorough review of relevant literature and related studies.
2. Determination of the population of study.
3. Development and modification of conceptual definitions.
4. Development of a test plan for instrument item construction.
5. An attitudinal instrument was developed to measure the attitude toward TQM practice in the organizations.
6. The instrument was examined by a panel of experts on TQM for the purpose of validation and

appropriateness of instrument items.

7. Revision of the instrument based on the suggestions of the experts.
8. A pilot test was conducted.
9. The instrument was revised.
10. The field test was conducted at selected organizations.
11. The data were analyzed.
12. The research report was finished, based upon the results of the data analysis.

## Definition of Terms

Quality:

Quality is product satisfaction, freedom from deficiencies, and fitness of use (Juran, 1988).

Total Quality Management(TQM):

The optimization of the quality activities involved in producing a quality product, process, or service. As such, it includes prevention and appraisal activities (Davis, Ledbetter, and Burati, 1989).

Knowledge:

Recall of factual material in a form similar to that in which it was presented during

instruction (Bloom, 1956).

Attitude:

Conceptualized as learned predispositions to respond positively or negatively to certain objects, situations, concepts, or persons. As such, they possess cognitive (beliefs or knowledge), affective (emotional, motivational), and performance (behavior or action tendencies) components (Aiken, 1980).

Learning:

What principles, facts, and techniques were understood and absorbed by the conferees? (Kirkpatrick, 1959).

Perception:

It precedes decisions and actions, an active on a passive process, and involves the conscious organization of incoming information (Kerr, 1982).

# CHAPTER II. REVIEW OF LITERATURE

The industrial revolution which happened during the last half of the 18th century is generally recognized as a guidepost in the development of manufacturing techniques. The most noticeable development was the replacement of human labor with mechanical power. Following the industrial revolution, the factories in manufacturing industries became the largest productive units. Starting about 1875, several important changes took place in the American industrial scheme. These changes included the following aspects: 1) financial, 2) technical, and 3) managerial (Anderson, Anderson, & Mandeville, 1942).

In financial changes, the most prominent features were the growth of the corporate style of organization and an increase in the size of the business enterprise. On the other hand, in technical changes, the standardization of parts and products led to the techniques of mass production. For changes in managerial function, people began to understand the old type of management practices (i.e., autocratic, forceful, and self-trained) were not the best managerial practice (Cornell, 1947). They began to seek principles instead of being content with surface appearances.

In early plants, the techniques of manufacturing, the actual application of skill and effort in the conversion of materials, were important matters that had to be solved (Anderson, Anderson, & Mandeville, 1942). In present days, the plants are adopting different methods to control materials, human resources, product quality, and the coordination of different departments.

## Scientific Management

One obvious contribution of scientific management is the overall improvement in factory management. Management has brought about a more effective utilization of equipment, labor, and materials. In this section, basic concepts of scientific management and their implications towards modern quality management, Total Quality Management (TQM) are examined. This section includes discussion of the Soho Foundry and the contribution to TQM of Frederick W. Taylor.

### Soho Foundry

One of the first complete applications of scientific management to manufacturing occurred in Great Britain at the Soho Engineering Foundry of Boulton, Watt, and Company in 1800 (George, 1968). There was definite evidence of market research and forecasting, planned site location, established production standards, production planning, standardized

components, and employee training. One of the modern concepts employed by the management at the Soho Foundry was product forecasting and production planning. Daiute (1964) summarized modern concepts employed by the Soho Foundry as:

> In this plant, there were: 1) extensive use was made of detailed operating plans, 2) the methods employed in planning were scientific, 3) problems were broken into elements and statistical data were gathered from which inferences were drawn, and 4) the production process were organized on the basis of machine and worker (p. 27).

Scientific planning, problem-solving techniques, utilization of statistical methods, and organization of the production process are basic foundations of modern management practices. It seems obvious that the Soho Foundry was more than a century ahead of its time.

Frederick W. Taylor

Between 1880 and 1890, Taylor developed the principles of scientific management which were to influence industry throughout the world. Taylor discovered that if piece rates were based to determine the wage, then management could ask for and reward certain performances of the workers. While increased production was his primary concern, Taylor realized that full satisfaction of management was concerned with possibilities for improving the workers' status, increasing wages, decreasing expenses and price, and providing employers and employees with a common purpose and

common interests. George (1968) summarized Taylor's idea into four fundamental principles which Taylor labeled duties of management, as follows:

> First: The development of a science for each element of a man's work, to replace the old rule-of-thumb method.
>
> Second: The selection of the best worker for each particular task, and then the effort to train, teach, and develop the worker, in place of the former practice of allowing the worker to select his own task and train himself as best he could.
>
> Third: The bringing of the science to the worker, and cooperating with him, to the end that all work might be done in accordance with the principles of the science which has been developed.
>
> Fourth: The assumption by management of the responsibility for the foregoing, and for planning the work (p. 123-124).

Taylor (1919) stated that the combination of these principles of management constituted scientific management, which was more conceptual and philosophical than mechanical. He also warned against confusing the mechanism of management with the philosophy of scientific management, and listed elements of this mechanism as follows:

> Time study, with the implements and methods for properly making it.
>
> Functional or divided foremanship and its superiority to the old-fashioned single foreman.

> The standardization of all tools and implements used in the trades, and also of the acts or movements of workmen for each class of work, the desirability of a planning room or department.
>
> The 'exception principle' in management.
>
> The use of slide-rules and similar time-saving implements.
>
> Instruction cards for the workman.
>
> The task idea in management, accompanied by a large bonus for the successful performance of the task.
>
> The 'differential rate.'
>
> Mnemonic systems for classifying manufactured products as well as implements used in manufacturing.
>
> A routing system.
>
> Modern cost system, etc., etc (p. 73).

With the rise of the Taylor system, the responsibilities of the shop foreman were narrowed. The foreman's obligation was to administer plans and meet production requirements. The Taylor system placed importance on the productivity of the workers. At this point, product quality seems to be endangered because the shop examiners' first priority to inspect each product was darkened by the pressure for increasing the level of production.

## Early Twentieth Century Thoughts

Following the development of Taylor's ideas, a number of associates and followers proclaimed their interpretation of the new science management. Among them were Henry L. Gantt, Harrington Emerson, and Henry Fayol. Each added a new dimension to the new philosophy of managerial concepts. In this section, these three scholar's contributions are examined.

### Henry L. Gantt

Henry L. Gantt made two distinguished contributions to the existing concepts of management. The idea most easily recalled was use of a straight-line chart to portray and measure an activity by the amount of time needed to perform the activity (George, 1968). In present days, this technique is used by a number of managements to compare actual to planned performance. It is also known as the Gantt Chart.

His second contribution is the humanitarian approach to management (George, 1968). In 1901, Gantt introduced the take-and-bonus wage system. It was based on Taylor's differential piece-rate system, but Gantt (1901) stated that his system was:

> ...as far as possible removed from the old-fashioned method of fixing piece rates from records of the total time it has taken to do a job (p. 32).

Under his plan, workers could earn a living while learning to increase their efficiency. Urwick (1956) referred to Gantt as "the apostle of industrial peace" because of his standing appeal for a wider recognition of the human factor in management, and for recognizing that financial incentives are only one of many that influence employee behavior.

Harrington Emerson

Harrington Emerson developed the term efficiency engineer and was one of America's first consultants, thus bringing emphasis to the staff principles. His idea was the first attempt at categorizing a set of principles to guide management. This attempt served to reemphasize the growing awareness of the distinct nature and universality of management (Anderson, Anderson, & Mandeville, 1942).

Emerson's concept of "efficiency" was conservation--the elimination of "wanton, wicked waste." He also developed a theory called "efficiency wage plan" (Anderson, Anderson, & Mandeville, 1942). In this plan, day wages are guaranteed and premium earnings begin to accumulate when the worker attains 67% efficiency. Unfortunately, this plan increases cost at low production rates, and the lack of a high

incentive offered for a particular high production rate lessens the "pulling capacity" of the plan and results in lower average production than with some other plans, notably the Gantt plan.

Henry Fayol

Henry Fayol observed that management was an activity common to all human undertakings, whether in the home or business. He noted further that these undertakings required some degree of planning, organizing, commanding, coordinating, and controlling (Sheldon, 1966). Fayol began by dividing the total industrial undertaking into six independent activities:

1. Technical; production, manufacture, adaption
2. Commercial; buying, selling, exchange
3. Financial; search for and optimum use of capital
4. Security; protection of property and persons
5. Accounting; stocktaking, balance sheets, costs, statistics
6. Managerial; planning, organizing command, coordination, control (George, 1968, p. 127).

The last activity, managerial, was by far the most important and deserved the most attention.

Fayol's theory concentrated on management from the top to bottom, emphasizing managerial ability and the application of sound management principles and techniques to all organizations. On the other hand, Taylor concerned himself primarily with the worker level and the technical aspects of production, emphasizing the importance of technical ability in management.

## Overview of Total Quality Management (TQM)

The importance of the overview of earlier management theory and thought is the recognition of these scholars' contributions and impacts on modern managerial practices. In the following sections, the researcher examines concepts and principles of the Total Quality Management (TQM)--its development, characteristics, and major contributors.

Total Quality Management (TQM) is one of the most talked-about manufacturing management approaches of the 1980s and will be a major management focus and trend in the 1990s. The concept of TQM has become the single most motivating theory in many major industries throughout the United States and foreign countries. TQM is a management philosophy that emphasizes the need to meet external and internal customers' needs and expectations and the importance of doing things right. TQM is a competitive strategy involving continuous improvement of products,

processes, and services to improve quality, cut costs, enhance productivity, and increase total customer satisfaction (Edosomwan & Savage-Moore, 1991).

TQM extends far beyond the philosophy and practices of quality control and quality assurance (Atkinson & Naden, 1989). Most organizations employing TQM actively pursue and encourage improvement at all levels and view change as a natural, continuous part of their activities. Stratton (1990) indicated the concern of David A. Nadler, president of the Delta Consulting Group, this way:

> ...while much progress toward quality programs has been made since 1980, much remains to be done because: 1. few companies are really engaged in total quality management, 2. progress is uneven, and 3. competitors are aggressive (p. 8).

Joiner and Scholtes (1988) also stressed that:

> ...one major cause of the problems faced by many organizations is the failure of many managers to realize that there is a 'new' way to manage their organizations, a way that yields much higher quality, higher productivity, better job security and better return on investment (p. 22).

As we can see here, TQM is a longer-term practice and is concerned with cultural change in the whole organization and creating visions, missions, and values. It is obvious that examining development, elements, and contributions made by scholars in TQM is essential to all organizations trying to implement the philosophy of TQM. In the following section, the researcher examines general characteristics of TQM.

## Development of TQM

Total Quality Management (TQM), continuous improvement with the goal of customer satisfaction, is becoming a popular principle with manufacturing organizations in the world. The basic concept was developed in the U.S. during the 1920s (Hall, 1992). It was popularized in Japan after World War II and brought back to the U.S. in the 1980s.

A number of scholars (Chatterjee, & Yilmaz, 1991; Howard, 1992) argued that U.S. companies must respond to foreign competition by adopting new attitudes towards product quality and customer services. Instead of the traditional view that quality is a necessary evil, managers need to implement total quality policies. Total quality constitutes identifying what real quality is, adopting that concept for the whole company, and developing a work environment that supports that concepts of quality.

Different techniques, Statistical Process Control (SPC), Material Requirement Planning (MRP), Computer Integrated Manufacturing (CIM), and Just-in-Time (JIT) have been developed and applied to industries to improve their quantity and quality of products since World War II. These techniques were used to control production process, inventory reduction, and factory automation. Each technique has its own unique characteristics. For instance, SPC allows sampling rather than whole product inspection and

point to the most likely root causes of quality and variation problems (Ciampa, 1992).

In 1983, Feigenbaum stated that:

> The work of quality control, however, remained restricted to production areas and grew rather slowly (p. 7).

As mentioned here, recommendations resulting from the use of statistical techniques mostly were not implemented by the existing decision-making structures. There was no specific decision-making and operating framework which was effective enough to take corrective action on the quality control problems. As a result, the concept of total quality was developed and organizations began to develop a specific decision-making and operating framework to deal with product quality.

## Characteristics of TQM

TQM is different from other programs or techniques in that it involves all employees and constitutes fundamental changes in the way an organization is measured and managed. In 1987, the institution of the Malcolm Baldridge National Quality Award provided a nationally accepted set of criteria for evaluating the extent to which a company implemented TQM. The key principles of the award include 1) customer-driven quality, 2) continuous improvement, 3) measurement, 4) participation, 5) leadership, and 6) management by data

(Brown, 1991). These six principles appear throughout the criteria further divided into seven categories. These categories are: 1) leadership, 2) information and analysis, 3) planning, 4) human resource utilization, 5) quality assurance of products and services, 6) results from quality assurance of products and services, and 7) customer satisfaction (Siegman 1992). The relationships among these categories are presented in Figure 1.

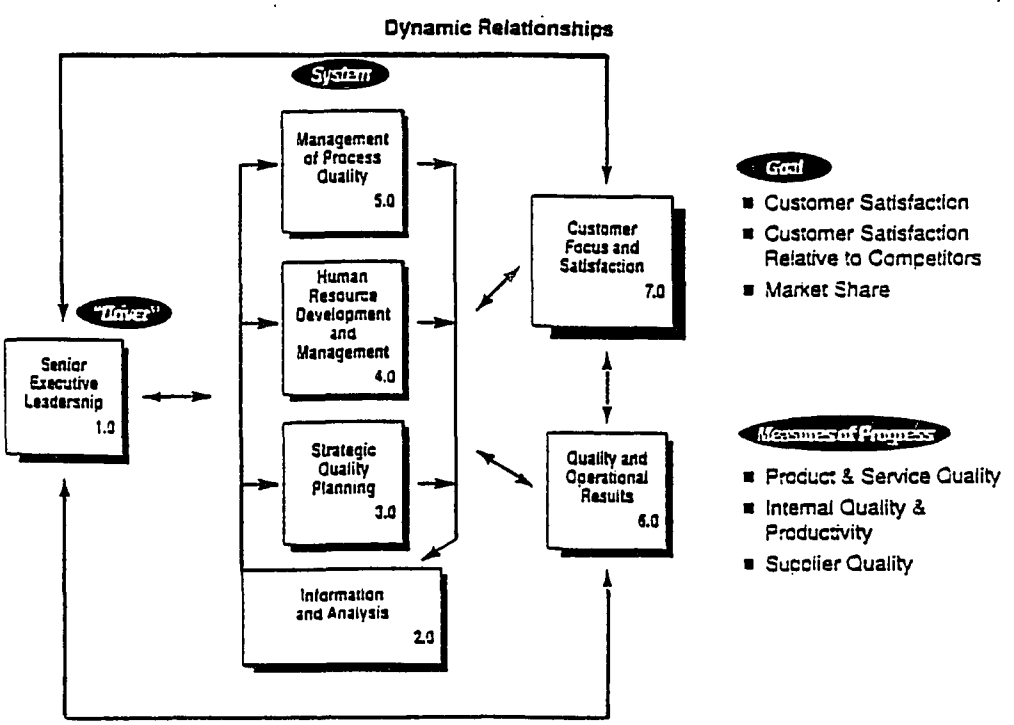


Figure 1. Baldridge Award criteria framework (U.S. Dept. of Commerce, 1992, p.5)

A survey conducted by the General Accounting Office (GAO) in 1991 concluded that

> ...the diversity of companies we studied showed that TQM is useful for small companies (no more than 500 employees) as well as large (500 or more employees) and for companies that sell services as well as for companies that produce and sell manufactured products (p. 24).

The study also found there are six major interrelated features in TQM practice. These six features appeared to improve the organizations' product quality, customer services, and financial performance. The features included:

1) Customer focus; Customer-driven quality,
2) Leadership; Upper management's commitments,
3) Employee involvement; Team work and training,
4) Open corporate culture; Information sharing and eliminating barriers between departments and levels of employment,
5) Fact-based decision-making; Use of statistical methods,
6) Partnership with suppliers; Closer and long-term partnership.

As we can see here, TQM can be applied to any kind of organization and requires a change in the culture and behavior of the individuals in the organization. For these changes to happen, senior managers must dismantle and change themselves. The most important factors in this practice are

strong leadership and commitment to customers' satisfaction.

From the criteria of the Malcolm Baldridge National Quality Award, the results of the GAO report, and other scholarly studies (Leader, 1989; Scott, 1989), it is obvious that TQM is one of the most complete methods of satisfying customers and improving performance of the organization. The next section of this chapter examines six components clarified by the GAO office for TQM.

## Customers

Traditional ways of defining quality were mainly focused on the measurements to meet specifications established by the manufacturers. Some terminologies were defined and adopted by most of the industries prior to the development of TQM. These terminologies included 1) hitting specification, 2) fitness for use, and 3) conformance to requirements (Guaspari, 1992). Mizuno (1989) stated that "customers' needs and attitudes toward product quality have changed in a number of ways" which summarized as follows:

1. Diversification: New product applications and internationalization have generated considerable diversification in use characteristics.
2. Increasing sophistication and complexity: New responses are required to meet higher quality requirements, product miniaturization, and the use of microelectronic products.
3. Great durability: Products today are expected to be durable.
4. Lower cost of quality: There is increasing demand that quality costs less, particularly as

calculated over the product's entire life cycle.

5. New interpretations of product liability: Product liability has gone beyond the issue of individual injury to include the product's adverse impact on the environment and society.
6. New products: Research and development has been speeded up as new developments in technology quickly make products obsolete.
7. Broader conditions of use.
8. Conservation of energy and resources.
9. Safety: Damage-proofing and easy disposal.
10. Improved maintenance and repair.
11. Ease of use and storage.
12. Improved work quality and information quality: Control items (control standards) should be meaningful and appropriate to planned level of product quality (Mizuno, 1989, p. 37).

These changes in customers' needs and attitudes were recognized by industries and scholars. This recognition leads to different meanings of quality.

Feigenbaum (1983) defined quality of products and services as customers' point of view. He stated that:

> The total composite product and service characteristics of marketing, engineering, manufacture, and maintenance through which the product and service in use will meet the expectations of customers (p. 48).

Juran (1988) also defined quality as "meeting the customer's expectations." A number of other scholars' (Deming, 1986;, Tylor, 1989; Guaspari, 1992) definitions on quality also focused on meeting or exceeding customers' expectations.

In TQM, customers are no longer treated as people paying money for any products or services whether these fulfill their expectations or not. TQM views the customer with respect and loyal customers' suggestions and opinions

on products or services are adhered to.

TQM views customers with two aspects, external and internal. External customers are those who actually purchase certain products for their own interest. On the other hand, internal customers are those who work at the company. The company has an obligation to satisfy these two types of customers.

The concept of internal customers is somewhat different from the external customers. The external customers are not necessarily related to each other. In other words, they possess some degree of independence. In contrast, internal customers should be closely related to each other. This dependence is very important. Juran (1988) described this importance as follow:

> Clerical employees in department A supply data to employees in department B. Factory employees in department C supply components to employees in department D. And so to supervisor, managers, and top executives (p. 121).

Each employee and department relies on the next employee and department.

## Leadership

Cornell (1947) stated the principle of leadership as follows:

> Wise leadership implies the ability to do what one sets out to do, the spirit to carry on until the task set is accomplished, the personality and ability to win cooperation and loyalty, and the skill to direct and control the effort of others (p. 60).

He also suggested that leadership implies faith on the part of the followers. This faith can be inspired only when an executive has intelligent faith in himself and in his ability to accomplish what he has set out to do. In TQM, the same principle of leadership is applied. TQM treats leadership as the most important factor, if a company needs an absolute commitment to leading and managing a total quality process across all organizational functions and systems.

TQM requires strong leadership. If a company tries to implement TQM, the leaders in the company should demonstrate strong commitment to cultural changes in the company, because TQM requires a fundamental change in perceptions of all employees. This might lead to conflicts and resistance among the employees. The leaders should possess the ability to overcome these conflicts (Ciampa, 1992).

There are several ways to overcome the conflicts. First of all, leaders in organizations strongly show or express their commitment to TQM. They must be willing to attend the necessary courses and learn TQM concepts and skills. In addition, they must be willing to practice TQM

in their own jobs. A TQM leader must head up efforts to develop reward systems that reinforce new TQM values (Johnson, 1990).

Leaders must make the necessary adjustments to their own behaviors, expectations, and values. Cultural changes, especially for large organizations, require a lot of time and patience to disregard traditional concepts and practices of leadership and management. The leaders in an organization should be articulated by developing, actively promoting, and living a vision which tells the organization what it must become (Strolle, 1991).

Employee involvement

TQM is different from other programs in that it involves all employees and constitutes a fundamental change in the way an organization is measured and managed (Brown, 1991). TQM requires educating and training employees at all levels to learn the concepts of TQM. They need to understand the importance of what they do and how they can improve their role as part of the functioning of an organization. This can be done only by training employees.

Team approach is another aspect of employee involvement in TQM. The open team-oriented organization structure will be able to create within the organization an atmosphere able to handle various problems faster and more productively.

Effective team problem-solving activities are presumed to be successful only with upper management's cooperation on the basis of a human-oriented management philosophy (Shin, 1991).

The team approach is basically a horizontal organization unit, allowing prompt communication within the whole organization. For TQM to work, a plan should be designed that is aligned horizontally with employees' suggestions and opinions to improve the quality of the production process.

Scott (1989) argues for "Establishing structured problem-solving methodologies that can identify opportunities for improvement." These methodologies should be applied to the whole operation--input, process, and output--in an organization. Brainstorming, especially for team problem-solving, is one example of how to achieve this improvement by involving all employees.

Open corporate culture

In Dr. Deming's "14 points of management obligation," he addressed two points which are related to open corporate culture. These are: 1) break down barriers between departments, and 2) remove barriers that rob hourly workers of their right to pride of workmanship (Butterfield, 1991). Essentially, TQM involves eliminating the barriers of

communication that arise between different departments, the level of employees, and setting up new cross-disciplinary quality teams.

Each department and individual should consider how its output affects others. All departments must find an effective way to communicate with each other continuously on both a formal and informal basis. Floor workers are more knowledgeable on what they are doing than their managers, and the manager should respect their ability and suggestions. Management must spend time recognizing what disturbs employees' work (Butterfield, 1991). Managers should assist in helping to resolve workers' problems and must open a communication channel, either formal or informal, to hear what workers are saying.

In 1991, a report from the GAO listed four basic elements designed to develop an agile and sensitive organization culture. These are:

1. Information sharing,
2. fewer formal and informal barriers,
3. a spirit of innovation, and
4. high employee morale (GAO, 1991).

The above list is a result of a review conducted at 20 companies in the United States by the GAO. These companies adopted TQM or are at a beginning stage of TQM implementation. To be productive without any variance in

the process, organizations need to eliminate barriers among both horizontal (different department) and vertical (levels of employees) functions. Communication, sharing information, and respecting others' opinions will lead organizations one step further to success in TQM implementation.

Fact-based decision-making

Mizuno (1989) defined quality control as a "diagnostic science rather than a remedial one." Preventive correction is the science of correcting the original causes so the problem does not recur. The same idea applies to fact-based decision-making in TQM. When a defective product or customer complaint appears, first distinguish its cause and immediately apply new procedures to ensure that the same defect or complaint will not arise again.

There is a method, "Plan-Do-Check-Act (PDCA)," widely adopted by industries to improve their product and service quality. In this method, results are checked, the cause of problems traced, and new work procedures established to ensure that the same problems will not happen again (Mizuno, 1989). This is a control, and for control an organization needs to identify defects and try to determine their causes. In other words, the organization should perform analysis and diagnosis. For analysis and diagnosis to be effective, the

organization should collect data, determine a primary cause of the problems, and make an objective decision based on the findings.

This leads to the use of statistical methods, i.e., Statistical Process Control (SPC). Under SPC philosophy, production is given the responsibility of measuring, comparing, and analyzing the product and process (Doty, 1991). The SPC technique is a mixture which contains a number of different methods for different applications. These include: 1) graphical presentation and 2) basic statistical methods. Graphical presentation in turn includes: 1) stratification, 2) Pareto diagrams, 3) cause and effect diagrams, 4) histograms, 5) control charts, and 6) scatter diagrams. On the other hand, the statistical method contains generally basic statistical techniques such as probability, acceptance sampling, and experimentation. Each category requires some degree of education and training, so it can be applied most appropriately by the employees for effective decision-making.

Partnership with suppliers

Traditionally, most organizations view their suppliers as providers of parts and services to accomplish the organization's mission. Organizations ask suppliers to produce components with their own specifications, and the

suppliers produce and supply the components according to the requests. It is a top-down relationship, i.e., a vertical rather than a horizontal, relationship.

TQM views the relationship between the two groups as a partnership in which they establish a closer relationship with each other for a longer term. Suppliers participate in the planning, designing, and production stages to recognize the organization's real need and anticipation. Some companies try to help train personnel from suppliers, to improve their own quality practice (GAO, 1991). Firms such as Ford Motor Co., Motorola, and Monsanto, have spent tremendous amounts of money to improve their own operations and are now moving towards reforming their suppliers (Morrow, 1991). Reforming and training suppliers is perhaps the foundation of the TQM concept. To survive in competition, suppliers must work at improving quality and refining their strategies to achieve it. In this way, the suppliers will be able to produce and supply higher-quality components at a reasonable cost.

In this section, the researcher examined six basic components of TQM. It is obvious that all six components should be linked together to get a maximum outcome by implementing TQM within organizations. All six components should work together, otherwise there is no way to expect positive results from TQM. It is long-term process,

requires patience from all levels of employees, and total cultural changes.

The next section of the paper explores the pioneers of TQM, W. Edwards Deming, Joseph M. Juran, and Philip B. Crosby, and the implications of their works for modern quality improvement efforts.

## W. Edwards Deming

In 1950, W. Edwards Deming taught the Union of Japanese Scientists and Engineers (JUSE) the theory of continuous quality improvement. According to Deming's teachings, quality is the predictable absence of error (Lorinc, 1990). It is a customer-oriented result achieved only when management decides to work out a system variation in production rather than blame employees for unacceptable workmanship.

Although Deming's approach is based on statistical process control, his teaching is more focused on the role of management. Modic (1988) explains Deming's philosophy as follows:

> ...he espouses a management philosophy that has to do with market research and pleasing the customer, working closely with vendors, and involving employees in the development and refinement of systems and methods to get the job done (p. 137).

In addition, Deming (1982) criticized managements that are accustomed to short-term profits rather than long-term

strategies to improve their process.

Deming (1982) further emphasized that organizations must move away from the traditional way of quality inspection, defect detection, and move toward defect prevention techniques. Management must search continually for methods to improve the process through statistical methods and team problem-solving techniques. All levels of employees and managements should be trained to use and apply new methods. Management should look for various techniques to improve the system through brainstorming, parts analysis, flow charts, control charts, etc. Management, as well as employees, must be educated to apply these methods. This will enhance performance and create a positive attitude among workers.

Deming (1982) indicated that numerical goals, slogans, and work standards should be eliminated. Deming sees work standards as a "fortress against improvement of quality and productivity." Gitlow and Gitlow (1987) state that,

> Supervisory relationships are pampered because of employees' fear of not reaching quotas, and barriers are created between managers, supervisors, employees, and unions because standards don't encourage meaningful communication. If employees can be supervised and trained using control charts as a common ground for communication, fear and barriers would diminish, the quality of work would improve, and there would be no need for quotas (p. 33).

According to Cole (1987), quantity, not quality, became the norm of postwar American management. No one had time for the quality issue when the customer bought everything American manufactures could produce, and when all major manufacturers operated on the principle that higher quality costs more. Deming's ideas lead to changes in this kind of attitude, to keep pace with global competition.

Although most of Deming's teachings are aimed at improving production line techniques, his underlying concepts are applicable to all areas of management. The ideas of effective communication, motivating employees, taking action, and eliminating barriers for those who want to do a good job are universal.

### Joseph M. Juran

Juran is an international authority on quality control who has conducted lectures on the subject at universities and academic conferences around the world (Mizuno, 1989). In 1954, JUSE invited Juran to conduct courses on quality control for top- and middle-management people. His theories on management's role in quality control and how quality control should be applied have influenced the quality control movement in Japan profoundly.

Juran emphasized the importance of control, which he defined as:

> The totality of all the means by which we establish and achieve standards (Juran, 1954, p. 41).

His idea of control is a continuous cycle beginning and ending with planning. Mizuno (1989) describes the element of the control circle as:

> Plan(P); establishing a plan or standard for achieving goal,
>
> Do(D) ; enacting planning or doing,
>
> Check(C); measuring and analyzing the results, and
>
> Action(A); implementing the necessary reforms when the results are not as originally planned (p. 59).

These four steps make up the control process. Juran (1974) divided the control circle steps into seven sub-steps. These sub-steps are:

1. Choosing the control subject, i.e., selecting what is to be regulated.
2. Choosing a unit of measure.
3. Setting a standard value, i.e., specifying the quality characteristic.
4. Creating a sensing device which can measure the characteristic in terms of the unit of measure.
5. Conducting actual measurement.
6. Interpreting the difference between actual and standard.
7. Decision-making and acting on the difference (p. 54).

Juran stress the need at the planning stage to set standard values and to clarify the methodology that can be used to

detect and compare these values.

Juran believes that managing for quality is based upon using the management processes of planning, control, and improvement. He labeled them as quality planning, quality control, and quality improvement. He calls these concepts the Juran Trilogy (Juran, 1988). Juran defines three concepts of quality planning with financial terminology, as listed below:

> Quality Planning; Budgeting, business planning,
> Quality Control; Cost control, expense control, inventory control,
> Quality Improvement; Cost reduction, profit improvement (p. 23).

The purpose of quality planning is to provide top management with the means of producing products or services that can satisfy customers' expectations. After planning is completed, the plan is turned over to the floor workers to produce products. As products are produced, some of the work must be redone because of the lack of sufficient quality. This circumstance leads quality control to prevent the process from getting worse.

Juran believes that responsibility for control should be assigned to individuals. He argues that such a method confers status that responds to some of our basic human instincts (Juran, 1988). In order to obtain superior quality, it is essential that accurate communications exist

among customers, processors, and suppliers. After these two elements of the trilogy have been met, quality improvement practice is the next logical step. Companies need to design a structure which will allow them to carry out a backlog of quality process at an unprecedented pace. The structure must be capable of identifying which tasks on which to focus, and must be able to assign clear responsibility for the completion of these tasks (Juran, 1988).

Juran's idea of trilogy describes a way of managing quality of products and/or services. Quality control is planning and implementing the most economical method of manufacturing products that will be useful and meet customers' expectations.

### Philip Crosby

Crosby's (1979) quality improvement program incorporates the development of four areas: 1) management participation and attitude, 2) professional quality management, 3) original programs, and 4) recognition. From these four areas, Crosby developed the Management Maturity Grid (MMG). This grid consists of five states with six management categories. By referencing the grid, any manager can pinpoint the stage of the quality program at that moment. Once the manager locates the position on the grid, the remaining steps can be used as a format to continue to

develop the quality improvement program. Crosby's 14-step quality improvement program which began at stage III on the MMG is listed below:

1. Management commitment
2. Quality improvement team
3. Quality measurement
4. Cost of quality evaluation
5. Quality awareness
6. Corrective action
7. Establish an Ad Hoc Committee for the Zero Defects Program
8. Supervisor training
9. Zero defects day
10. Goal setting
11. Error cause removal
12. Recognition
13. Quality councils
14. Do it over again (Crosby, 1979, p. 17).

Crosby's (1979) quality improvement program is primarily based on a team concept. The team consists of members from each department, with one of the members appointed as chairperson. The quality improvement team is responsible for establishing programs and procedures to implement the steps in the quality improvement program, as well as taking action if the programs established are not being executed in the departments. He suggested that all levels of employees should be exposed formally to the procedures prior to implementation of the program. The program should consist of procedures for both manufacturing areas and non-manufacturing areas.

Crosby (1979) further suggested that his 14-step quality improvement approach will take more than a year for

its successful implementation, and that it will improve quality as each step is implemented.

## Attitude Measurement

Basically, measurement consists of gathering observations about people's behavior, and allocating values to these observations according to certain rules. Attitude measurement is not an automatic process where the rules are laid down in advance and applied in every instance (Lemon, 1973). To the contrary, the measurement procedure will depend on: 1) the researcher's theoretical assumptions about the nature of the attitude to be measured (Mueller, 1970), 2) the nature of the relationship of the attitude with behavior, and 3) its relationship with the rules which are used to assign numbers to these behavioral observations (Lemon, 1973).

### Process of measurement

Lazarsfeld and Barton (1951) have described the process of measurement in social science in terms of four stages. The first stage is the formation of an initial image of the nature of the concepts the researcher tries to measure. This stage is mostly concerned with defining concepts the researcher is trying to measure. The second stage is specifying the relevant dimensions of the concept, so it can

serve as a basis for measurement. In the next stage, the researcher tries to translate these theoretical ideas into practice and searches for indicators which represent the theoretical concepts guiding the research. The strategy the researcher uses for this may mary for one case to another, but it is important to note that the strategy which the researcher finally adopts will determine the nature of the concepts that the researcher measures (Scott, 1968). The final stage suggested by Lazarsfeld and Barton is the combination of scores from these indicators into indices representing the underlying attitude.

Even when a researcher has selected certain indicators as being characteristic of the attitude the researcher is trying to measure, the researcher still has to decide which observations to make of these indicators (Scott, 1968). The researcher has to make fundamental decisions about the setting in which his or her observations are to take place. Although such decisions obviously will be based on the researcher's original conceptualization of attitude and its relationship to other indicators, they will also depend on the type of scoring system the researcher uses to ascribe values to these observations (Lemon, 1973).

Essential characteristics of an instrument

One essential characteristic of a measuring instrument

is that it should fulfill the purpose for which it was designed. In order to establish how far a measure does what it is designed to do, certain formal techniques have become established. As the purpose for which measures are designed will vary, so too do the techniques vary for assessing their adequacy (Heise, 1970).

Lemon (1973) proposed the purpose of such techniques as below:

> 1) To establish a formal relationship between scores on the attitude measure, and some criterion which the measure is trying to predict.
> 2) To ensure adequate coverage of the relevant content area, so that a person's performance on the measure is representative of the person's behavior in the attitude area which is being sampled.
> 3) To establish the value of a person's attitude (p. 37).

These purpose could be labelled as predictive, content, and construct validity respectively. These three purposes happen to be the major means of establishing the validity of a measure.

Predictive validity is defined as "the degree to which the predictions made by a test are confirmed by the later behavior of the subjects (Borg and Gall, 1983, p. 277). The predictive validity of an attitude measure is the degree to which it enables the researcher to predict the value of some criterion (Lemon, 1973). Content validity is widely used in

evaluating tests of academic achievement of different kinds. Construct validity is the extent to which a particular measurement has an established degree of measuring a "hypothetical construct" (Borg and Gall, 1983, p. 280). A construct is something which is derived from a number of different observations (Lemon, 1973). Attitudes, intelligence, and personality characteristics are all construct of this kind.

Another essential characteristic of a measuring instrument is that it should be reliable. Reliability is concerned with the soundness and consistency of the measure, in other words, "with how good a measure it is of whatever it is measuring" (Leman, 1973, p. 44). A classification of the major procedures for assessing the reliability of an attitude measure are: 1) coefficient of stability (test-retest), and 2) coefficient of internal consistency (KR-20, KR-21, and Cronbach Alpha).

## Summary

Traditional quality control programs are narrow, and the responsibilities are that of the quality control department. Quality is a systems approach to assure that the customer will receive a reliable product. The customer considers the quality of a product against its price before making the decision to purchase. Another factor the

customer must take into consideration is the quality of service, that is, the warranty and periodic checks.

On the other hand, because a company is in business to serve customers, its standards must be customer-oriented. Too often, quality programs are limited to the elimination of customer rejects or returns for defective products.

The quality improvement programs outlined above were developed by experts in the field of quality. Even some organizations have implemented portions of these programs. There is still a great deal of work that needs to be accomplished for organizations to produce a quality product at a reduced cost. As stated by each of these experts, in order to launch a TQM program, top management must be committed totally to quality improvement. Total quality improvement is a never-ending process which, when implemented properly, helps to establish a successful company.

The review of related literature has provided several insights into the current research effort. Historical perspectives and analysis of the previously cited research results all helped in the formulation of the design and procedures for carrying out this study.

# CHAPTER III. METHODOLOGY

This chapter describes the methods and procedures employed in fulfilling the objectives of this study. The topics addressed are: definition of population and identification of sample, development of the instrument, data collection procedure, and method of statistical analysis of the data.

## Definition of Population and Identification of Sample

This study was designed to develop and establish the validity of an instrument that measures employees' knowledge about quality improvement concepts and practices. After establishing the validity of the instrument, the instrument then may be useful in measuring the knowledge level of employees and levels of TQM implementation in manufacturing organizations. The target population included all manufacturing organizations in Iowa. The initial listing of the companies in Iowa was obtained from the Official Iowa Manufacturers Directory and the Electronic Datafile which is distributed by Business Publications Corporation in association with the Iowa Department of Economic Development (IDED). Since there are over 4000 companies listed, the researcher obtained another list of companies which are currently engaged in TQM training programs from the Center

for Continuous Quality Improvement (CCQI) housed in the Iowa State University Research Park.

The Center provided a list of thirty-one companies across Iowa. From the list, the researcher determined the size of each company and number of months they have been engaged with TQM training activities. This task was completed by contacting each company. The companies were grouped according to size into three categories. The companies in each group were determined by the number of employees within that company. A small company contained less than fifty employees, a medium company had between fifty and two hundred, and a large one had more than two hundred employees.

The companies were further divided according to the levels of TQM implementation, i.e., less than 23 months and more than 23 months. Since all of the companies on the CCQI list have some levels of TQM implementation, the companies with no exposure to TQM were randomly selected from the remaining list in the Official Iowa Manufacturers Directory and the Electronic Datafile. The samples drawn from the Electronic Datafile were selected in proportion to the number of small, medium and large companies in the list supplied by the CCQI. A total of twelve companies were selected from the list, and three additional companies were obtained from the Electronic Datafile.

## Variables of the Study

The following dependent and independent variables were included in this study.

### Dependent variables

The dependent variables of this study were two different types of responses obtained from employees. These were: 1) perceptions regarding current practices within the organization towards quality improvement efforts, and 2) perceptions regarding ideal practices within the organization to improve the quality of products and/or services.

### Independent variables

The independent variables of this study included:

1) size of the company;
    a) small (less than 50 employees),
    b) medium (between 51 and 200 employees), and
    c) large (more than 200 employees).
2) levels of TQM implementation;
    a) less than 23 months, and
    c) more than 23 months,

## Development of the Instrument

A Total Quality Management Profile (TQMP) was developed and employed to collect data for this study. This section of the study explains the development of the TQMP in the following order: format criteria, overview of instrument development, experts' review, and results of the review.

### Format criteria

The level of all employees' perception toward Total Quality Management (TQM) practice in their organization was measured by TQMP using a Likert-type five-point scale of agreement. The choice of "5" indicates strongly agree, "4" agree, "3" neutral, "2" disagree, and "1" strongly disagree with each statement. A series of steps were followed to design the instrument and to ensure consistent and accurate results.

The first step was an examination of the literature regarding concepts of TQM. This stage resulted in a large list of items, in modified form, serving as a pool from which the final set of items was drawn. The items were grouped into six dimensions of TQM. These dimensions are: leadership, customer orientation, involvement, continuous improvement, value of statistical methods, and relationship with suppliers. Guidelines for item development are listed in Appendix A.

Overview of instrument development

The TQMP has forty items. Thirty-eight items were related to six dimensions of TQM, and two items requested information on level of employment and the department in which the employee worked. Each item in the instrument was developed and modified according to six dimensions. The dimensions of leadership, customer orientation, and involvement covered twenty-seven items, nine items for each dimension. Four items were included for continuous improvement and relationship with supplier, and three items for the value of statistical methods.

Experts review

An examination of all items was performed by a panel of experts who submitted their judgements based on a table of specifications. A list of the names and titles of the panel can be found in Appendix B, and the letter sent to the panel to solicit their assistance can be found in Appendix C. The table of specifications contains the elements of TQM found in the review of related literature. It provided the content and structure of each item in the TQMP. A summary of the table of specifications is presented in Table 1.

Table 1. Summary table of item specifications

| Dimensions | Elements | Item Numbers |
|---|---|---|
| Leadership | Commitment to Quality | 1, 2, 3 |
| | Commitment to Customer | 4, 5, 6 |
| | Communication Channel | 7, 8, 9 |
| Customer | Loyalty | 10, 11, 12 |
| | Satisfaction | 13, 14, 15 |
| | Feedback | 16, 17, 18 |
| Involvement | Decision Making | 19, 20, 21 |
| | Information Sharing | 22, 23, 24 |
| | Participation | 25, 26, 27 |
| Continuous Improvement | Goals | 28, 29 |
| | Training | 30, 31 |
| Value of Statistical Methods | Value of statistics as a tool | 32, 33, 34 |
| Relationship with Suppliers | Involvement | 35, 36 |
| | Certification program | 37, 38 |

The panel's task was to compare the elements of leadership, customer orientation, involvement, continuous improvement, value of statistical methods, and relationship with suppliers to the items as operationalized aspects of the literature review. The panel reviewed the items for content validity, plausibility of items, and appropriateness. The instrument was revised based on recommendations (see Appendix D and E) by the panel. It was then presented to the researcher's Graduate Committee

members. They read through the instrument and made further suggestions. Based on their recommendations, the instrument was revised again before the final draft was produced. An example of the final draft can be found in Appendix F. Determination about the validity of the TQMP was provided by seven experts and the Graduate Committee members.

Results of panel and committee review

An item was rated based on the following criteria: a) essential; b) appropriate but not essential; and c) not appropriate. The items rated as "essential" by five out of seven experts were automatically chosen.

The results of the leadership statements, or the first dimension, are as follows: eight items were selected, and item 8 was modified by changing the wording. Regarding the second dimension, customer statements, eight items remained, and item 12, regarding "we serve our customers with a fair value for the price of our products," was modified to "we serve our customers by establishing a fair value for the price of our products" for clarity. In a third dimension, involvement, eight items remained with few changes in wording, and item 21 was changed to "there is an effective process for routinely obtaining employees' opinions and suggestions" because of its similarity with item 30.

In the fourth and fifth dimensions, continuous improvement and value of statistical method statements, all of seven items were kept without modification. In regard to the sixth dimension, relationship with suppliers, item 38 was dropped due to its similarity with item 37. Item 38 was then replaced with a statement recommended by an expert.

The final draft was pilot-tested at a manufacturing company in Cedar Rapids, Iowa. The instrument was delivered by the researcher and administered to thirty-six employees in the company. There were no major concerns regarding the contents or wording of the instrument.

### Data Collection Procedure

After an approval from the Iowa State University Human Subject Committee (see Appendix J), the researcher communicated with company executive officers by phone calls to solicit their assistance on this study. All of them agreed to participate in this testing. With their permission, the researcher visited each company with instruments and cover letters (see Appendix G and H) and administered to the employees who were selected by simple random sampling from a list of employees at each company.

## Method of Statistical Analysis of Data

This section summarizes the statistical techniques used to test the research hypotheses stated in Chapter I. Mean distributions was employed as descriptive statistics. The mean responses on each of the thirty-eight statements were used to describe general characteristics of different employees' perceptions. This analysis was used to determine the mean scores for each level of TQM implementation and size of the company.

A value of Cronbach's alpha was computed for each current and ideal section and for each of six dimensions of TQM and for the overall instrument. Two factor analyses were performed. First, a principle axis factor analysis with a varimax rotation was completed to detect whether underlying dimensions detected empirically would correspond to the six logical (a priori) dimensions identified on the survey. Second, a factor analysis of the correlation matrix for the six composite dimension scores was performed.

Research hypotheses were tested using the following techniques: 1) one-way analysis of variance (ANOVA) was employed to examine for differences in mean responses between the groups who had implemented for TQM equal to or more than 23 months and for less than 23 months, 2) multivariate analysis of variance (MANOVA) was employed to detect the existence of significant differences between

employees' perceptions on the six dimensions of TQM, and 3) a two-way analysis of variance of the composite scores for each of the six dimensions.

# CHAPTER IV. FINDINGS

The results of the analysis of the data will be presented in the following order:

1. Pilot test of the Total Quality Management Profile (TQMP),
2. Characteristics of the sample,
3. Evaluation of the TQMP,
4. Results of data analysis and hypothesis testing, and
5. Results of a two-way ANOVA of the composite scores for each of the six dimensions on the TQMP.

## Pilot Test of the Total Quality Management Profile (TQMP)

A pilot test was conducted on the TQMP to aid in the creation of a useful instrument. The final draft was pilot-tested at a manufacturing company in Cedar Rapids, Iowa. The instrument was administered to thirty-six employees in the company. In addition to responding to the profile, employees were asked to complete information about the TQMP. The additional information collected included the time necessary to complete the TQMP and the identification and modification of items that may have been confusing. There were no major concerns regarding the contents and wording of the profile.

## Characteristics of the Sample

One hundred and thirty four employees throughout seventeen organizations participated in this study. Table 2 represents the distribution of the sample. The number of companies representing each category, i.e. small, medium, and large, is proportionally different. Every effort was made to assure equal cell sizes. Fifteen companies participated in this study, including eight small companies, five medium companies, and two large companies.

Table 2. Characteristics of sample

| Size of Company | Months with TQM | n |
|---|---|---|
| Small | Less than 23 months | 36 |
| | More than 23 months | 16 |
| Medium | Less than 23 months | 17 |
| | More than 23 months | 15 |
| Large | Less than 23 months | 32 |
| | More than 23 months | 18 |
| Total | | 134 |

## Evaluation of the TQMP

The SPSSx package was utilized to analyze the data and calculate the reliability estimate of the TQMP. The analysis was conducted for each of six dimensions--leadership, customer, employee involvement, continuous improvement efforts, statistical methods, and relationship

with suppliers--of TQM and divided into the perceived current and ideal practices of TQM.

As presented in Tables 3 and 4, the overall reliability of the current practice section of the TQMP was .944, and .963 for the ideal practice section. The reliabilities of individual sections ranged from .606 to .875 for the current practice section. On the other hand, somewhat higher individual section reliabilities, from .795 to .925, were obtained for the ideal practice section.

Table 3. Reliability analysis of current practice section of TQMP

| Dimension | Item Numbers | Reliability |
|---|---|---|
| Leadership | 1 - 9 | .802 |
| Customers | 10 - 18 | .836 |
| Involvement | 19 - 27 | .875 |
| Continuous Improvement | 28 - 31 | .606 |
| Statistical Methods | 32 - 34 | .787 |
| Relationship w/ Suppliers | 35 - 38 | .800 |
| Overall | 1 - 38 | .944 |

A principle axis factor analysis with a varimax rotation was completed to detect whether the underlying dimensions detected empirically would correspond to the six logical (a priori) dimensions identified on the survey. A count of each item was then made with respect to its a

Table 4. Reliability analysis of ideal practice section of TQMP

| Dimension | Item Numbers | Reliability |
|---|---|---|
| Leadership | 1 - 9 | .795 |
| Customers | 10 - 18 | .881 |
| Involvement | 19 - 27 | .925 |
| Continuous Improvement | 28 - 31 | .845 |
| Statistical Methods | 32 - 34 | .878 |
| Relationship w/ Suppliers | 35 - 38 | .839 |
| Overall | 1 - 38 | .963 |

priori dimensions and factor group. As the results suggested in Table 5, five factors may exist. Items were identified by the highest factor loading. The resulting crosstab is shown in Table 6. Only the fifth dimension, statistical methods, appears to be congruent with factor 5. The remaining dimensions are spread across multiple factors. This suggests that, in their ratings, respondents are not differentiating among the six dimensions as they were originally conceptualized. Based on the limited number of respondents, however, caution should be exercised when using the results of these procedure. A factor analysis of the correlation matrix, Table 7, for the six composite dimension scores was performed. The results suggest that there is only one dominant factor. Table 8 presents the result of a factor analysis for six dimensions.

Table 5. Eigenvalue of factor analysis for 38 items on TQMP

| Factor | Eigenvalue | Percentage of variance | Cumulative percentage |
|---|---|---|---|
| 1 | 12.49 | 32.9 | 32.9 |
| 2 | 2.23 | 5.9 | 38.8 |
| 3 | 1.79 | 4.7 | 43.5 |
| 4 | 1.17 | 3.1 | 46.5 |
| 5 | 1.01 | 2.7 | 49.2 |

Table 6. Crosstab of a priori dimensions and empirical factors

| Dimension* | Factor | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| 1 | 3 | 2 | | 4 | |
| 2 | 4 | 1 | | | 4 |
| 3 | 1 | 4 | 2 | 1 | 1 |
| 4 | 2 | | | 2 | |
| 5 | | | | | 3 |
| 6 | | 1 | 1 | 1 | 1 |

* Dimension:
1. Leadership
2. Customer orientation
3. Involvement
4. Continuous improvement
5. Statistical methods
6. Relationship with suppliers

Table 7. Correlation coefficient between 6-Dimensions

| Dim.* | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| 1 | 1 | 0.627 | 0.759 | 0.443 | 0.491 | 0.476 |
| 2 | | 1 | 0.725 | 0.518 | 0.638 | 0.653 |
| 3 | | | 1 | 0.615 | 0.634 | 0.583 |
| 4 | | | | 1 | 0.626 | 0.440 |
| 5 | | | | | 1 | 0.573 |
| 6 | | | | | | 1 |

* Dimensions on the TQMP:
1. Leadership
2. Customer
3. Involvement
4. Continuous Improvement
5. Statistical Methods
6. Relationship with suppliers

Table 8. Eigenvalue of factor analysis for six-dimensions on TQMP

| Factor | Eigenvalue | Percentage of variance | Cumulative percentage |
|---|---|---|---|
| 1 | 3.54 | 94.2 | 94.2 |

## Results of Data Analysis and Hypothesis Testing

A descriptive analysis of the data is presented in this section, and the results of the hypothesis tests are included with appropriate tables. Since the variables of the study included size of the company and months with TQM practice, presentation of the results is divided into two sub-sections, size of the company and months with TQM.

### Size of the companies

Figure 2 is a graphical representation of the perceptions of both current and ideal TQM practices. The figure indicates that on all thirty-eight items the respondents have a higher level of agreement in a perceived ideal setting. These data were further divided according to the size of companies.

Table 9 displays the numerical results of perceived current TQM practices among the three different sizes of companies. Several items (4, 6, and 30) have a higher degree of agreement with the statements in the profile. Some items (16, 21, 26, and 37) have a lower degree of agreement with the statements. Figure 3 presents this result more clearly.

Table 10 and Figure 4 provide the mean responses on each of thirty-eight items regarding ideal TQM practices among the different size companies. Compared to the results

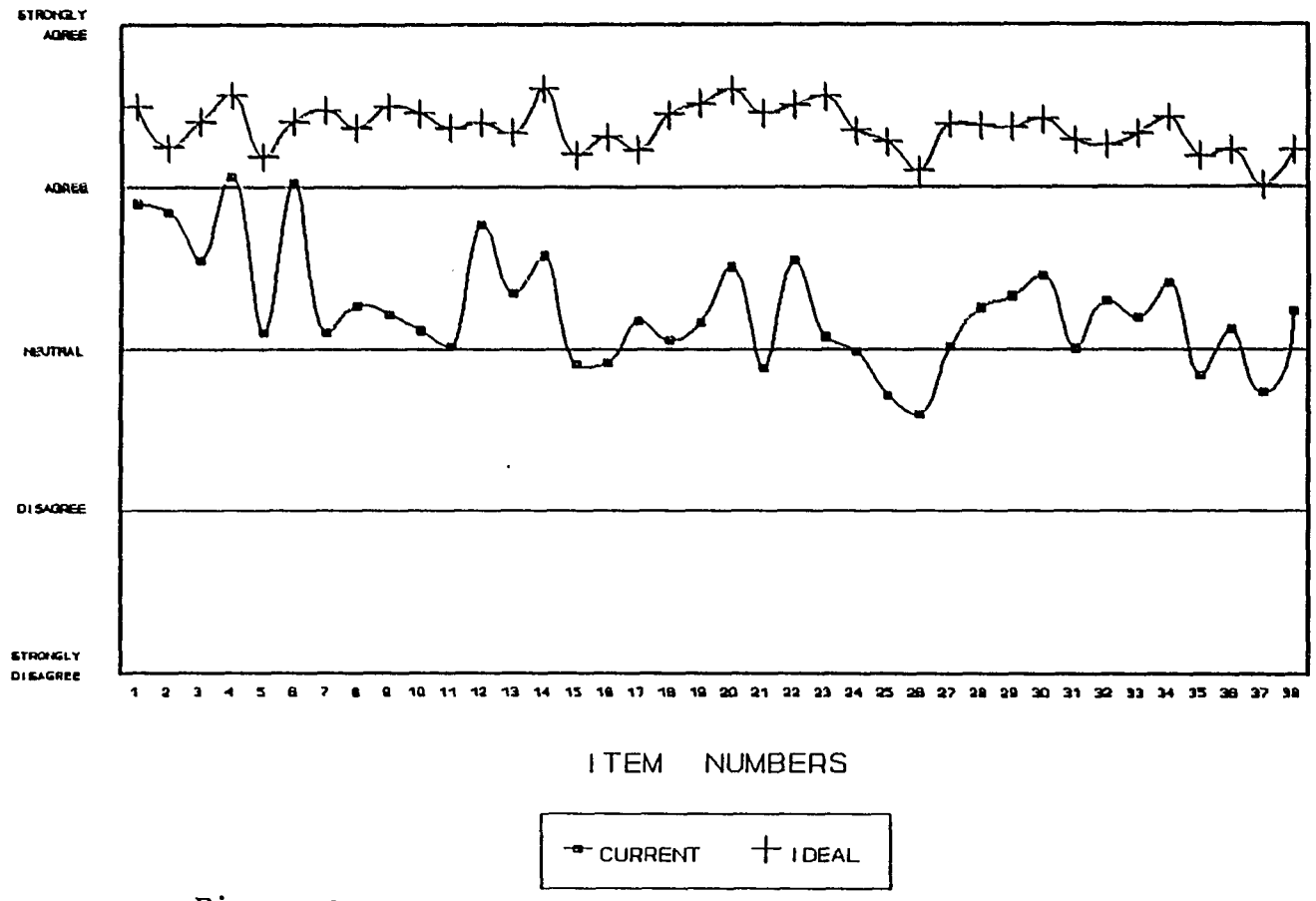


Figure 2. Overall comparison of current & ideal practices

Table 9. Mean responses for each of thirty-eight items on current TQM practices among different sized companies

| Item Number | SM[a](n=52) | MD[b](n=32) | LG[c](n=50) |
|---|---|---|---|
| 1 | 3.88 | 4.06 | 3.80 |
| 2 | 3.90 | 3.81 | 3.82 |
| 3 | 3.34 | 3.56 | 3.76 |
| 4 | 4.21 | 3.84 | 4.06 |
| 5 | 3.00 | 3.03 | 3.28 |
| 6 | 4.13 | 3.75 | 4.10 |
| 7 | 3.07 | 3.34 | 3.00 |
| 8 | 3.63 | 3.06 | 3.02 |
| 9 | 3.21 | 3.28 | 3.18 |
| 10 | 3.21 | 2.93 | 3.14 |
| 11 | 2.94 | 3.09 | 3.06 |
| 12 | 3.65 | 3.93 | 3.78 |
| 13 | 3.19 | 3.40 | 3.48 |
| 14 | 3.55 | 3.31 | 3.78 |
| 15 | 3.13 | 2.65 | 2.84 |
| 16 | 2.98 | 2.90 | 2.86 |
| 17 | 3.26 | 3.28 | 3.02 |
| 18 | 3.13 | 2.71 | 3.22 |
| 19 | 3.23 | 3.50 | 2.90 |
| 20 | 3.44 | 3.81 | 3.40 |
| 21 | 2.98 | 2.81 | 2.84 |
| 22 | 3.61 | 3.46 | 3.54 |
| 23 | 3.05 | 3.12 | 3.08 |
| 24 | 2.94 | 3.40 | 2.78 |
| 25 | 2.50 | 3.31 | 2.58 |
| 26 | 2.65 | 2.59 | 2.56 |
| 27 | 3.13 | 2.81 | 3.04 |
| 28 | 3.30 | 3.00 | 3.38 |
| 29 | 3.32 | 3.68 | 3.10 |
| 30 | 2.73 | 4.31 | 3.66 |
| 31 | 2.69 | 3.59 | 2.98 |
| 32 | 3.07 | 3.71 | 3.26 |
| 33 | 3.13 | 3.40 | 3.14 |
| 34 | 3.36 | 3.65 | 3.30 |
| 35 | 3.13 | 2.65 | 2.66 |
| 36 | 3.34 | 3.06 | 2.96 |
| 37 | 2.61 | 2.81 | 2.82 |
| 38 | 3.34 | 3.34 | 3.06 |

[a] Small company (less than 50 employees)
[b] Medium company (between 50 and 200 employees)
[c] Large company (more than 200 employees)

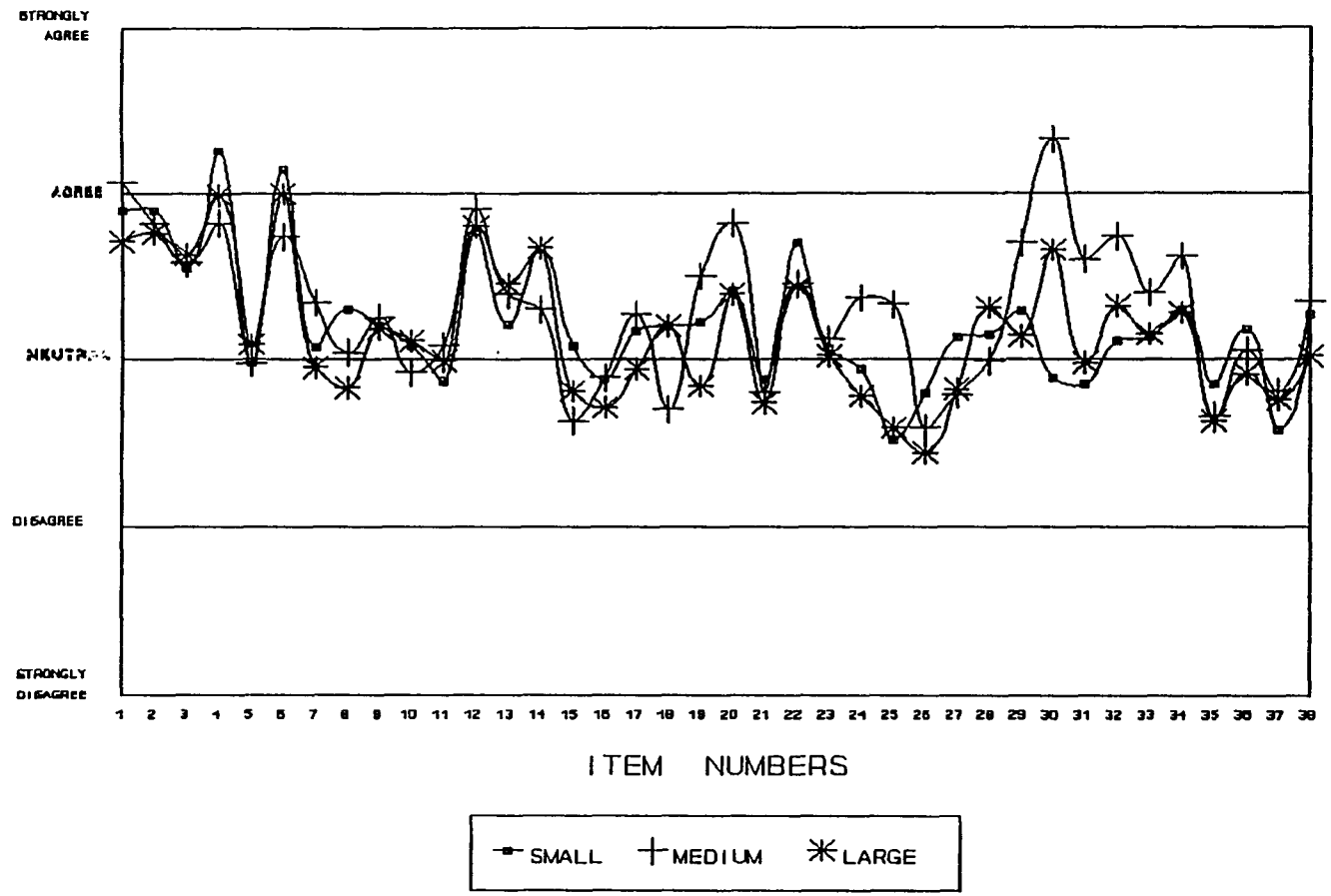


**Figure 3. Current TQM practices among the different size of companies**

Table 10. Mean responses for each of thirty-eight items on ideal TQM practices among different sized companies

| Item Number | SM[a](n=52) | MD[b](n=32) | LG[c](n=50) |
|---|---|---|---|
| 1 | 4.40 | 4.50 | 4.60 |
| 2 | 4.34 | 4.21 | 4.16 |
| 3 | 4.25 | 4.46 | 4.54 |
| 4 | 4.51 | 4.65 | 4.58 |
| 5 | 4.09 | 4.12 | 4.32 |
| 6 | 4.40 | 4.40 | 4.42 |
| 7 | 4.40 | 4.65 | 4.44 |
| 8 | 4.32 | 4.65 | 4.22 |
| 9 | 4.42 | 4.53 | 4.54 |
| 10 | 4.48 | 4.46 | 4.44 |
| 11 | 4.26 | 4.56 | 4.34 |
| 12 | 4.26 | 4.53 | 4.46 |
| 13 | 4.26 | 4.37 | 4.40 |
| 14 | 4.61 | 4.59 | 4.62 |
| 15 | 4.19 | 4.37 | 4.10 |
| 16 | 4.28 | 4.28 | 4.36 |
| 17 | 4.25 | 4.25 | 4.20 |
| 18 | 4.36 | 4.40 | 4.56 |
| 19 | 4.59 | 4.56 | 4.42 |
| 20 | 4.55 | 4.59 | 4.64 |
| 21 | 4.57 | 4.34 | 4.40 |
| 22 | 4.50 | 4.53 | 4.50 |
| 23 | 4.42 | 4.53 | 4.44 |
| 24 | 4.32 | 4.40 | 4.34 |
| 25 | 4.28 | 4.50 | 4.14 |
| 26 | 4.21 | 4.18 | 3.94 |
| 27 | 4.40 | 4.34 | 4.40 |
| 28 | 4.36 | 4.43 | 4.36 |
| 29 | 4.34 | 4.53 | 4.30 |
| 30 | 4.23 | 4.53 | 4.54 |
| 31 | 4.34 | 4.46 | 4.12 |
| 32 | 4.07 | 4.43 | 4.34 |
| 33 | 4.15 | 4.56 | 4.36 |
| 34 | 4.26 | 4.65 | 4.44 |
| 35 | 4.32 | 4.06 | 4.14 |
| 36 | 4.21 | 4.31 | 4.20 |
| 37 | 3.86 | 4.09 | 4.10 |
| 38 | 4.13 | 4.43 | 4.20 |

[a] Small company (less than 50 employees)
[b] Medium company (between 50 and 200 employees)
[c] Large company (more than 200 employees)

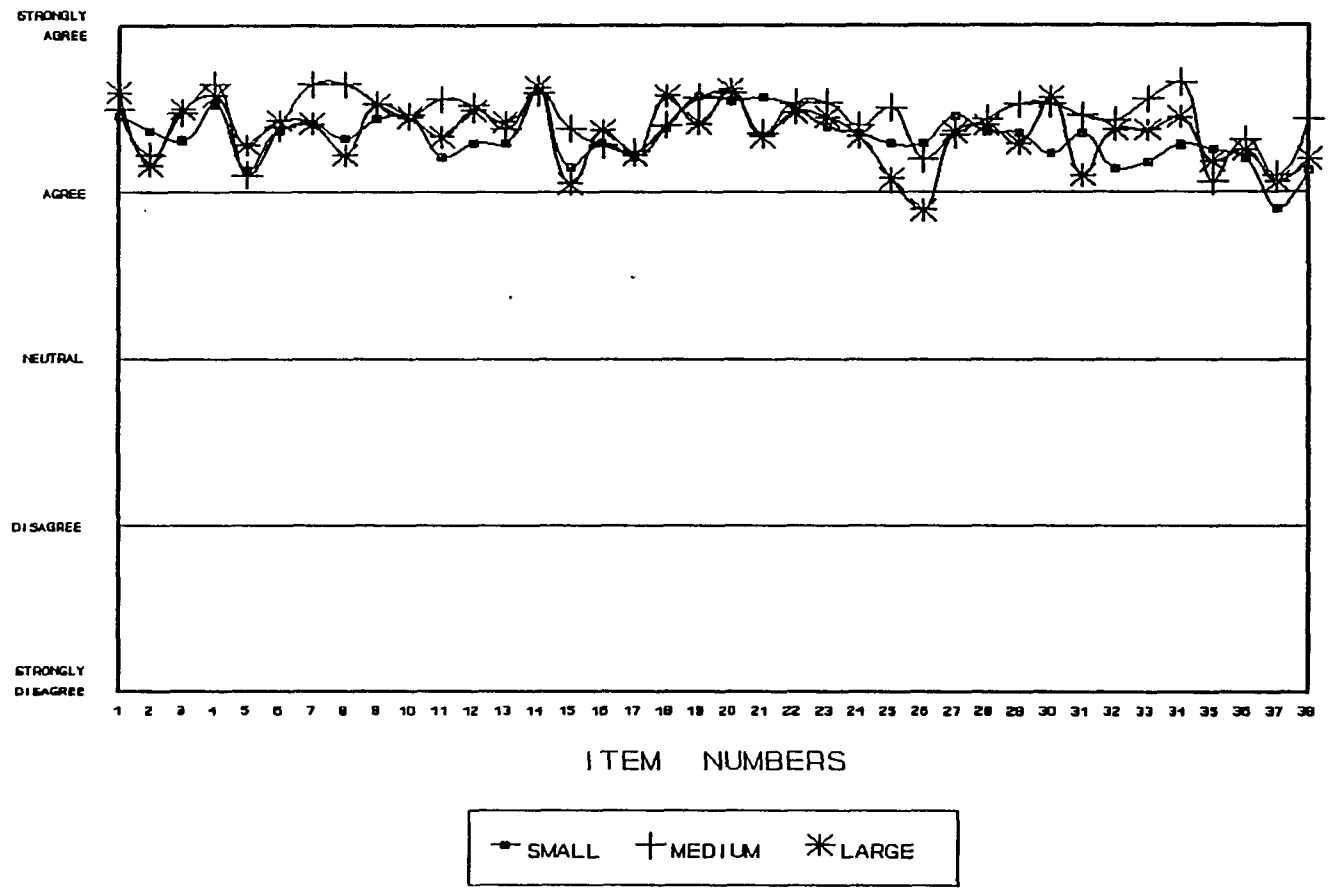


**Figure 4. Ideal TQM practices among the different size of companies**

shown in Table 11, the ideal section was perceived as having much higher agreement across all statements from employees at three different sizes of companies.

Months with TQM

Table 12 displays the mean ratings by employees of current TQM practices in their organizations with different levels of TQM implementation, less than 23 months and more than 23 months. Most of the employees with higher levels of exposure to TQM seemed to have less positive perceptions toward current TQM practices within their organizations. Primarily, items included in the continuous improvement dimension effort have more positive responses from the employees with higher levels of exposure to TQM. Figure 5 displays the results more clearly.

Table 12 indicates that most of the responses obtained from the two groups of employees were not different regarding ideal TQM practices. Figure 6 also supports this conclusion graphically. Responses on thirty-eight items indicated that employees seemed to have definite expectations of which practices their organizations should follow.

Table 11. Mean responses for each of thirty-eight items on current TQM practices between the different levels of TQM implementation

| Item Number | Levels of implementation | |
|---|---|---|
| | Less than 23 months(n=85) | Equal to or more than 23 months(n=49) |
| 1 | 3.95 | 3.79 |
| 2 | 3.89 | 3.77 |
| 3 | 3.48 | 3.67 |
| 4 | 4.18 | 3.85 |
| 5 | 3.47 | 2.48 |
| 6 | 4.16 | 3.79 |
| 7 | 3.17 | 3.00 |
| 8 | 3.75 | 2.42 |
| 9 | 3.28 | 3.10 |
| 10 | 3.29 | 2.81 |
| 11 | 3.18 | 2.73 |
| 12 | 3.72 | 3.83 |
| 13 | 3.41 | 3.24 |
| 14 | 3.67 | 3.42 |
| 15 | 3.08 | 2.61 |
| 16 | 3.17 | 2.46 |
| 17 | 3.35 | 2.87 |
| 18 | 3.12 | 2.95 |
| 19 | 3.23 | 3.06 |
| 20 | 3.52 | 3.48 |
| 21 | 3.10 | 2.51 |
| 22 | 3.65 | 3.36 |
| 23 | 3.14 | 2.97 |
| 24 | 3.07 | 2.85 |
| 25 | 2.63 | 2.87 |
| 26 | 2.62 | 2.57 |
| 27 | 3.30 | 2.53 |
| 28 | 3.47 | 2.89 |
| 29 | 3.25 | 3.44 |
| 30 | 3.24 | 3.81 |
| 31 | 2.85 | 3.28 |
| 32 | 3.14 | 3.57 |
| 33 | 3.21 | 3.18 |
| 34 | 3.56 | 3.14 |
| 35 | 3.08 | 2.42 |
| 36 | 3.29 | 2.79 |
| 37 | 2.81 | 2.61 |
| 38 | 3.30 | 3.12 |

Table 12. Mean responses for each of thirty-eight items on ideal TQM practices between the different levels of TQM implementation

| Item Number | Levels of implementation | |
|---|---|---|
| | Less than 23 months(n=85) | Equal to or more than 23 months(n=49) |
| 1 | 4.43 | 4.61 |
| 2 | 4.22 | 4.28 |
| 3 | 4.34 | 4.53 |
| 4 | 4.56 | 4.59 |
| 5 | 4.24 | 4.08 |
| 6 | 4.45 | 4.32 |
| 7 | 4.48 | 4.46 |
| 8 | 4.35 | 4.38 |
| 9 | 4.45 | 4.55 |
| 10 | 4.48 | 4.42 |
| 11 | 4.37 | 4.34 |
| 12 | 4.35 | 4.48 |
| 13 | 4.28 | 4.44 |
| 14 | 4.56 | 4.69 |
| 15 | 4.23 | 4.14 |
| 16 | 4.29 | 4.34 |
| 17 | 4.23 | 4.22 |
| 18 | 4.40 | 4.53 |
| 19 | 4.49 | 4.57 |
| 20 | 4.58 | 4.61 |
| 21 | 4.50 | 4.36 |
| 22 | 4.47 | 4.57 |
| 23 | 4.42 | 4.51 |
| 24 | 4.31 | 4.40 |
| 25 | 4.28 | 4.28 |
| 26 | 4.05 | 4.18 |
| 27 | 4.37 | 4.40 |
| 28 | 4.31 | 4.48 |
| 29 | 4.35 | 4.40 |
| 30 | 4.34 | 4.55 |
| 31 | 4.29 | 4.28 |
| 32 | 4.16 | 4.42 |
| 33 | 4.25 | 4.44 |
| 34 | 4.37 | 4.51 |
| 35 | 4.20 | 4.18 |
| 36 | 4.16 | 4.34 |
| 37 | 3.98 | 4.04 |
| 38 | 4.18 | 4.30 |

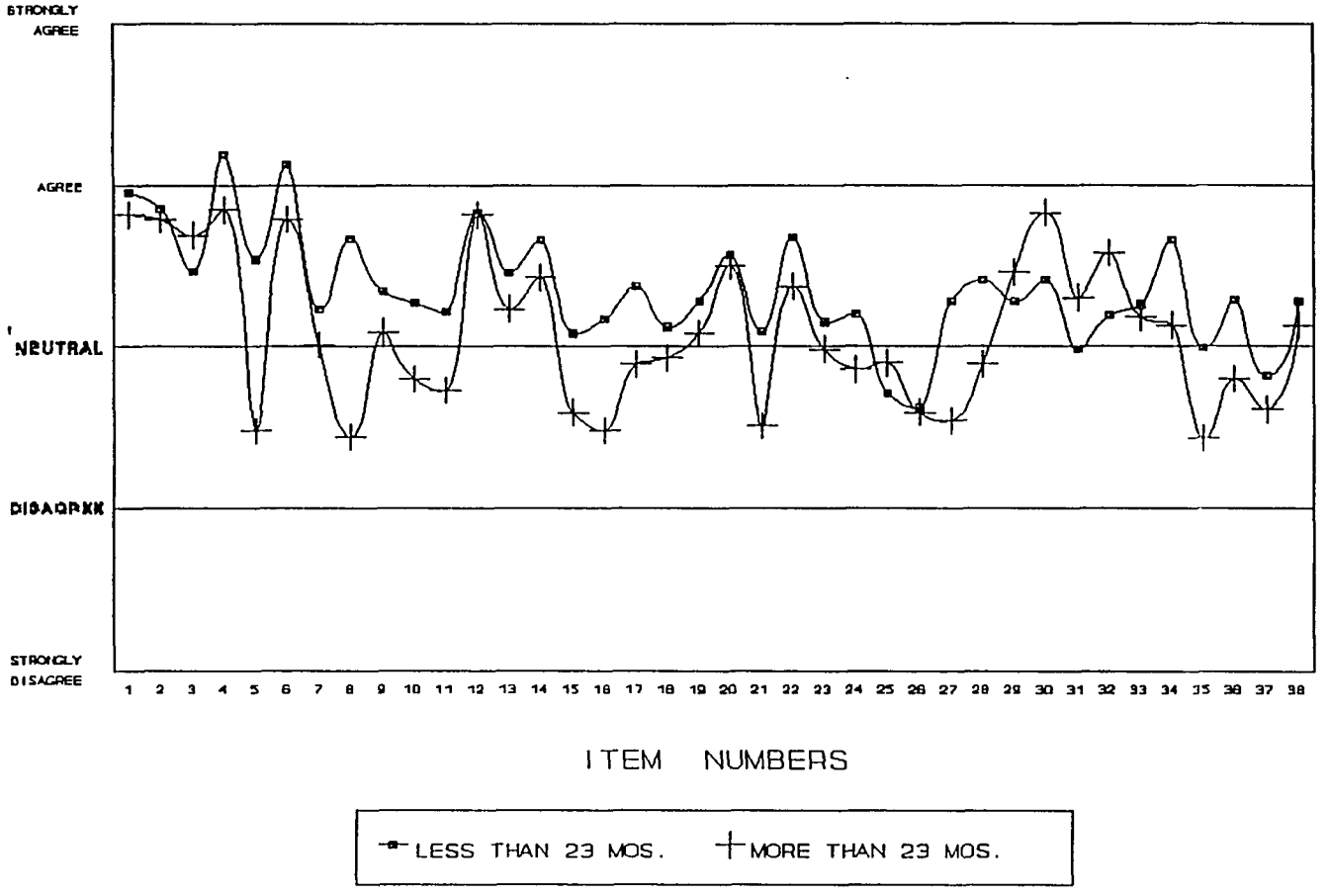


Figure 5. Comparison of current practices at different levels of implementation

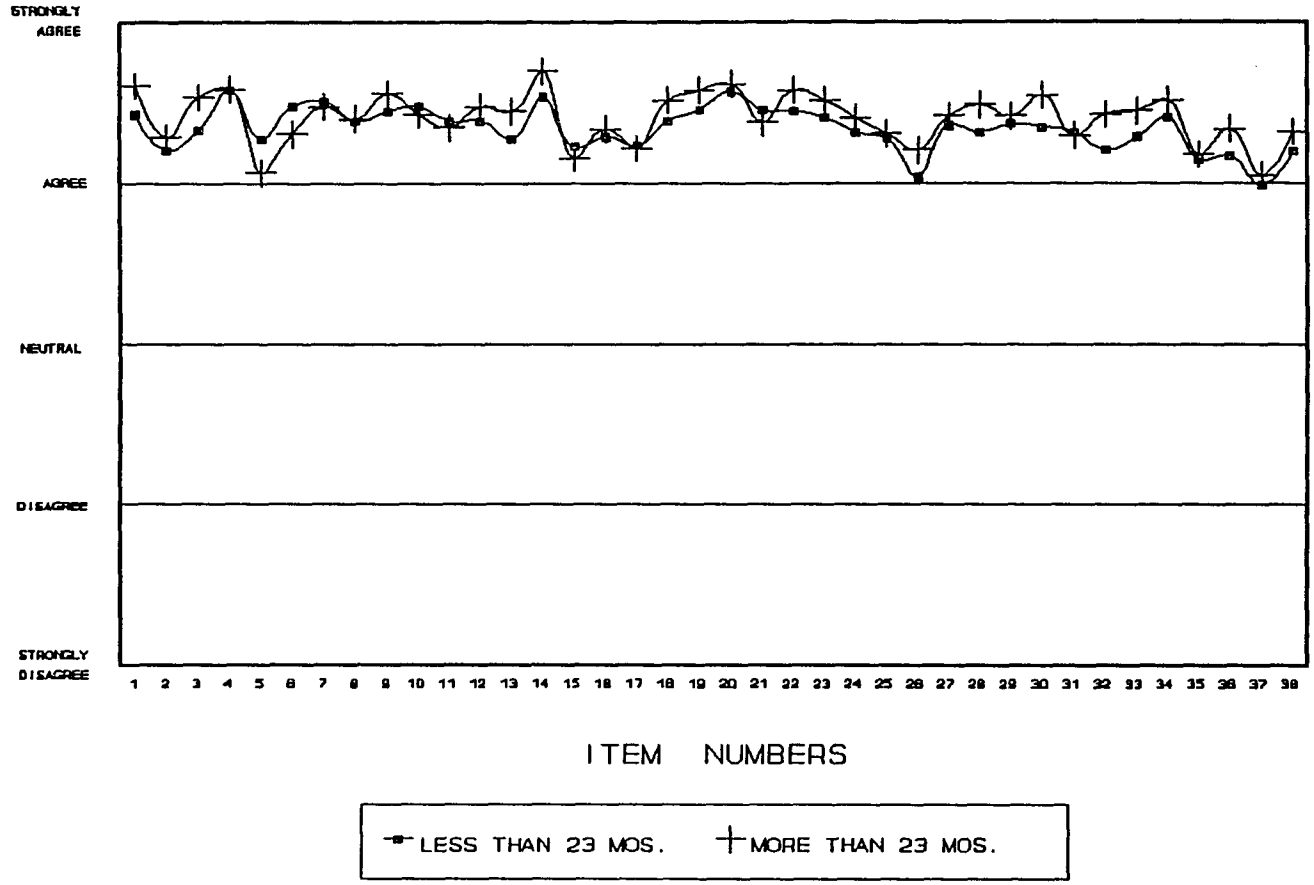


**Figure 6. Comparison of ideal practices at different levels of implementation**

Results of hypothesis testing

Hypothesis 1 There is no significant difference in mean responses to items on the TQMP regarding current TQM practices among small, medium, and large companies.

$$H_o: \mu_{cis}=\mu_{cim}=\mu_{cil}$$

where

c is current practice
i is item number (1-38)
s is small company
m is medium company
l is large company

Table 13 presents the results of the ANOVA procedure on thirty-eight statements concerning the current practices on the TQMP among the employees at small, medium, and large companies. The results indicate that several practices included in "employee involvement" and "continuous improvement effort" dimensions have significantly different responses between the employees of small, medium, and large companies. Comparisons of the mean responses on these practices are presented in Table 14. Table 15 reports results of the Scheffe multiple comparison pairwise test procedure on these practices which have significantly different mean responses across company sizes. Most of the differences which were found had to do with employee involvement and continuous improvement efforts.

Table 13. Analysis of variance of responses to each item on current practices among three different sizes of companies (n=134, df=2, 131)

| Item Number | SS[a] | MS[b] | F |
|---|---|---|---|
| 1 | 1.354 | 0.677 | 0.61 |
| 2 | 0.240 | 0.120 | 0.12 |
| 3 | 4.370 | 2.185 | 1.76 |
| 4 | 2.683 | 1.341 | 1.52 |
| 5 | 2.272 | 1.136 | 0.72 |
| 6 | 3.322 | 1.661 | 1.87 |
| 7 | 2.409 | 1.204 | 0.79 |
| 8 | 11.415 | 5.707 | 3.27* |
| 9 | 0.202 | 0.101 | 0.07 |
| 10 | 1.521 | 0.760 | 0.71 |
| 11 | 0.567 | 0.283 | 0.23 |
| 12 | 1.604 | 0.802 | 0.85 |
| 13 | 2.239 | 1.119 | 1.33 |
| 14 | 4.315 | 2.157 | 1.83 |
| 15 | 4.928 | 2.464 | 2.69 |
| 16 | 0.377 | 0.188 | 0.16 |
| 17 | 2.021 | 1.010 | 0.93 |
| 18 | 5.289 | 2.644 | 2.18 |
| 19 | 7.321 | 3.660 | 2.76 |
| 20 | 3.768 | 1.884 | 1.24 |
| 21 | 0.745 | 0.372 | 0.26 |
| 22 | 0.437 | 0.218 | 0.14 |
| 23 | 0.090 | 0.045 | 0.03 |
| 24 | 7.866 | 3.933 | 2.88 |
| 25 | 14.728 | 7.364 | 7.53* |
| 26 | 0.229 | 0.114 | 0.09 |
| 27 | 2.080 | 1.040 | 0.62 |
| 28 | 3.001 | 1.500 | 1.24 |
| 29 | 6.734 | 3.367 | 3.48* |
| 30 | 52.905 | 26.452 | 22.45* |
| 31 | 16.194 | 8.097 | 6.48* |
| 32 | 8.278 | 4.139 | 4.11* |
| 33 | 1.763 | 0.881 | 0.77 |
| 34 | 2.648 | 1.324 | 1.30 |
| 35 | 7.212 | 3.606 | 3.10* |
| 36 | 4.017 | 2.008 | 2.03 |
| 37 | 1.295 | 0.647 | 0.68 |
| 38 | 2.550 | 1.275 | 1.49 |

[a] Model SS
[b] Model MS
* Significant at .05

Table 14. Means and standard deviation of responses to selected current practices on the TQMP

| | Size of Companies | | | | | |
|---|---|---|---|---|---|---|
| | Small | | Medium | | Large | |
| Item | Mean | SD | Mean | SD | Mean | SD |
| 8 | 3.63 | 1.31 | 3.06 | 1.36 | 3.02 | 1.30 |
| 15 | 3.13 | 0.97 | 2.65 | 0.97 | 2.84 | 0.93 |
| 19 | 3.23 | 1.19 | 3.50 | 1.01 | 2.90 | 1.18 |
| 24 | 2.94 | 1.03 | 3.40 | 1.34 | 2.78 | 1.18 |
| 25 | 2.50 | 0.85 | 3.31 | 1.06 | 2.58 | 1.07 |
| 29 | 3.32 | 1.04 | 3.68 | 0.78 | 3.10 | 1.03 |
| 30 | 2.73 | 1.19 | 4.31 | 0.69 | 3.66 | 1.17 |
| 31 | 2.69 | 1.05 | 3.59 | 1.16 | 2.98 | 1.15 |
| 32 | 3.07 | 0.98 | 3.71 | 0.99 | 3.26 | 1.02 |
| 35 | 3.13 | 1.15 | 3.40 | 1.07 | 2.66 | 1.09 |

Table 15. Scheffe method for comparison of mean responses to selected items among different sized companies

| Item number | Contrast++ | S.Error | T-Value | Pr.>T |
|---|---|---|---|---|
| 8 | Gp.1-Gp.2 | 0.297 | 1.926 | 0.056 |
| | Gp.1-Gp.3 | 0.261 | 2.347 | 0.020* |
| | Gp.2-Gp.3 | 0.142 | -0.142 | 0.887 |
| 15 | Gp.1-Gp.2 | 0.215 | 2.225 | 0.028* |
| | Gp.1-Gp.3 | 0.189 | 1.554 | 0.123 |
| | Gp.2-Gp.3 | 0.216 | 0.848 | 0.398 |
| 19 | Gp.1-Gp.2 | 0.258 | -1.041 | 0.300 |
| | Gp.1-Gp.3 | 0.228 | 1.450 | 0.149 |
| | Gp.2-Gp.3 | 0.260 | -2.301 | 0.023* |
| 24 | Gp.1-Gp.2 | 0.264 | -1.766 | 0.080 |
| | Gp.1-Gp.3 | 0.231 | 0.701 | 0.485 |
| | Gp.2-Gp.3 | 0.262 | -2.366 | 0.019* |
| 25 | Gp.1-Gp.2 | 0.222 | -3.658 | 0.000* |
| | Gp.1-Gp.3 | 0.195 | -0.409 | 0.684 |
| | Gp.2-Gp.3 | 0.223 | -3.273 | 0.001* |
| 29 | Gp.1-Gp.2 | 0.221 | -1.631 | 0.150 |
| | Gp.1-Gp.3 | 0.194 | 1.164 | 0.246 |
| | Gp.2-Gp.3 | 0.227 | -2.638 | 0.009* |
| 30 | Gp.1-Gp.2 | 0.243 | -6.486 | 0.000* |
| | Gp.1-Gp.3 | 0.215 | -4.322 | 0.000* |
| | Gp.2-Gp.3 | 0.245 | -2.656 | 0.009* |
| 31 | Gp.1-Gp.2 | 0.251 | -3.588 | 0.000* |
| | Gp.1-Gp.3 | 0.221 | -1.299 | 0.196 |
| | Gp.2-Gp.3 | 0.253 | -2.425 | 0.017* |
| 32 | Gp.1-Gp.2 | 0.225 | -2.848 | 0.005* |
| | Gp.1-Gp.3 | 0.198 | -0.922 | 0.358 |
| | Gp.2-Gp.3 | 0.227 | -2.020 | 0.045* |
| 35 | Gp.1-Gp.2 | 0.242 | 1.973 | 0.051 |
| | Gp.1-Gp.3 | 0.213 | 2.221 | 0.028* |
| | Gp.2-Gp.3 | 0.244 | 0.015 | 0.988 |

++ Group comparison: Gp.1 (Small Companies)
Gp.2 (Medium Companies)
GP.3 (Large Companies)

* Significant at .05

Hypothesis 2 There is no significant difference in mean responses to items on the TQMP regarding ideal TQM practices among small, medium, and large companies.

$$H_o: \mu_{dis}=\mu_{dim}=\mu_{dil}$$

where

d is ideal practice
i is item number (1-38)
s is small company
m is medium company
l is large company

Table 16 summarizes the results of the ANOVA procedure for all statements regarding the ideal practices of TQMP among the employees at small, medium, and large companies. The results indicate that one statement, "Our organization has shown steady improvement in product quality recently," has significantly different mean responses among the employees at small, medium, and large companies. Table 17 presents mean comparisons of the practices which have significant differences. Table 18 displays that employees of medium companies perceive a higher degree of agreement towards the goal of recent improvement than do employees of small companies. Employees at small companies perceived these practices more negatively, compared to the results of medium and large companies.

Table 16. Analysis of variance of responses to each item on ideal practices among three different sizes of companies (n=134, df=2, 131)

| Item Number | SS[a] | MS[b] | F |
|---|---|---|---|
| 1 | 0.980 | 0.490 | 0.91 |
| 2 | 0.915 | 0.457 | 0.45 |
| 3 | 2.286 | 1.143 | 1.63 |
| 4 | 0.374 | 0.187 | 0.38 |
| 5 | 1.436 | 0.718 | 1.06 |
| 6 | 0.007 | 0.003 | 0.01 |
| 7 | 1.374 | 0.687 | 1.12 |
| 8 | 3.841 | 1.920 | 2.70 |
| 9 | 0.411 | 0.205 | 0.38 |
| 10 | 0.043 | 0.021 | 0.05 |
| 11 | 1.756 | 0.878 | 1.71 |
| 12 | 1.619 | 0.809 | 1.59 |
| 13 | 0.478 | 0.239 | 0.51 |
| 14 | 0.014 | 0.007 | 0.02 |
| 15 | 1.482 | 0.741 | 0.84 |
| 16 | 0.173 | 0.086 | 0.13 |
| 17 | 0.078 | 0.039 | 0.06 |
| 18 | 1.037 | 0.518 | 0.85 |
| 19 | 0.858 | 0.429 | 0.90 |
| 20 | 0.173 | 0.086 | 0.02 |
| 21 | 1.320 | 0.660 | 1.06 |
| 22 | 0.023 | 0.011 | 0.02 |
| 23 | 0.250 | 0.125 | 0.22 |
| 24 | 0.133 | 0.066 | 0.09 |
| 25 | 2.530 | 1.265 | 1.91 |
| 26 | 2.169 | 1.084 | 1.39 |
| 27 | 0.082 | 0.041 | 0.06 |
| 28 | 0.136 | 0.068 | 0.13 |
| 29 | 1.105 | 0.552 | 0.88 |
| 30 | 2.977 | 1.488 | 2.45 |
| 31 | 2.631 | 1.315 | 1.89 |
| 32 | 3.070 | 1.535 | 2.22 |
| 33 | 3.388 | 1.694 | 2.91 |
| 34 | 2.984 | 1.492 | 3.50* |
| 35 | 1.617 | 0.808 | 1.19 |
| 36 | 0.280 | 0.140 | 0.22 |
| 37 | 1.716 | 0.858 | 0.87 |
| 38 | 1.895 | 0.947 | 1.44 |

[a] Model SS
[b] Model MS
* Significant at .05

Table 17. Means and standard deviations of responses to selected ideal practices on the TQMP

| | Size of Companies | | | | | |
|---|---|---|---|---|---|---|
| | Small | | Medium | | Large | |
| Item | Mean | SD | Mean | SD | Mean | SD |
| 34 | 4.26 | 0.71 | 4.65 | 0.54 | 4.44 | 0.64 |

Table 18. Scheffe method for comparison of mean responses on selected items between different sized companies

| Item number | Contrast++ | S.Error | T-Value | Pr.>T |
|---|---|---|---|---|
| 34 | Gp.1-Gp.2 | 0.146 | -2.640 | 0.009* |
| | Gp.1-Gp.3 | 0.129 | -1.321 | 0.189 |
| | Gp.2-Gp.3 | 0.147 | 1.464 | 0.146 |

++ Group comparison: Gp.1 (Small Companies)
Gp.2 (Medium Companies)
GP.3 (Large Companies)

* Significant at .05

Hypothesis 3 There is no significant difference between mean responses to items on the TQMP regarding current TQM practices across two different levels of TQM implementation.

$$H_o: \mu_{ciy1}=\mu_{ciy2}$$

where

c is current practice
i is item number (1-38)
y1 is less than 23 months
y2 is equal to or more than 23 months

Table 19 summarizes the results of the ANOVA procedure on each of the thirty-eight items on mean perception of current practices between the employees with different levels of exposure to TQM. The results indicate that a number of statements on the TQMP have significantly different mean responses between two different groups of employees. These statements included, primarily, the "leadership," "customer orientation," and "continuous improvement effort" dimensions of TQM. Table 20 gives the results of mean comparison for the practices which have significant differences. The employees with lower levels of exposure to TQM have more positive perception than does the other group of employees.

Table 19. Analysis of variance for responses to each item on current practices between two different levels of TQM implementation (n=134, df=1, 131)

| Item Number | SS[a] | MS[b] | F |
|---|---|---|---|
| 1 | 0.766 | 0.766 | 0.69 |
| 2 | 0.437 | 0.437 | 0.42 |
| 3 | 1.135 | 1.135 | 0.90 |
| 4 | 3.407 | 3.407 | 3.91 |
| 5 | 29.899 | 29.899 | 22.00* |
| 6 | 4.227 | 4.227 | 4.82* |
| 7 | 0.967 | 0.967 | 0.63 |
| 8 | 54.516 | 54.516 | 38.73* |
| 9 | 1.010 | 1.010 | 0.73 |
| 10 | 7.095 | 7.095 | 6.94* |
| 11 | 6.393 | 6.392 | 5.39* |
| 12 | 0.358 | 0.358 | 0.38 |
| 13 | 0.865 | 0.865 | 1.02 |
| 14 | 1.820 | 1.820 | 1.53 |
| 15 | 6.869 | 6.869 | 7.68* |
| 16 | 15.539 | 15.539 | 14.80* |
| 17 | 7.024 | 7.024 | 6.78* |
| 18 | 0.900 | 0.900 | 0.73 |
| 19 | 0.941 | 0.941 | 0.69 |
| 20 | 0.048 | 0.048 | 0.03 |
| 21 | 11.028 | 11.028 | 8.17 |
| 22 | 2.640 | 2.640 | 1.70 |
| 23 | 0.811 | 0.811 | 0.61 |
| 24 | 1.416 | 1.416 | 1.01 |
| 25 | 1.824 | 1.824 | 1.71 |
| 26 | 0.084 | 0.084 | 0.07 |
| 27 | 18.681 | 18.681 | 12.19* |
| 28 | 10.191 | 10.191 | 8.87* |
| 29 | 1.123 | 1.123 | 1.12 |
| 30 | 10.072 | 10.072 | 6.74* |
| 31 | 5.664 | 5.664 | 4.29* |
| 33 | 5.753 | 5.753 | 5.66* |
| 34 | 5.531 | 5.531 | 5.58* |
| 35 | 13.285 | 13.285 | 11.98* |
| 36 | 8.846 | 8.846 | 9.36* |
| 37 | 1.237 | 1.237 | 1.31 |
| 38 | 1.045 | 1.045 | 1.22 |

[a] Model SS
[b] Model MS
* Significant at .05

Table 20. Means and standard deviations of responses to selected current practices on the TQMP

| Item | Level of TQM Implementation | | | |
|---|---|---|---|---|
| | Less than 23 months | | Equal to or more than 23 months | |
| | Mean | SD | Mean | SD |
| 4 | 4.18 | 0.80 | 3.85 | 1.11 |
| 5 | 3.47 | 1.20 | 2.48 | 1.10 |
| 6 | 4.16 | 0.87 | 3.79 | 1.04 |
| 8 | 3.75 | 1.17 | 2.42 | 1.20 |
| 10 | 3.29 | 0.96 | 2.81 | 1.09 |
| 11 | 3.18 | 1.09 | 2.73 | 1.07 |
| 15 | 3.08 | 0.88 | 3.42 | 1.03 |
| 16 | 3.17 | 0.95 | 2.46 | 1.13 |
| 17 | 3.35 | 0.98 | 2.87 | 1.07 |
| 21 | 3.10 | 1.19 | 2.51 | 1.10 |
| 28 | 3.47 | 1.08 | 2.89 | 1.10 |
| 30 | 3.24 | 1.19 | 3.81 | 1.26 |
| 34 | 3.56 | 1.00 | 3.14 | 0.97 |
| 35 | 3.08 | 1.10 | 2.42 | 0.95 |
| 36 | 3.32 | 0.96 | 2.79 | 0.97 |

Hypothesis 4 There is no significant difference in mean responses to items on the TQMP regarding ideal TQM practices between two different levels of TQM implementation.

$$H_o: \mu_{diy1}=\mu_{diy2}$$

where

d is ideal practice
i is item number (1-38)
y1 is less than 23 months
y2 is equal to or more than 23 months

Table 21 summarizes the results of the ANOVA procedure for each of the thirty-eight items on the mean ideal practice perceptions of the TQMP between employees with two different levels of exposure to TQM. The results indicate that there are no significant differences between the two groups of employees.

Based on the results, the mean responses to ideal practices on the TQMP were not significantly different between employees experiencing two levels of implementation. Employees in all sizes of companies had similiar perceptions about all aspects of TQM as it is applied in their company. Even if the employees had no experience of TQM training, they perceived almost same way toward the ideal TQM practices in their organizations.

Table 21. Analysis of variance for responses to each item on ideal practices between two different levels of TQM implementation (n=134, df=1, 131)

| Item Number | SS[a] | MS[b] | F |
|---|---|---|---|
| 1 | 0.973 | 0.973 | 1.82 |
| 2 | 0.120 | 0.120 | 0.12 |
| 3 | 1.115 | 1.115 | 1.58 |
| 4 | 0.022 | 0.022 | 0.05 |
| 5 | 0.850 | 0.850 | 1.25 |
| 6 | 0.543 | 0.543 | 0.76 |
| 7 | 0.005 | 0.005 | 0.01 |
| 8 | 0.037 | 0.037 | 0.05 |
| 9 | 0.264 | 0.264 | 0.49 |
| 10 | 0.089 | 0.089 | 0.19 |
| 11 | 0.027 | 0.027 | 0.05 |
| 12 | 0.582 | 0.582 | 1.14 |
| 13 | 0.862 | 0.862 | 1.86 |
| 14 | 0.518 | 0.518 | 1.39 |
| 15 | 0.265 | 0.265 | 0.30 |
| 16 | 0.086 | 0.086 | 0.13 |
| 17 | 0.003 | 0.003 | 0.01 |
| 18 | 0.530 | 0.530 | 0.87 |
| 19 | 0.185 | 0.185 | 0.39 |
| 20 | 0.017 | 0.017 | 0.04 |
| 21 | 0.596 | 0.596 | 0.95 |
| 22 | 0.316 | 0.316 | 0.57 |
| 23 | 0.233 | 0.233 | 0.41 |
| 24 | 0.254 | 0.254 | 0.34 |
| 25 | 0.000 | 0.000 | 0.00 |
| 26 | 0.484 | 0.484 | 0.61 |
| 27 | 0.031 | 0.031 | 0.04 |
| 28 | 0.921 | 0.921 | 1.77 |
| 29 | 0.094 | 0.094 | 0.15 |
| 30 | 1.368 | 1.368 | 2.22 |
| 31 | 0.002 | 0.002 | 0.00 |
| 32 | 2.164 | 2.164 | 3.12 |
| 33 | 1.123 | 1.123 | 1.89 |
| 34 | 0.555 | 0.555 | 1.26 |
| 35 | 0.008 | 0.008 | 0.01 |
| 36 | 1.032 | 1.032 | 1.65 |
| 37 | 0.085 | 0.085 | 0.09 |
| 38 | 0.431 | 0.431 | 0.65 |

[a] Model SS
[b] Model MS

Hypothesis 5 There is no significant difference between mean responses to items on the TQMP regarding current TQM practices of small companies with different levels of implementation.

$$H_o: \mu_{sciy1}=\mu_{sciy2}=\cdots=\mu_{sciy8}$$

where

s is small size companies
c is current practice
i is item number (1-38)
y1 is 0 month
y2 is 1 month
y3 is 6 months
y4 is 8 months
y5 is 12 months
y6 is 23 months
y7 is 24 months
y8 is 25 months

Table 22 presents the results of the ANOVA procedure for each of thirty-eight items on the current practice means between the employees with different levels of exposure to TQM at small companies. The results indicate that a number of statements included in "employees involvement," "continuous improvement effort," and "statistical method" dimension of TQM have significantly different mean responses between two different groups of employees at small companies. The comparisons for these statements are presented in Figure 7. The results indicate that the responses from the employees with no exposure to TQM show the most positive perception of current TQM practices.

Table 22. Comparison of responses regarding current practices at small companies with different levels of implementation (n=52, df=7, 44)

| Item Number | SS[a] | MS[b] | F-Value |
|---|---|---|---|
| 1 | 9.891 | 1.413 | 1.21 |
| 2 | 7.777 | 1.111 | 1.00 |
| 3 | 17.252 | 2.550 | 2.56* |
| 4 | 3.092 | 0.441 | 0.62 |
| 5 | 6.211 | 0.887 | 0.65 |
| 6 | 3.585 | 0.512 | 0.85 |
| 7 | 22.153 | 3.164 | 2.51* |
| 8 | 44.893 | 6.413 | 6.54* |
| 9 | 9.575 | 1.637 | 1.54 |
| 10 | 11.059 | 1.579 | 2.52* |
| 11 | 3.771 | 0.538 | 0.46 |
| 12 | 7.688 | 1.098 | 1.15 |
| 13 | 8.410 | 1.201 | 1.48 |
| 14 | 17.604 | 2.514 | 2.97* |
| 15 | 3.435 | 0.490 | 0.48 |
| 16 | 4.414 | 0.630 | 0.51 |
| 17 | 5.739 | 0.819 | 0.71 |
| 18 | 8.157 | 1.165 | 1.07 |
| 19 | 22.783 | 3.254 | 2.84* |
| 20 | 25.771 | 3.681 | 2.74* |
| 21 | 18.891 | 2.698 | 1.98 |
| 22 | 20.752 | 2.964 | 2.74* |
| 23 | 19.871 | 2.838 | 2.45* |
| 24 | 21.660 | 3.094 | 4.11* |
| 25 | 7.969 | 1.138 | 1.73 |
| 26 | 17.013 | 2.430 | 2.19 |
| 27 | 19.502 | 2.786 | 1.79 |
| 28 | 17.679 | 2.525 | 2.82* |
| 29 | 9.800 | 1.400 | 1.35 |
| 30 | 24.064 | 3.437 | 3.14* |
| 31 | 16.663 | 2.380 | 2.59* |
| 32 | 3.075 | 0.439 | 0.41 |
| 33 | 3.585 | 0.512 | 0.41 |
| 34 | 13.510 | 1.930 | 2.46* |
| 35 | 32.302 | 4.614 | 5.68* |
| 36 | 15.813 | 2.259 | 2.76* |
| 37 | 9.716 | 1.388 | 1.31 |
| 38 | 6.880 | 0.982 | 1.40 |

[a] Model SS
[b] Model MS
* Significant at .05

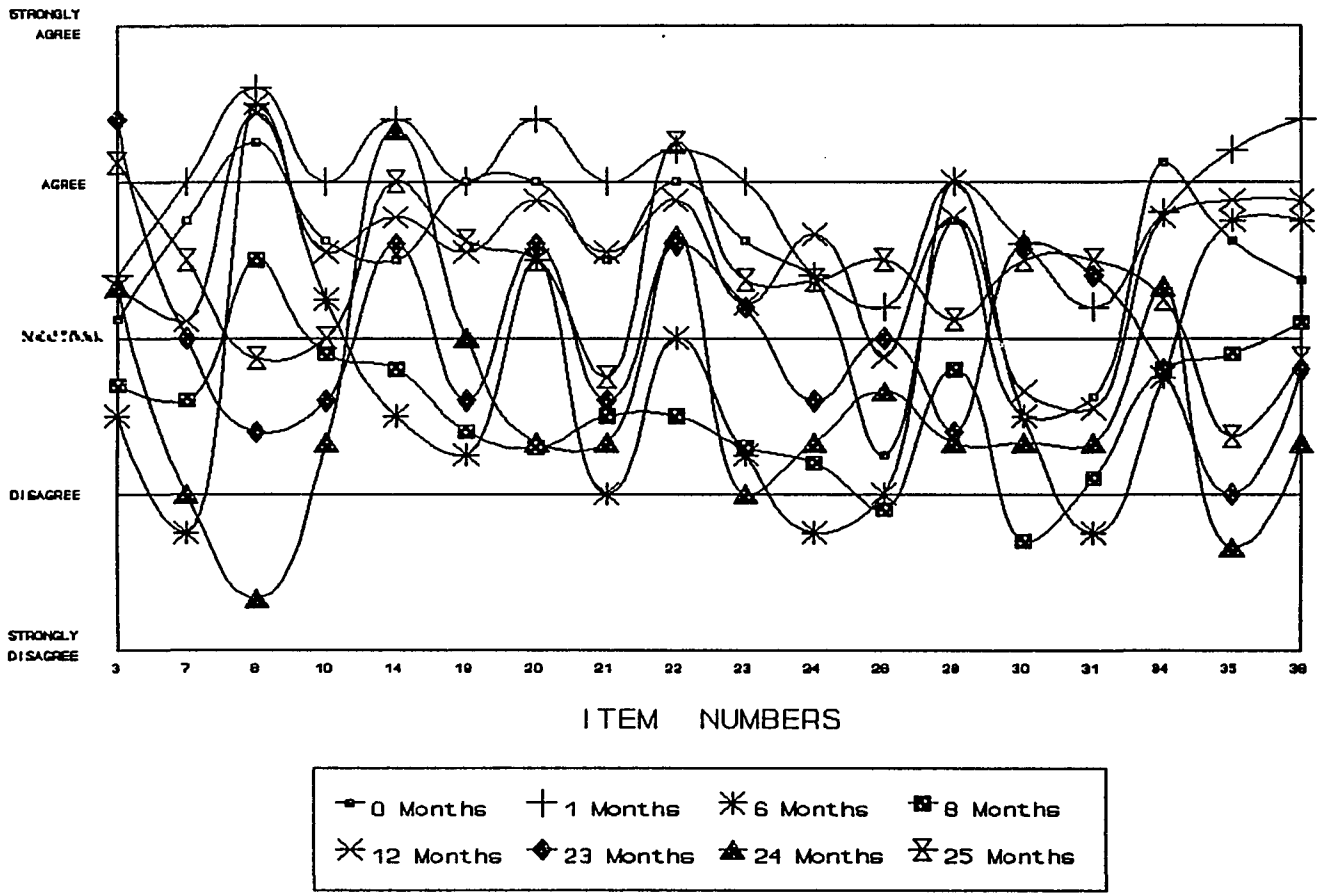


**Figure 7. Comparison of mean responses at small companies**

Hypothesis 6 There is no significant difference between mean responses to items on the TQMP regarding current TQM practices of medium companies with different levels of implementation.

$$H_o: \mu_{mciy1}=\mu_{mciy2}=\ldots=\mu_{mciy5}$$

where

m is medium size companies
c is current practice
i is item number (1-38)
y1 is 0 month
y2 is 12 months
y3 is 15 months
y4 is 24 months
y5 is 25 months

Table 23 presents the results of the ANOVA procedure for each of thirty-eight items on the current practice perceptions comparing employees with different levels of exposure to TQM at medium companies. The results indicate that a number of statements included in the practice of "customer orientation" and "continuous improvement effort" dimension of TQM show significantly different mean responses among two different groups of employees from medium companies. The mean comparisons of these statements are presented in Figure 8. The results indicate that employees with the highest levels of exposure to TQM have less positive perceptions toward the current TQM practices in medium companies.

Table 23. Comparison of responses to the current practices at medium companies with different levels of implementation (n=36, df=4, 31)

| Item Number | SS[a] | MS[b] | F-Value |
|---|---|---|---|
| 1 | 1.690 | 0.422 | 0.51 |
| 2 | 1.527 | 0.381 | 0.35 |
| 3 | 5.462 | 1.365 | 1.07 |
| 4 | 5.571 | 1.392 | 1.31 |
| 5 | 27.521 | 6.880 | 10.65* |
| 6 | 2.444 | 0.611 | 0.70 |
| 7 | 2.482 | 0.620 | 0.48 |
| 8 | 9.041 | 2.260 | 1.25 |
| 9 | 9.032 | 2.258 | 1.40 |
| 10 | 8.795 | 2.198 | 2.04 |
| 11 | 15.161 | 3.790 | 4.34* |
| 12 | 6.628 | 1.657 | 2.32 |
| 13 | 3.456 | 0.864 | 1.28 |
| 14 | 3.827 | 0.956 | 0.78 |
| 15 | 8.634 | 2.158 | 2.83* |
| 16 | 5.239 | 1.309 | 2.02 |
| 17 | 3.122 | 0.780 | 0.83 |
| 18 | 4.613 | 1.153 | 0.87 |
| 19 | 2.330 | 0.582 | 0.53 |
| 20 | 6.727 | 1.681 | 1.33 |
| 21 | 8.005 | 2.001 | 1.64 |
| 22 | 11.706 | 2.926 | 2.07 |
| 23 | 9.309 | 2.327 | 1.95 |
| 24 | 8.963 | 2.240 | 1.29 |
| 25 | 2.462 | 0.615 | 0.51 |
| 26 | 2.218 | 0.554 | 0.40 |
| 27 | 13.552 | 3.388 | 2.75* |
| 28 | 5.815 | 1.453 | 1.15 |
| 29 | 5.986 | 1.496 | 3.13* |
| 30 | 3.152 | 0.788 | 1.82 |
| 31 | 1.071 | 0.267 | 0.18 |
| 32 | 6.551 | 1.637 | 1.85 |
| 33 | 7.329 | 1.832 | 1.74 |
| 34 | 11.815 | 2.953 | 3.41* |
| 35 | 7.648 | 1.912 | 2.94* |
| 36 | 3.213 | 0.803 | 1.30 |
| 37 | 0.652 | 0.163 | 0.27 |
| 38 | 1.782 | 0.445 | 0.41 |

[a] Model SS
[b] Model MS
* Significant at .05

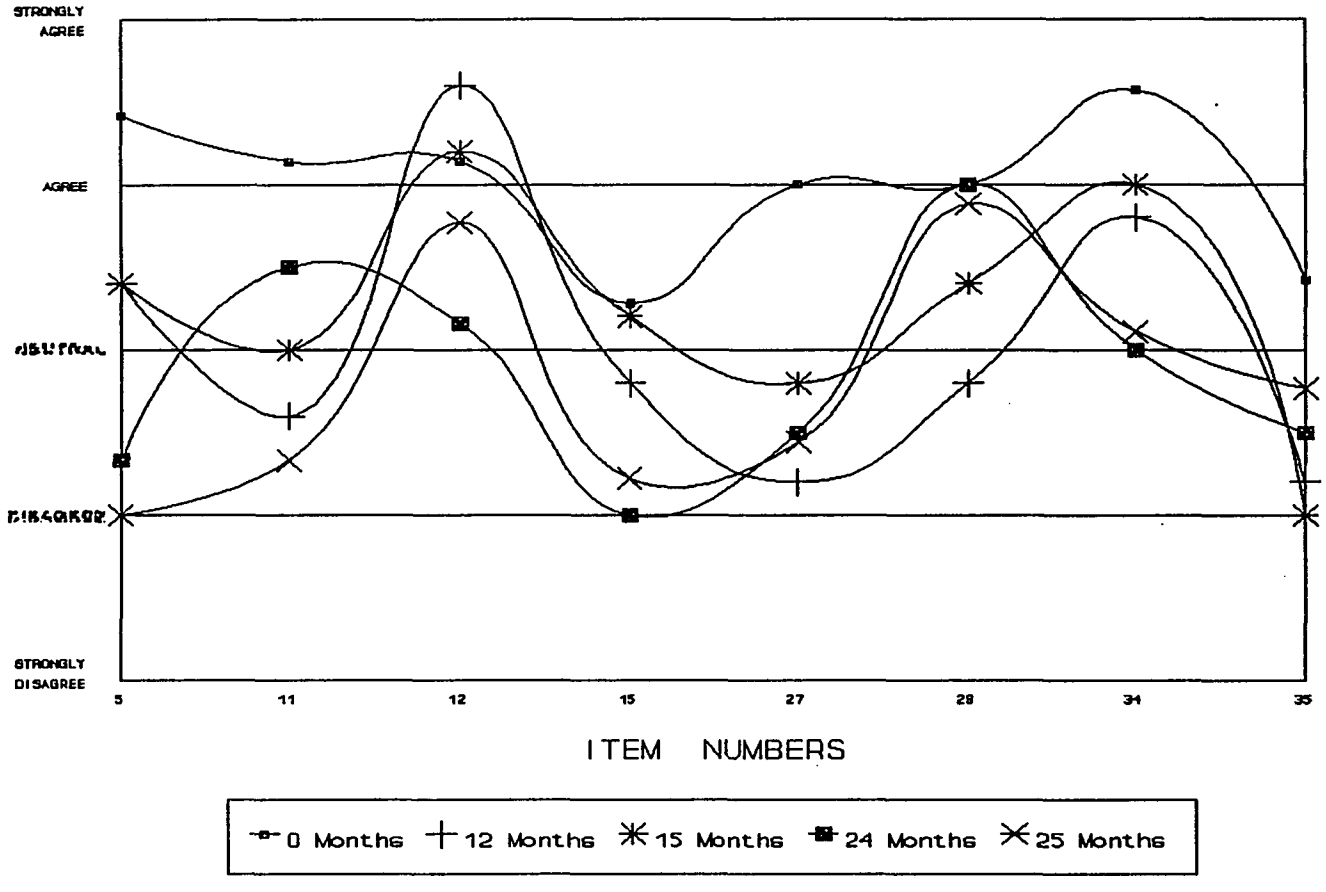


**Figure 8. Comparison of mean responses at medium companies**

Hypothesis 7 There is no significant difference between mean responses to items on the TQMP regarding current TQM practices of large companies with different levels of implementation.

$$H_o: \mu_{lciy1}=\mu_{lciy2}$$

where

l is large companies
c is current practice
i is item number (1-38)
y1 is 6 months
y2 is 25 months

Table 24 presents results of the ANOVA procedure for each of thirty-eight items on the current practice perceptions between employees with different levels of exposure to TQM at large companies. The results indicate that two practices, "leadership" and "continuous improvement effort," in TQMP have significantly different responses between the two different groups of employees. The mean comparisons for these statements are presented in Figure 9. The results indicate that employees with higher levels of exposure to TQM have less positive perceptions toward current practices. For large companies, different employee perceptions were found toward leadership practices in the companies. Employees with a higher level of exposure to TQM have more positive perception.

Table 24. Comparison of responses to the current practices at large companies with two different levels of implementation (n=50, df=1, 48)

| Item Number | SS[a] | MS[b] | F-Value |
|---|---|---|---|
| 1 | 4.753 | 4.753 | 4.13* |
| 2 | 1.966 | 1.966 | 1.99 |
| 3 | 9.901 | 9.901 | 9.28* |
| 4 | 3.208 | 3.208 | 3.53 |
| 5 | 22.333 | 22.333 | 14.54* |
| 6 | 5.281 | 5.281 | 4.59* |
| 7 | 1.388 | 1.388 | 0.79 |
| 8 | 20.480 | 20.480 | 15.73* |
| 9 | 0.050 | 0.050 | 0.03 |
| 10 | 0.551 | 0.551 | 0.42 |
| 11 | 3.208 | 3.208 | 2.35 |
| 12 | 0.333 | 0.333 | 0.33 |
| 13 | 0.605 | 0.605 | 0.66 |
| 14 | 7.093 | 7.093 | 6.14* |
| 15 | 0.390 | 0.390 | 0.44 |
| 16 | 13.520 | 13.520 | 11.09* |
| 17 | 3.511 | 3.511 | 3.15 |
| 18 | 0.333 | 0.333 | 0.26 |
| 19 | 2.347 | 2.347 | 1.70 |
| 20 | 0.125 | 0.125 | 0.08 |
| 21 | 5.723 | 5.723 | 4.36* |
| 22 | 6.600 | 6.600 | 3.87 |
| 23 | 1.711 | 1.711 | 1.33 |
| 24 | 0.000 | 0.000 | 0.00 |
| 25 | 0.027 | 0.027 | 0.02 |
| 26 | 8.820 | 8.820 | 7.91* |
| 27 | 27.256 | 27.256 | 23.09* |
| 28 | 2.960 | 2.960 | 2.42 |
| 29 | 0.888 | 0.888 | 0.83 |
| 30 | 0.001 | 0.001 | 0.00 |
| 31 | 0.011 | 0.011 | 0.01 |
| 32 | 2.456 | 2.456 | 2.40 |
| 33 | 0.020 | 0.020 | 0.02 |
| 34 | 0.170 | 0.170 | 0.16 |
| 35 | 0.720 | 0.720 | 0.59 |
| 36 | 1.590 | 1.590 | 1.35 |
| 37 | 1.966 | 1.966 | 1.91 |
| 38 | 0.823 | 0.823 | 0.94 |

[a] Model SS
[b] Model MS
* Significant at .05

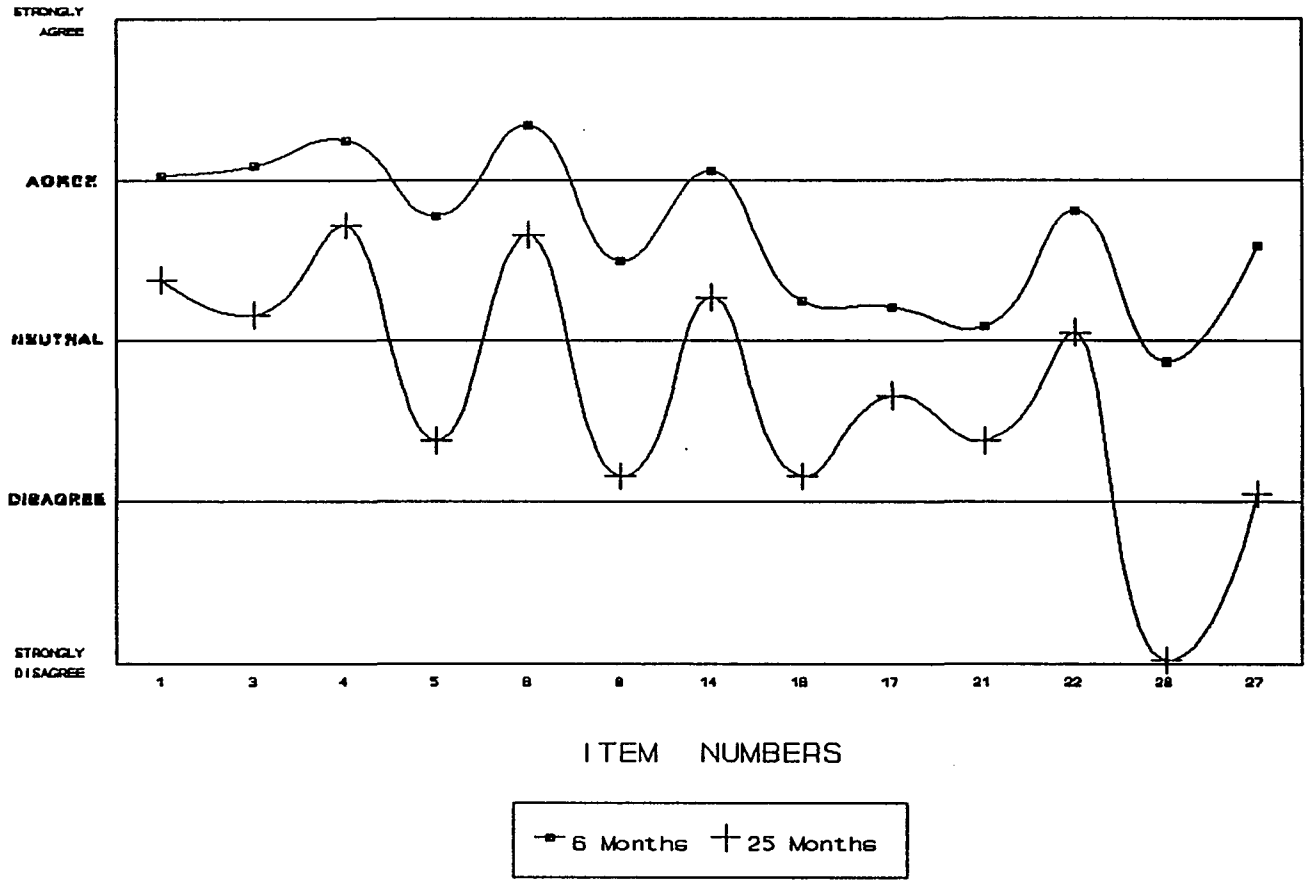


Figure 9. Comparison of mean responses at large companies

Hypothesis 8 There is no significant difference between mean responses to items on the TQMP regarding ideal TQM practices of small companies with different levels of implementation.

$$H_o: \mu_{sdiy1}=\mu_{sdiy2}=\ldots=\mu_{sdiy8}$$

where

s; small size companies
d; ideal practice
i; item number (1-38)
y1 is 0 month
y2 is 1 month
y3 is 6 months
y4 is 8 months
y5 is 12 months
y6 is 23 months
y7 is 24 months
y8 is 25 months

Table 25 presents the results of the ANOVA procedure for each of thirty-eight items for ideal practice perception between employees with different levels of exposure to TQM from small companies. The results indicated that there were no significantly different mean responses among eight different groups of employees from small companies.

Employees in small size companies had similiar perceptions about all aspects of TQM as it is applied in their company. Even if the employees had no experience of TQM training, they perceived almost same way toward the ideal TQM practices in their organizations.

Table 25. Comparison of responses to the ideal practices at small companies with different levels of implementation (n=52, df=7, 44)

| Item Number | SS[a] | MS[b] | F-Value |
|---|---|---|---|
| 1 | 3.705 | 0.529 | 0.81 |
| 2 | 6.297 | 0.899 | 1.34 |
| 3 | 5.011 | 0.715 | 0.86 |
| 4 | 4.480 | 0.640 | 0.99 |
| 5 | 7.802 | 1.114 | 1.50 |
| 6 | 2.488 | 0.355 | 0.52 |
| 7 | 7.519 | 1.074 | 1.63 |
| 8 | 7.411 | 1.058 | 1.45 |
| 9 | 2.125 | 0.303 | 0.47 |
| 10 | 1.883 | 0.269 | 0.56 |
| 11 | 4.441 | 0.634 | 0.78 |
| 12 | 2.041 | 0.291 | 0.46 |
| 13 | 4.005 | 0.572 | 1.04 |
| 14 | 2.977 | 0.425 | 1.22 |
| 15 | 2.813 | 0.401 | 0.41 |
| 16 | 6.598 | 0.942 | 1.29 |
| 17 | 4.883 | 0.697 | 1.14 |
| 18 | 3.210 | 0.458 | 0.75 |
| 19 | 3.544 | 0.506 | 1.31 |
| 20 | 3.054 | 0.436 | 0.69 |
| 21 | 2.345 | 0.335 | 0.90 |
| 22 | 2.936 | 0.419 | 0.66 |
| 23 | 1.970 | 0.281 | 0.40 |
| 24 | 2.911 | 0.415 | 0.56 |
| 25 | 2.100 | 0.300 | 0.46 |
| 26 | 5.475 | 0.782 | 1.04 |
| 27 | 8.252 | 1.178 | 1.97 |
| 28 | 3.268 | 0.466 | 0.90 |
| 29 | 4.269 | 0.609 | 1.05 |
| 30 | 2.383 | 0.340 | 0.37 |
| 31 | 4.638 | 0.662 | 1.26 |
| 32 | 11.011 | 1.573 | 2.12 |
| 33 | 6.702 | 0.957 | 1.50 |
| 34 | 4.983 | 0.711 | 1.47 |
| 35 | 5.053 | 0.721 | 1.42 |
| 36 | 4.659 | 0.665 | 1.05 |
| 37 | 3.860 | 0.551 | 0.45 |
| 38 | 0.752 | 0.107 | 0.13 |

[a] Model SS
[b] Model MS

Hypothesis 9 There is no significant difference between mean responses to items on the TQMP regarding ideal TQM practices of medium companies with different levels of implementation.

$$H_o: \mu_{mdiy1}=\mu_{mdiy2}=\cdots=\mu_{mdiy5}$$

where
m is medium size companies
d is ideal practice
i is item number (1-38)
y1 is 0 month
y2 is 12 months
y3 is 15 months
y4 is 24 months
y5 is 25 months

Table 26 presents results of the ANOVA procedure for each of thirty-eight items for ideal practice perceptions among the employees with different levels of exposure to TQM in medium companies. The results indicated that one statement, "Our organization has a procedure for the utilization of employees' ideas for improvement purpose," in the TQMP has significantly different perceptions among five different groups of employees from medium companies.

Employees with higher levels of exposure to TQM training program perceived less positively than employees with lower levels of exposure to TQM program. This indicates that employees who had been engaged with the training had better knowledge about TQM concepts. This made them to be able to have ability to compare.

Table 26. Comparison of responses to the ideal practices at medium companies with different levels of implementation (n=32, df=4, 27)

| Item Number | SS[a] | MS[b] | F-Value |
|---|---|---|---|
| 1 | 3.363 | 0.840 | 1.36 |
| 2 | 1.722 | 0.430 | 0.39 |
| 3 | 7.365 | 1.841 | 2.41 |
| 4 | 0.861 | 0.215 | 0.47 |
| 5 | 4.871 | 1.217 | 1.98 |
| 6 | 2.906 | 0.726 | 1.81 |
| 7 | 0.734 | 0.183 | 0.76 |
| 8 | 0.734 | 0.184 | 0.47 |
| 9 | 2.121 | 0.530 | 1.21 |
| 10 | 0.798 | 0.199 | 0.36 |
| 11 | 1.105 | 0.276 | 1.10 |
| 12 | 1.421 | 0.355 | 0.91 |
| 13 | 1.315 | 0.328 | 0.87 |
| 14 | 1.515 | 0.378 | 0.84 |
| 15 | 3.709 | 0.927 | 1.41 |
| 16 | 1.389 | 0.347 | 0.49 |
| 17 | 1.085 | 0.271 | 0.57 |
| 18 | 4.848 | 1.212 | 1.43 |
| 19 | 3.424 | 0.856 | 2.74* |
| 20 | 1.401 | 0.350 | 1.14 |
| 21 | 2.234 | 0.558 | 0.72 |
| 22 | 3.765 | 0.941 | 2.08 |
| 23 | 2.851 | 0.712 | 1.73 |
| 24 | 3.934 | 0.983 | 0.96 |
| 25 | 2.252 | 0.563 | 1.11 |
| 26 | 4.390 | 1.097 | 1.60 |
| 27 | 3.504 | 0.876 | 1.00 |
| 28 | 2.838 | 0.709 | 1.74 |
| 29 | 1.365 | 0.341 | 0.87 |
| 30 | 4.432 | 1.108 | 1.93 |
| 31 | 0.984 | 0.246 | 0.51 |
| 32 | 1.327 | 0.331 | 0.40 |
| 33 | 0.427 | 0.106 | 0.21 |
| 34 | 0.501 | 0.125 | 0.39 |
| 35 | 0.884 | 0.221 | 0.24 |
| 36 | 1.317 | 0.329 | 0.51 |
| 37 | 0.729 | 0.182 | 0.21 |
| 38 | 0.946 | 0.236 | 0.49 |

[a] Model SS
[b] Model MS
* Significant at .05

Hypothesis 10 There is no significant difference between mean responses to items on the TQMP regarding ideal TQM practices of large companies with different levels of implementation.

$$H_o: \mu_{ldiy1}=\mu_{ldiy2}$$

where

l is large companies
d is ideal practice
i is item number (1-38)
y1 is 6 months
y2 is 25 months

Table 27 presents the results of the ANOVA procedure for each of thirty-eight items on ideal practice perceptions between employees with different levels of exposure to TQM at large companies. The results indicate that none of the statements have significantly different responses between two different groups of employees from large companies.

Employees in large size companies had similiar perceptions about all aspects of TQM as it is applied in their company. Even if the employees had no experience of TQM training, they perceived almost same way toward the ideal TQM practices in their organizations. They have a better understanding, compared to small and large companies, about the ideal TQM practices in their organization and anticipated to observe the practices.

Table 27. Comparison of responses to the ideal practices at large companies with two different levels of implementation (n=50, df=1, 48)

| Item Number | SS[a] | MS[b] | F-Value |
|---|---|---|---|
| 1 | 0.003 | 0.003 | 0.01 |
| 2 | 0.001 | 0.001 | 0.00 |
| 3 | 0.642 | 0.642 | 1.42 |
| 4 | 0.027 | 0.027 | 0.07 |
| 5 | 0.661 | 0.661 | 1.21 |
| 6 | 0.180 | 0.180 | 0.18 |
| 7 | 0.320 | 0.320 | 0.43 |
| 8 | 0.000 | 0.000 | 0.00 |
| 9 | 0.045 | 0.045 | 0.08 |
| 10 | 0.101 | 0.101 | 0.22 |
| 11 | 0.001 | 0.001 | 0.00 |
| 12 | 0.642 | 0.642 | 1.30 |
| 13 | 0.281 | 0.281 | 0.62 |
| 14 | 0.061 | 0.061 | 0.17 |
| 15 | 1.253 | 1.253 | 1.27 |
| 16 | 0.200 | 0.200 | 0.33 |
| 17 | 0.500 | 0.500 | 0.64 |
| 18 | 0.320 | 0.320 | 0.70 |
| 19 | 0.027 | 0.027 | 0.04 |
| 20 | 0.200 | 0.200 | 0.63 |
| 21 | 2.347 | 2.347 | 2.99 |
| 22 | 0.086 | 0.086 | 0.16 |
| 23 | 0.101 | 0.101 | 0.17 |
| 24 | 0.001 | 0.001 | 0.00 |
| 25 | 1.773 | 1.773 | 2.23 |
| 26 | 1.333 | 1.333 | 1.62 |
| 27 | 0.888 | 0.888 | 1.47 |
| 28 | 1.075 | 1.075 | 1.81 |
| 29 | 0.013 | 0.013 | 0.02 |
| 30 | 0.933 | 0.933 | 2.89 |
| 31 | 0.116 | 0.116 | 0.11 |
| 32 | 0.720 | 0.720 | 1.54 |
| 33 | 0.200 | 0.200 | 0.35 |
| 34 | 0.101 | 0.101 | 0.24 |
| 35 | 1.051 | 1.051 | 1.44 |
| 36 | 1.680 | 1.680 | 2.66 |
| 37 | 0.680 | 0.680 | 0.71 |
| 38 | 0.013 | 0.013 | 0.02 |

[a] Model SS
[b] Model MS

Hypothesis 11 There is no significant difference between mean responses to current leadership practices on the TQMP for two different levels of implementation.

$$H_o: \mu_{ciy1}=\mu_{ciy2}$$

where
c is current practice
i is item number (1-9)
y1 is less than 23 months
y2 is equal to or more than 23 months

Table 28 presents the results of the MANOVA procedure for mean differences between means for nine statements related to current leadership practices between employees with two different levels of exposure to TQM. The results indicate that three practices--utilization of systematic techniques, upper management's commitment, and effective methods of communication--have significantly different mean responses between the two different groups of employees. Table 29 shows the comparison of different groups of employees' responses to overall leadership practices. The results indicate the existence of significantly different employee perceptions toward current leadership practices. Employees with a higher level, equal to or more than 23 months, of exposure to TQM perceived less positively.

Table 28. Comparison of responses to current leadership practices between employees with different levels of exposure to TQM

| Item | Group# | Mean | SD | MS[a] | F-Value |
|---|---|---|---|---|---|
| 1 | 1 | 3.95 | 0.96 | 0.76 | 0.69 |
| | 2 | 3.79 | 1.19 | | |
| 2 | 1 | 3.89 | 0.90 | 0.43 | 0.42 |
| | 2 | 3.77 | 1.19 | | |
| 3 | 1 | 3.48 | 1.11 | 1.13 | 0.90 |
| | 2 | 3.67 | 1.12 | | |
| 4 | 1 | 4.18 | 0.80 | 3.40 | 3.91 |
| | 2 | 3.85 | 1.11 | | |
| 5 | 1 | 3.47 | 1.20 | 29.89 | 21.99* |
| | 2 | 2.49 | 1.10 | | |
| 6 | 1 | 4.16 | 0.87 | 4.22 | 4.84* |
| | 2 | 3.79 | 1.04 | | |
| 7 | 1 | 3.17 | 1.24 | 0.96 | 0.63 |
| | 2 | 3.00 | 1.22 | | |
| 8 | 1 | 3.75 | 1.17 | 54.51 | 38.72* |
| | 2 | 2.42 | 1.20 | | |
| 9 | 1 | 3.28 | 1.10 | 1.01 | 0.72 |
| | 2 | 3.10 | 1.29 | | |

[a] Model MS
# Groups of Employees: 1-Less than 23 months
2-Equal to or more than 23 months
* Significant at .05

Table 29. Comparison of responses to overall current leadership practices among employees with different levels of exposure to TQM

| Test Technique | Exact F | Pr.>F |
|---|---|---|
| Wilk's Criterion | 7.52 | 0.0001 |
| Pillai's Trace | 7.52 | 0.0001 |
| Hotelling-Lawley Trace | 7.52 | 0.0001 |

Hypothesis 12 There is no significant difference between mean responses to current customer practices on the TQMP for two different levels of implementation.

$$H_o: \mu_{ciy1}=\mu_{ciy2}$$

where

c is current practice
i is item number (10-18)
y1 is less than 23 months
y2 is equal to or more than 23 months

Table 30 presents the results of the MANOVA procedure for differences between means for nine statements related to current customer practices, between employees with two different levels of exposure to TQM. The results indicate that five practices, existence of a systematic and effective process to obtain customers' feedback and application to product design, have significantly different mean responses between the two different groups of employees. Table 31 shows the comparison of different groups of employees' responses to overall customer practices. The results indicate that there are significantly different employee perceptions.

Table 30. Comparison of responses to current customer practices between employees with different levels of exposure to TQM

| Item | Group# | Mean | SD | MS[a] | F-Value |
|---|---|---|---|---|---|
| 10 | 1 | 3.29 | 0.96 | 7.09 | 6.03* |
| | 2 | 2.81 | 1.09 | | |
| 11 | 1 | 3.18 | 1.09 | 6.39 | 5.39* |
| | 2 | 2.73 | 1.07 | | |
| 12 | 1 | 3.72 | 0.95 | 0.35 | 0.37 |
| | 2 | 3.83 | 1.00 | | |
| 13 | 1 | 3.41 | 0.83 | 0.86 | 1.02 |
| | 2 | 3.24 | 1.05 | | |
| 14 | 1 | 3.67 | 1.04 | 1.82 | 1.53 |
| | 2 | 3.42 | 1.17 | | |
| 15 | 1 | 3.08 | 0.88 | 6.86 | 7.68* |
| | 2 | 2.61 | 1.03 | | |
| 16 | 1 | 3.17 | 0.95 | 15.53 | 14.08* |
| | 2 | 2.46 | 1.13 | | |
| 17 | 1 | 3.35 | 0.98 | 7.02 | 6.78* |
| | 2 | 2.87 | 1.07 | | |
| 18 | 1 | 3.12 | 1.07 | 0.90 | 0.72 |
| | 2 | 2.95 | 1.17 | | |

[a] Model MS
\# Group of Employees: 1-Less than 23 months
2-Equal to or more than 23 months
* Significant at .05

Table 31. Comparison of responses to overall current customer practices among employees with different levels of exposure to TQM

| Test Technique | Exact F | Pr.>F |
|---|---|---|
| Wilk's Criterion | 2.45 | 0.0138 |
| Pillai's Trace | 2.45 | 0.0138 |
| Hotelling-Lawley Trace | 2.45 | 0.0138 |

Hypothesis 13 There is no significant difference between mean responses to current employees involvement practices on the TQMP for two different levels of implementation.

$$H_o: \mu_{ciy1}=\mu_{ciy2}$$

where
c is current practice
i is item number (19-27)
y1 is less than 23 months
y2 is equal to more than 23 months

Table 32 presents the results of the MANOVA procedure for differences between means for nine statements related to current employee involvement issues, between employees with two different levels of exposure to TQM. The results indicated that two practices, utilization of a process to obtain employees' suggestions and open corporate culture, have significantly different mean responses between two different groups of employees. Table 33 shows the comparison of different groups of employees' responses to overall employees involvement practices. The results indicate that there are significantly different perceptions.

Table 32. Comparison of responses to current employee involvement practices between employees with different levels of exposure to TQM

| Item | Group# | Mean | SD | MS[a] | F-Value |
|---|---|---|---|---|---|
| 19 | 1 | 3.23 | 1.15 | 0.94 | 0.69 |
| | 2 | 3.06 | 1.19 | | |
| 20 | 1 | 3.52 | 1.21 | 0.04 | 0.03 |
| | 2 | 3.49 | 1.29 | | |
| 21 | 1 | 3.10 | 1.19 | 11.02 | 8.16* |
| | 2 | 2.51 | 1.02 | | |
| 22 | 1 | 3.65 | 1.23 | 2.64 | 1.70 |
| | 2 | 3.36 | 1.27 | | |
| 23 | 1 | 3.14 | 1.13 | 0.81 | 0.61 |
| | 2 | 2.98 | 1.18 | | |
| 24 | 1 | 3.07 | 1.17 | 1.41 | 1.00 |
| | 2 | 2.85 | 1.20 | | |
| 25 | 1 | 2.63 | 0.98 | 1.82 | 1.70 |
| | 2 | 2.87 | 1.11 | | |
| 26 | 1 | 2.62 | 1.03 | 0.84 | 0.06 |
| | 2 | 2.57 | 1.27 | | |
| 27 | 1 | 3.30 | 1.22 | 18.68 | 12.19* |
| | 2 | 2.53 | 1.26 | | |

[a] Model MS
# Group of Employees: 1-Less than 23 months
2-Equal to or more than 23 months
* Significant at .05

Table 33. Comparison of responses to overall current employee involvement practices among employees with different levels of exposure to TQM

| Test Technique | Exact F | Pr.>F |
|---|---|---|
| Wilk's Criterion | 3.33 | 0.0010 |
| Pillai's Trace | 3.33 | 0.0010 |
| Hotelling-Lawley Trace | 3.33 | 0.0010 |

Hypothesis 14 There is no significant difference between mean responses to current practices of continuous improvement efforts on the TQMP for two different levels of implementation.

$$H_o: \mu_{ciy1}=\mu_{ciy2}$$

where

c is current practice
i is item number (28-31)
y1 is less than 23 months
y2 is equal to or more than 23 months

Table 34 presents the results of the MANOVA procedure for differences between means for four statements related to the current practice of continuous improvement efforts, between employees with two different levels of exposure to TQM. The results indicate that two practices, existence of a training program and an opportunity to learn about TQM, have significantly different mean responses between the two different groups of employees. Table 35 shows the comparison of different groups of employees' responses to overall continuous improvement practices. The results indicate that there are significantly different employee perceptions.

Table 34. Comparison of responses to current practices of continuous improvement efforts between employees with different levels of exposure to TQM

| Item | Group[#] | Mean | SD | MS[a] | F-Value |
|---|---|---|---|---|---|
| 28 | 1 | 3.47 | 1.05 | 10.19 | 8.87 |
| | 2 | 2.89 | 1.10 | | |
| 29 | 1 | 3.25 | 1.00 | 1.12 | 1.12 |
| | 2 | 3.44 | 1.00 | | |
| 30 | 1 | 3.24 | 1.19 | 10.07 | 6.74* |
| | 2 | 3.81 | 1.26 | | |
| 31 | 1 | 2.85 | 1.06 | 5.66 | 4.28* |
| | 2 | 3.28 | 1.29 | | |

[a] Model MS
[#] Group of Employees: 1-Less than 23 months
2-Equal to or more than 23 months
* Significant at .05

Table 35. Comparison of responses to overall current practices of continuous improvement efforts among employees with different levels of exposure to TQM

| Test Technique | Exact F | Pr.>F |
|---|---|---|
| Wilk's Criterion | 6.42 | 0.0001 |
| Pillai's Trace | 6.42 | 0.0001 |
| Hotelling-Lawley Trace | 6.42 | 0.0001 |

Hypothesis 15 There is no significant difference between mean responses to current practices of statistical methods on the TQMP for two different levels of implementation.

$$H_o: \mu_{ciy1}=\mu_{ciy2}$$

where

c is current practice
i is item number (32-34)
y1 is less than 23 months
y2 is equal to or more than 23 months

Table 36 presents the results of the MANOVA procedure for differences between means for three statements related to the current practice of statistical methods, between employees with two different levels of exposure to TQM. The results indicate that two practices, use of statistical methods to ensure and improve production process, have significantly different mean responses between the two different groups of employees. Table 37 shows the comparison of different groups of employees' responses to overall practices of statistical methods. The results indicated that there are significantly different perceptions toward the current practice of statistical methods. Employees with higher levels of exposure to TQM perceived less positively than those with a lower levels of exposure.

Table 36. Comparison of responses to current practices of statistical methods between employees with different levels of exposure to TQM

| Item | Group[#] | Mean | SD | MS[a] | F-Value |
|---|---|---|---|---|---|
| 32 | 1 | 3.14 | 0.95 | 5.75 | 5.65* |
| | 2 | 3.57 | 1.15 | | |
| 33 | 1 | 3.21 | 0.96 | 0.02 | 0.02 |
| | 2 | 3.18 | 1.23 | | |
| 34 | 1 | 3.56 | 1.00 | 5.53 | 5.57* |
| | 2 | 3.14 | 0.97 | | |

[a] Model MS
[#] Group of Employees: 1-Less than 23 months
2-Equal to or more than 23 months
* Significant at .05

Table 37. Comparison of responses to overall current practices of statistical methods among employees with different levels of exposure to TQM

| Test Technique | Exact F | Pr.>F |
|---|---|---|
| Wilk's Criterion | 7.56 | 0.0011 |
| Pillai's Trace | 7.56 | 0.0011 |
| Hotelling-Lawley Trace | 7.56 | 0.0011 |

Hypothesis 16 There is no significant difference between mean responses to current practices of relationship with suppliers on the TQMP for two different levels of implementation.

$$H_o: \mu_{ciy1}=\mu_{ciy2}$$

where

c is current practice
i is item number (35-38)
y1 is less than 23 months
y2 is equal to or more than 23 months

Table 38 presents the results of the MANOVA procedure for differences between means for four statements related to the current practices of relationship with suppliers, between employees with two different levels of exposure to TQM. The results indicate that two practices, utilization of a certification program and systematic process to obtain quality products from suppliers, have significantly different mean responses between the two different groups of employees. Table 39 shows the comparison of different groups of employees' responses on the overall relationship with suppliers. The results indicate that there are significantly different perceptions toward current practices of relationship with suppliers.

Table 38. Comparison of responses to current practices of relationship with suppliers between employees with different levels of exposure to TQM

| Item | Group# | Mean | SD | MS[a] | F-Value |
|---|---|---|---|---|---|
| 35 | 1 | 3.08 | 1.10 | 13.28 | 11.97* |
| | 2 | 2.42 | 0.95 | | |
| 36 | 1 | 3.32 | 0.96 | 8.84 | 9.36* |
| | 2 | 2.79 | 0.97 | | |
| 37 | 1 | 2.81 | 0.97 | 1.23 | 1.31 |
| | 2 | 2.61 | 0.97 | | |
| 38 | 1 | 3.30 | 0.96 | 1.04 | 1.21 |
| | 2 | 3.12 | 0.85 | | |

[a] Model MS
\# Group of Employees: 1-Less than 23 months
2-Equal to or more than 23 months
* Significant at .05

Table 39. Comparison of responses to overall current relationship with suppliers among employees with different levels of exposure to TQM

| Test Technique | Exact F | Pr.>F |
|---|---|---|
| Wilk's Criterion | 3.48 | 0.0010 |
| Pillai's Trace | 3.48 | 0.0010 |
| Hotelling-Lawley Trace | 3.48 | 0.0010 |

Hypothesis 17 There is no significant difference between mean responses to ideal leadership practices on the TQMP with two different levels of implementation.

$$H_o: \mu_{iny1}=\mu_{iny2}$$

where

i is ideal practice
n is item number (1-9)
y1 is less than 23 months
y2 is equal to or more than 23 months

Table 40 shows the comparison of different groups of employees' responses to overall leadership practices. The results indicated that there are no significantly different perceptions between the groups of employees. Table 41 presents the results of the MANOVA procedure for differences between means for nine statements related to ideal leadership practices, between employees with two different levels of exposure to TQM. The results also indicate that there is no significant difference in mean response between the two different groups of employees.

Table 40. Comparison of responses to overall ideal leadership issue among employees with different levels of exposure to TQM

| Test Technique | Exact F | Pr.>F |
|---|---|---|
| Wilk's Criterion | 0.72 | 0.6860 |
| Pillai's Trace | 0.72 | 0.6860 |
| Hotelling-Lawley Trace | 0.72 | 0.6860 |

Table 41. Comparison of responses to ideal leadership practices between employees with different levels of exposure to TQM

| Item | Group# | Mean | SD | MS[a] | F-Value |
|---|---|---|---|---|---|
| 1 | 1 | 4.43 | 0.74 | 0.97 | 1.82 |
| | 2 | 4.61 | 0.70 | | |
| 2 | 1 | 4.22 | 0.99 | 0.12 | 0.11 |
| | 2 | 4.28 | 1.02 | | |
| 3 | 1 | 4.34 | 0.92 | 1.11 | 1.57 |
| | 2 | 4.53 | 0.68 | | |
| 4 | 1 | 4.56 | 0.73 | 0.02 | 0.04 |
| | 2 | 4.59 | 0.64 | | |
| 5 | 1 | 4.24 | 0.80 | 0.85 | 1.25 |
| | 2 | 4.08 | 0.86 | | |
| 6 | 1 | 4.45 | 0.85 | 0.54 | 0.76 |
| | 2 | 4.32 | 0.82 | | |
| 7 | 1 | 4.48 | 0.86 | 0.00 | 0.00 |
| | 2 | 4.46 | 0.61 | | |
| 8 | 1 | 4.35 | 0.89 | 0.03 | 0.05 |
| | 2 | 4.38 | 0.78 | | |
| 9 | 1 | 4.45 | 0.81 | 0.26 | 0.48 |
| | 2 | 4.55 | 0.58 | | |

[a] Model MS
# Groups of Employees: 1-Less than 23 months
2-Equal to or more than 23 months

Hypothesis 18 There is no significant difference between mean responses to ideal customer practices on the TQMP with two different levels of implementation.

$$H_o: \mu_{iny1}=\mu_{iny2}$$

where

i is ideal practice
n is item number (10-18)
y1 is less than 23 months
y2 is equal to or more than 23 months

Table 42 shows the comparison of different groups of employees' responses to overall customer practices. The results indicate that there are no significantly different perceptions toward ideal customer practices. Table 43 presents the results of the MANOVA procedure for differences between means for nine statements related to ideal customer practices, between employees with two different levels of exposure to TQM. The results indicate that there is no significantly different response between the two different groups of employees.

Table 42. Comparison of responses on overall ideal customer practices among the employees with different levels of exposure to TQM

| Test Technique | Exact F | Pr.>F |
|---|---|---|
| Wilk's Criterion | 0.66 | 0.7380 |
| Pillai's Trace | 0.66 | 0.7380 |
| Hotelling-Lawley Trace | 0.66 | 0.7380 |

Table 43. Comparison of responses on ideal customer practices between employees with different levels of exposure to TQM

| Item | Group# | Mean | SD | MS[a] | F-Value |
|---|---|---|---|---|---|
| 10 | 1 | 4.48 | 0.64 | 0.08 | 0.19 |
| | 2 | 4.42 | 0.73 | | |
| 11 | 1 | 4.37 | 0.75 | 0.02 | 0.05 |
| | 2 | 4.34 | 0.66 | | |
| 12 | 1 | 4.35 | 0.76 | 0.58 | 1.13 |
| | 2 | 4.49 | 0.61 | | |
| 13 | 1 | 4.28 | 0.70 | 0.86 | 1.85 |
| | 2 | 4.44 | 0.64 | | |
| 14 | 1 | 4.56 | 0.66 | 0.51 | 1.38 |
| | 2 | 4.69 | 0.50 | | |
| 15 | 1 | 4.23 | 0.86 | 0.26 | 0.29 |
| | 2 | 4.14 | 1.06 | | |
| 16 | 1 | 4.29 | 0.87 | 0.08 | 0.12 |
| | 2 | 4.34 | 0.72 | | |
| 17 | 1 | 4.23 | 0.82 | 0.00 | 0.01 |
| | 2 | 4.22 | 0.74 | | |
| 18 | 1 | 4.40 | 0.79 | 0.53 | 0.86 |
| | 2 | 4.53 | 0.76 | | |

[a] Model MS
# Group of Employees: 1-Less than 23 months
2-Equal to or more than 23 months

Hypothesis 19 There is no significant difference between mean responses to ideal employees involvement practices on the TQMP for two different levels of implementation. $H_o: \mu_{iny1}=\mu_{iny2}$

where

i is ideal practice
n is item number (19-27)
y1 is less than 23 months
y2 is equal to or more than 23 months

Table 44 shows the comparison of the two different groups of employees' responses to overall employees involvement practices. The results indicate that there are no significantly different perceptions toward ideal employee involvement practices. Table 45 presents the results of the MANOVA procedure for differences between means for nine statements related to ideal employee involvement practices, between employees with two different levels of exposure to TQM. The results indicate that there is no significantly different response between the two different groups of employees.

Table 44. Comparison of responses to overall ideal employees involvement practices among employees with different levels of exposure to TQM

| Test Technique | Exact F | Pr.>F |
|---|---|---|
| Wilk's Criterion | 0.83 | 0.5820 |
| Pillai's Trace | 0.83 | 0.5820 |
| Hotelling-Lawley Trace | 0.83 | 0.5820 |

Table 45. Comparison of responses to ideal employees involvement practices between employees with different levels of exposure to TQM

| Item | Group# | Mean | SD | MS[a] | F-Value |
|---|---|---|---|---|---|
| 19 | 1 | 4.49 | 0.68 | 0.18 | 0.38 |
| | 2 | 4.57 | 0.70 | | |
| 20 | 1 | 4.58 | 0.66 | 0.01 | 0.04 |
| | 2 | 4.61 | 0.64 | | |
| 21 | 1 | 4.50 | 0.73 | 0.59 | 0.95 |
| | 2 | 4.36 | 0.88 | | |
| 22 | 1 | 4.47 | 0.76 | 0.31 | 0.57 |
| | 2 | 4.57 | 0.64 | | |
| 23 | 1 | 4.42 | 0.82 | 0.23 | 0.41 |
| | 2 | 4.51 | 0.61 | | |
| 24 | 1 | 4.31 | 0.92 | 0.25 | 0.34 |
| | 2 | 4.40 | 0.73 | | |
| 25 | 1 | 4.28 | 0.86 | 0.00 | 0.00 |
| | 2 | 4.05 | 0.73 | | |
| 26 | 1 | 4.18 | 0.91 | 0.48 | 0.61 |
| | 2 | 4.37 | 0.83 | | |
| 27 | 1 | 4.40 | 0.80 | 0.03 | 0.04 |
| | 2 | 2.53 | 0.88 | | |

[a] Model MS
# Group of employees: 1-Less than 23 months
2-Equal to or more than 23 months

Hypothesis 20 There is no significant difference between mean responses to ideal practices of continuous improvement efforts on the TQMP for two different levels of implementation.

$$H_o: \mu_{iny1}=\mu_{iny2}$$

where
i is ideal practice
n is item number (28-31)
y1 is less than 23 months
y2 is equal to or more than 23 months

Table 46 shows the comparison of different groups of employees' responses to overall continuous improvement practices. The results indicate that there are no significantly different perception toward ideal practices of continuous improvement efforts. Table 47 presents the results of the MANOVA procedure for differences between means for four statements related to ideal practices of continuous improvement efforts, between employees with two different levels of exposure to TQM. The results indicate that none of the statements have significantly different responses between the two different groups of employees.

Table 46. Comparison of responses to overall ideal practices of continuous improvement efforts among employees with different levels of exposure to TQM

| Test Technique | Exact F | Pr.>F |
|---|---|---|
| Wilk's Criterion | 1.16 | 0.3310 |
| Pillai's Trace | 1.16 | 0.3310 |
| Hotelling-Lawley Trace | 1.16 | 0.3310 |

Table 47. Comparison of responses to ideal practices of continuous improvement efforts between employees with different levels of exposure to TQM

| Item | Group# | Mean | SD | MS[a] | F-Value |
|---|---|---|---|---|---|
| 28 | 1 | 4.31 | 0.77 | 0.92 | 1.77 |
| | 2 | 4.49 | 0.61 | | |
| 29 | 1 | 4.35 | 0.79 | 0.09 | 0.15 |
| | 2 | 4.40 | 0.78 | | |
| 30 | 1 | 4.34 | 0.82 | 1.36 | 2.24 |
| | 2 | 4.55 | 0.70 | | |
| 31 | 1 | 4.29 | 0.81 | 0.00 | 0.00 |
| | 2 | 4.28 | 0.89 | | |

[a] Model MS
# Group of Employees: 1-Less than 23 months
2-Equal to or more than 23 months

Hypothesis 21 There is no significant difference between mean responses to ideal practices of statistical methods on the TQMP for two different levels of implementation.

where $H_o: \mu_{iny1}=\mu_{iny2}$

i is ideal practice
n is item number (32-34)
y1 is less than 23 months
y2 is equal to or more than 23 months

Table 48 shows the comparison of different groups of employees' responses to overall practices of statistical methods. The results indicate that there are no significantly different perceptions toward ideal practices of statistical methods. Table 49 presents the results of the MANOVA procedure for differences between means for three statements related to ideal practices of statistical methods, between employees with two different levels of exposure to TQM. The results indicate that none of the statements has significantly different responses between two groups of employees.

Table 48. Comparison of responses to overall ideal practices of statistical methods among employees with different levels of exposure to TQM

| Test Technique | Exact F | Pr.>F |
|---|---|---|
| Wilk's Criterion | 1.02 | 0.3830 |
| Pillai's Trace | 1.02 | 0.3830 |
| Hotelling-Lawley Trace | 1.02 | 0.3830 |

Table 49. Comparison of responses to ideal practices of statistical methods between employees with different levels of exposure to TQM

| Item | Group# | Mean | SD | MS[a] | F-Value |
|---|---|---|---|---|---|
| 32 | 1 | 4.16 | 0.84 | 2.16 | 3.11 |
| | 2 | 4.42 | 0.81 | | |
| 33 | 1 | 4.25 | 0.77 | 1.12 | 1.89 |
| | 2 | 4.44 | 0.76 | | |
| 34 | 1 | 4.37 | 0.67 | 0.55 | 1.26 |
| | 2 | 4.51 | 0.64 | | |

[a] Model MS
# Group of Employees: 1-Less than 23 months
2-Equal to or more than 23 months

Hypothesis 22 There is no significant difference between mean responses to ideal practices of relationships with suppliers on the TQMP for two different levels of implementation.

$$H_o: \mu_{iny1}=\mu_{iny2}$$

where

i is ideal practice
n is item number (35-38)
y1 is less than 23 months
y2 is equal to or more than 23 months

Table 50 presents the results of the MANOVA procedure for differences between means for four statements related to ideal practices of relationships with suppliers, between employees with two different levels of exposure to TQM. The results indicate that there were no significantly different

responses between the two different groups of employees. Table 51 shows the comparison of different groups of employees' responses to overall relationships with suppliers. The results indicate that there are no significantly different perceptions toward ideal practices of relationships with suppliers.

Table 50. Comparison of responses to ideal practices of relationships with suppliers between employees with different levels of exposure to TQM

| Item | Group# | Mean | SD | MS[a] | F-Value |
|---|---|---|---|---|---|
| 35 | 1 | 4.20 | 0.81 | 0.01 | 0.01 |
| | 2 | 4.18 | 0.85 | | |
| 36 | 1 | 4.16 | 0.82 | 1.03 | 1.64 |
| | 2 | 4.34 | 0.72 | | |
| 37 | 1 | 3.98 | 0.99 | 0.08 | 0.08 |
| | 2 | 4.04 | 0.99 | | |
| 38 | 1 | 4.18 | 0.83 | 0.43 | 0.65 |
| | 2 | 4.30 | 0.76 | | |

[a] Model MS
# Group of Employees: 1-Less than 23 months
2-Equal to or more than 23 months

Table 51. Comparison of responses to overall ideal practice of relationships with suppliers among employees with different levels of exposure to TQM

| Test Technique | Exact F | Pr.>F |
|---|---|---|
| Wilk's Criterion | 1.14 | 0.3390 |
| Pillai's Trace | 1.14 | 0.3390 |
| Hotelling-Lawley Trace | 1.14 | 0.3390 |

Results of a two-way ANOVA of the composite scores for each of the six dimensions on the TQMP

Since hypotheses 11 through 22 were tested to examine the different mean responses between the two levels of TQM implementation, it was necessary to test the differences among small, medium, and large companies by controlling the levels of implementation. Composite scores of the six current dimensions were compared to detect differences in mean responses between company size and implementation level. In addition, the test determined if a significant interaction between size and level existed.

Tables 52 through 57 present means and standard deviations for each dimension. Table 58 shows the results of a two-way analysis of variance with the two main effects, size and level, and interaction between these effects.

The results indicated that an analysis of the fourth dimension, "continuous improvement effort," produced significantly different responses based on company size. Compared to small and large companies, medium companies reported more positive current levels of performance on this dimension.

Three dimensions, "leadership," "customer orientation," and "relationships with suppliers," have significantly different responses based on level of implementation. Employees with lower exposure to TQM have

more positive perceptions.

Companies with a shorter implementation period reported more positive current performance on all three dimensions. No significant interactions between sizes and levels were found.

Table 52. Composite means and standard deviations of leadership dimension

| Level* | Size# | | | Row Mean (SD) | Grand Mean (SD) |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | | |
| 1 | 3.62 (0.65) n=36 | 3.71 (0.48) n=17 | 3.81 (0.69) n=32 | 3.71 (0.63) n=85 | 3.56 (0.70) n=134 |
| 2 | 3.56 (0.63) n=16 | 3.32 (0.81) n=15 | 3.12 (0.75) n=18 | 3.33 (0.73) n=49 | |
| Column Mean (SD) | 3.58 (0.64) n=52 | 3.51 (0.63) n=32 | 3.45 (0.71) n=50 | | |

* Level of implementation:
1-Less than 23 months
2-Equal to or more than 23 months

\# Size of companies:
1-Small
2-Medium
3-Large

Table 53. Composite means and standard deviations of customer dimension

| Level* | Size# | | | Row Mean (SD) | Grand Mean (SD) |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | | |
| 1 | 3.25 (0.51) n=36 | 3.41 (0.39) n=17 | 3.38 (0.80) n=32 | 3.35 (0.60) n=85 | 3.21 (0.68) n=134 |
| 2 | 3.17 (0.78) n=16 | 2.82 (0.71) n=15 | 2.98 (0.70) n=18 | 3.00 (0.73) n=49 | |
| Column Mean (SD) | 3.21 (0.61) n=52 | 3.12 (0.54) n=32 | 3.20 (0.77) n=50 | | |

* Level of implementation:
1-Less than 23 months
2-Equal to or more than 23 months

\# Size of companies:
1-Small
2-Medium
3-Large

Table 54. Composite means and standard deviations of employees involvement dimension

| Level* | Size# | | | Row Mean (SD) | Grand Mean (SD) |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | | |
| 1 | 3.04 (0.85) n=36 | 3.33 (0.53) n=17 | 3.15 (0.95) n=32 | 3.27 (0.70) n=85 | 3.06 (0.82) n=134 |
| 2 | 3.12 (0.77) n=16 | 3.75 (0.73) n=15 | 3.25 (0.76) n=18 | 3.37 (0.76) n=49 | |
| Column Mean (SD) | 3.04 (0.79) n=52 | 3.65 (0.58) n=32 | 3.27 (0.72) n=50 | | |

* Level of implementation:
1-Less than 23 months
2-Equal to or more than 23 months

\# Size of companies:
1-Small
2-Medium
3-Large

Table 55. Composite means and standard deviations of continuous improvement effort dimension

| Level* | Size# | | | Row Mean (SD) | Grand Mean (SD) |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | | |
| 1 | 2.96 (0.81) n=36 | 3.55 (0.44) n=17 | 3.29 (0.72) n=32 | 3.27 (0.70) n=85 | 3.29 (0.74) n=134 |
| 2 | 3.12 (0.77) n=16 | 3.75 (0.73) n=15 | 3.25 (0.76) n=18 | 3.37 (0.76) n=49 | |
| Column Mean (SD) | 3.04 (0.79) n=52 | 3.65 (0.58) n=32 | 3.27 (0.72) n=50 | | |

* Level of implementation:
1-Less than 23 months
2-Equal to or more than 23 months

\# Size of companies:
1-Small
2-Medium
3-Large

Table 56. Composite means and standard deviations of statistical methods dimension

| Level* | Size# | | | Row Mean (SD) | Grand Mean (SD) |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | | |
| 1 | 3.21 (0.84) n=36 | 3.72 (0.59) n=17 | 3.18 (0.90) n=32 | 3.34 (0.82) n=85 | 3.30 (0.86) n=134 |
| 2 | 3.14 (0.92) n=16 | 3.44 (0.93) n=15 | 3.31 (0.93) n=18 | 3.28 (0.93) n=49 | |
| Column Mean (SD) | 3.16 (0.86) n=52 | 3.57 (0.75) n=32 | 3.24 (0.91) n=50 | | |

* Level of implementation:
1-Less than 23 months
2-Equal to or more than 23 months

\# Size of companies:
1-Small
2-Medium
3-Large

Table 57. Composite means and standard deviations of relationships with suppliers dimension

| Level* | Size# | | | Row Mean (SD) | Grand Mean (SD) |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | | |
| 1 | 3.33 (0.70) n=36 | 2.97 (0.66) n=17 | 2.99 (0.88) n=32 | 3.09 (0.76) n=85 | 2.94 (0.77) n=134 |
| 2 | 2.60 (0.76) n=16 | 2.96 (0.60) n=15 | 2.66 (0.84) n=18 | 2.74 (0.74) n=49 | |
| Column Mean (SD) | 2.97 (0.74) n=52 | 2.97 (0.64) n=32 | 2.83 (0.86) n=50 | | |

* Level of implementation:
1-Less than 23 months
2-Equal to or more than 23 months

\# Size of companies:
1-Small
2-Medium
3-Large

Table 58. Two-way analysis of variance of size and levels of implementation main effects with interaction

| Dimen.+ | Source# | Df | SS[a] | F | Pr.>F |
|---|---|---|---|---|---|
| 1 | S | 2 | 0.11 | 0.12 | 0.885 |
| | D | 1 | 4.45 | 9.71 | 0.002* |
| | S * D | 2 | 2.26 | 2.47 | 0.088 |
| 2 | S | 2 | 0.23 | 0.26 | 0.768 |
| | D | 1 | 3.43 | 7.73 | 0.006* |
| | S * D | 2 | 1.29 | 1.46 | 0.237 |
| 3 | S | 2 | 1.08 | 0.79 | 0.457 |
| | D | 1 | 1.89 | 2.75 | 0.099 |
| | S * D | 2 | 1.97 | 1.44 | 0.241 |
| 4 | S | 2 | 7.98 | 7.33 | 0.001* |
| | D | 1 | 0.24 | 0.46 | 0.500 |
| | S * D | 2 | 0.35 | 0.32 | 0.724 |
| 5 | S | 2 | 3.58 | 2.40 | 0.095 |
| | D | 1 | 0.07 | 0.10 | 0.751 |
| | S * D | 2 | 0.79 | 0.53 | 0.590 |
| 6 | S | 2 | 1.43 | 1.22 | 0.297 |
| | D | 1 | 4.55 | 7.79 | 0.006* |
| | S * D | 2 | 2.47 | 2.11 | 0.125 |

[a] Type-I SS

\+ Dimensions on the TQMP:
1-Leadership
2-Customer
3-Involvement
4-Continuous Improvement
5-Statistical Methods
6-Relationship with suppliers

\# Source of Effect:
S-Size
D-Levels
S*D-Interaction

* Significant at .05

# CHAPTER V. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Chapters I through IV of this study dealt with the introduction, review of related literature, methodology, and data analysis of this research. This chapter restates the problem, purpose, and hypotheses of the study. A brief discussion and presentation of conclusions based upon the findings follows each hypothesis. Finally, the chapter presents overall conclusions and provides recommendations.

## Restatement of the Problem

The problem of this study was to develop an instrument that can be shown to yield reliable data for measuring the current and ideal status of TQM implementation among companies with known degrees of TQM implementation.

## Restatement of the Purpose

To date, it appears that no instrumentation has been developed for researchers to measure the progress toward Total Quality Management within the organization and how much progress the organization has made towards implementing Total Quality Management concepts. By developing an instrument, the researchers will be able to make comparisons among types of companies, among groups within the same organization, and among different types of

implementation plans, to determine which procedure is the most effective at implementing TQM.

Therefore, the purposes of this research are four-fold. These purposes are as follows:

1) Develop an instrument.
2) Establish reliability by using one of the reliability estimating methods.
3) Use the instrument to compare the results of responses among small, medium, and large companies.
4) Use the instrument to compare the results of responses between the two known groups;
   Group A - Implemented TQM less than 23 months, and
   Group B - Implemented TQM equal to or more than 23 months.

## General Summary

This study was conducted to develop an instrument to measure employee perceptions regarding the adoption of Total Quality Management (TQM) in their work environment. The independent variables investigated were: levels of TQM implementation, i.e., exposed to TQM practice more than 23 months or less than 23 months, and size of the companies, i.e., small (less than 50 employees), medium (between 50 and

200 employees), and large (more than 200 employees).

A review of related literature was conducted and reported. The review of literature presented the following major areas: Scientific Management, early twentieth century management thought, overview of Total Quality Management (TQM), development of TQM, characteristics of TQM, and TQM pioneers.

A Total Quality Management Profile (TQMP), which asks about current and ideal TQM practices in manufacturing organizations, was proposed with 38 statements on a Likert-type five-point scale. The initial TQMP was sent out to a panel of experts who provided guidelines for appropriate changes. A pilot test was administered at a company in Cedar Rapids, Iowa. After modifying the instrument based on the results of the pilot test, data were collected at the selected companies.

A preliminary test of the TQMP indicated on overall reliability of .94 for current practices and .96 for ideal practices. A principle axis factor analysis with a varimax rotation showed that five factors may exist. A count of each item was then made with respect to its a priori dimensions and factor group. Items were identified by the highest factor loading. A factor analysis of the correlation matrix results suggest that there is only one dominant factor.

The findings were based upon testing the relevant hypotheses. All twenty-two hypotheses were tested using the following techniques: 1) one-way analysis of variance (ANOVA) was employed to examine the differences between mean responses, different-sized companies, and different levels of TQM implementation; 2) a multivariate analysis of variance (MANOVA), including the use of Wilks' Criterion, Pillai's Trace, and the Hotelling-Lawley Trace; and 3) two-way analysis of variance to determine differences for each dimension in the TQMP between groups with different levels of exposure to TQM.

## Conclusions

The conclusions of this study are presented in terms of the stated hypotheses. Each hypothesis is restated and followed by a conclusion based upon the findings presented in Chapter Four.

### Hypotheses 1-2

It was hypothesized that there was no significant difference between mean responses to items on the TQMP regarding the current and ideal TQM practices at small, medium, and large companies.

Conclusion of hypotheses 1-2 The purpose of these hypotheses was to detect the existence of different perceptions on the current (hypothesis 1) and ideal (hypothesis 2) practices among small, medium, and large companies. Based upon the findings presented in Tables 13, 14, and 15, 10 of the 38 statements regarding current practices showed significant differences. Employees at medium companies have the most positive perceptions compared to small and large companies. Compared to the results of medium and large companies, employees at small companies perceived current practices less positively.

For ideal practices on the TQMP, one of the 38 statements showed a significant differences. Again, employees from medium companies reported the most positive perception on this statement.

Discussion of hypotheses 1-2 Overall responses to current TQM practices indicated that there were significantly different perceptions between different sized companies toward a number of concepts in TQM. This had been expected, since the companies have their own unique characteristics, specifically different sizes and varying levels of TQM implementation.

Most of the differences which were found had to do with employee involvement and continuous improvement efforts. These practices are related to the employees' participation

in and the existence of TQM training programs. As indicated in Table 14, the medium companies have the most positive perceptions regarding these practices. They seemed to have structured TQM training programs adequately, and their employees had more chances to participate in the quality improvement process.

In contrast, employees at the small companies perceived these practices more negatively, compared to the results of medium and large companies. Interestingly, however, small-firm employees have the most positive perception regarding leadership practices in their companies. Smaller firms have fewer levels of management compared to larger companies and employees thus are provided a better chance to access upper management.

In 37 statements, there were no significant differences in mean responses to the ideal TQM practices on the TQMP. In the case of "Our organization has shown steady improvement in product quality recently," there were significant differences in mean responses. The different groups of employees perceived ideal TQM practices in similar ways whether they were in small, medium, or large companies. It appears that the size of the company had no effect on the perceived ideal TQM environment.

Hypotheses 3-4

It was hypothesized that there was no significant difference between mean responses to items on the TQMP regarding current and ideal TQM practices for two different levels of TQM implementation.

Conclusion of hypothesis 3-4 It was concluded, based upon the findings reported in Tables 19 and 20, that significantly different mean responses were obtained from employees with two different levels of exposure to TQM. Eighteen statements regarding current practices on the TQMP received different responses. Statement 8, "our organization is using systematic techniques to obtain external customer feedback on our products," has the most different (F=38.73) response between employee groups, compared to other statements. The responses on 15 statements, out of 18, show more positive perceptions among employees who have lower levels of exposure to TQM. Based on the results presented in Table 21, the mean responses to ideal practices on the TQMP were not significantly different between employees experiencing two levels of implementation.

Discussion of hypotheses 3-4 The results indicated that there were significantly different mean responses to current TQM practices between two levels of exposure to the TQM. It was expected that there would be fewer positive

perceptions from employees with higher levels of exposure to TQM.

Employees have the most positive perception regarding the existence of TQM training programs, indicating that employees with higher levels of exposure increased their knowledge about TQM concepts and compared current practices with this knowledge. The reverse was true for employees with lower levels of exposure to TQM. They did not have a clear understanding of the TQM concepts, which might lead them to perceive most of the statements on the TQMP more positively.

No significant differences were found regarding ideal TQM practices. Since perceptions about ideal practices have been similar in other cases, this was an expected outcome.

Hypotheses 5-7

It was hypothesized that there were no significant differences between mean responses to items on the TQMP regarding the current TQM practices of small, medium, and large companies with different levels of implementation.

Conclusion of hypotheses 5-7 Based upon the findings presented in Tables 22, 23, and 24, and Figures 7, 8, and 9, conclusions for each hypothesis are presented below:

Hypothesis 5:

Eighteen statements included in "employees involvement," "continuous improvement effort," and "statistical method" dimensions of TQM have significantly different mean responses among employees at small companies. Overall comparison revealed that employees with lower levels of exposure, i.e., less than 23 months, have the most positive perception on these dimensions

Hypothesis 6:

Eight statements included in the practice of "customer orientation" and "continuous improvement effort" dimension of TQM have significantly different mean responses among employees at medium companies. Employees those who have less exposure, i.e., less than 23 months, to TQM perceived more positively than the other group of employees.

Hypothesis 7:

Two practices, "leadership" and "continuous improvement effort," in TQMP have significantly different mean responses among employees at large companies. Employees with 6 months of exposure to TQM perceived more positively than those who with 25 months of exposure to TQM.

Discussion of hypotheses 5-7 A number of responses from the employees at three different sizes of companies were significantly different from each other. An expected result was obtained from small and large companies. A number of the current practices were viewed differently by the employees at these companies. On the other hand, the mean responses from the employees at medium companies were not significantly different from each other regarding most current TQM practices.

There were eight different small companies involved in this study. Each company had a different level (0, 1, 6, 8, 12, 23, 24, and 25 months) of TQM implementation. Since it was beyond the scope of this study, no attempt was made to test the differences between the groups of employees. Overall comparisons revealed that there were different employee perceptions toward "employee involvement practices" and "the practices of statistical methods" of TQM.

Five different levels, ranging from 0 to 25 months, of TQM implementation existed in medium companies. Most of the differences were found in the practice of "continuous improvement effort."

For large companies, different employee perceptions were found toward leadership practices in the companies. Employees with a higher level of exposure to TQM have more positive perception toward the practices associated with

leadership dimension.

Hypotheses 8-10

It was hypothesized that there were no significant differences between mean responses to items on the TQMP regarding the ideal TQM practices of small, medium, and large companies with different levels of implementation.

Conclusion of hypotheses 8-10 Based upon the findings presented in Tables 25, 26, and 27, there were no significant differences between the perceptions of employees at small, medium, and large companies.

Discussion of hypotheses 8-10 The results indicated that there were no significant differences in mean employee perceptions toward ideal TQM practices throughout the companies. Employees in all sizes of companies had similar perceptions about most aspects of TQM as it is applied in their company.

Hypotheses 11-16

It was hypothesized that there were no significant differences between mean responses to current practices regarding the six dimensions of leadership, customer orientation, employees involvement, continuous improvement efforts, statistical methods, and relationship with suppliers, across the levels of implementation.

Conclusion of hypotheses 11-16 Hypotheses 11 to 16 were tested to examine differences in employee perceptions of current practices regarding the above six dimensions on the TQMP. Conclusions for each hypothesis are as follows.

In these conclusions, the results discussed include, first, the findings from MANOVA tests for mean differences across multiple items on each dimension, and second, the findings from two-way ANOVA tests for mean differences within a single composite item.

Hypothesis 11:

It can be concluded, based upon the findings presented in Tables 28, 29, 52, and 58, that there was a significant difference in employees' mean perceptions of current "leadership" practices. Employees with a higher level, equal to or more than 23 months, of exposure to TQM perceived less positively than those with a lower level of exposure to TQM.

Hypothesis 12:

Based upon the findings presented in Tables 30, 31, 53, and 58 there was a significant difference in employees' mean perceptions on current "customer orientation" practices. Employees with a higher level, equal to or more than 23 months, of exposure to TQM perceived less positively than those with a lower level of exposure to TQM.

Hypothesis 13:

It can be concluded, based upon the findings presented in Tables 32 and 33, that there was a significant difference in mean employees' mean perceptions of current "employee involvement" practices. Employees with a higher level, equal to or more than 23 months, of exposure to TQM perceived less positively than those with a lower level of exposure to TQM. However, based upon the results presented in Tables 54 and 58, a two-way ANOVA yielded no significantly different employees perceptions on this dimension when all items were taken as a group summed.

Hypothesis 14:

It also can be concluded, based upon the findings presented in Tables 34 and 35, that there was a significant difference in employees' mean perceptions of current practices of "continuous improvement efforts." Employees with a higher level, equal to or more than 23 months, of exposure to TQM perceived less positively than those with a lower level of exposure to TQM. In contrast, Tables 55 and 58 showed that there was no significantly different employees' mean perceptions on this dimension when all items were taken as a group summed.

Hypothesis 15:

It can be concluded, based upon the findings presented in Tables 36 and 37, that there was a significant difference in the employees' mean perceptions on the current practice of "statistical methods." Employees with a higher level, equal to or more than 23 months, of exposure to TQM perceived less positively than those with a lower level of exposure to TQM. However, Tables 56 and 58 represented that there was no significantly different employees' mean perceptions on the use of statistical method when all items were taken as a group summed.

Hypothesis 16:

Based upon the findings presented in Tables 38, 39, 57, and 58, there was a significant difference in employees' mean perceptions of current practices of "relationship with suppliers." Employees with a higher level, equal to or more than 23 months, of exposure to TQM perceived less positively than those with a lower level of exposure to TQM.

Discussion of hypotheses 11-16 The results indicate that an expected significant difference was found. The results of employees' perceptions toward current practices on the six dimensions are mostly based on their levels of exposure to TQM. Employees with higher levels of exposure

to TQM have less positive perceptions about the current practices regarding leadership, customer orientation, employee involvement, statistical methods, and relationship with suppliers. For the practice of "continuous improvement effort," employees with higher levels of exposure have more positive perceptions. Since this practice included the existence of the TQM training programs, the employees responses reflected the evidence of their engagement with the training programs. It appears that the employees with a longer exposure to TQM have a better knowledge about what is happening in their companies.

For the three dimensions (employees involvement, continuous improvement, and statistical methods), the MANOVA and two-way composite-item ANOVAs provide different results. It is interesting that each involves a very "hands-on" set of concerns that employees may have regarding how TQM affects their daily task performance. This is in contrast to the other three dimensions (leadership, customer orientation, and relationship with suppliers), the MANOVA and two-way composite-item ANOVA results were similiar, where the common theme is a departure from daily task structures. This pattern may be explainable by employees' conceptualizing these daily tasks as a set of discrete functions, which is reflected in the MANOVA analysis using all items separately but masked by the composite-item ANOVA

which assumes that all these tasks have a common goal.

Hypotheses 17-22

It was hypothesized that there was no significant difference between mean responses to ideal practices on the six dimensions of leadership, customer orientation, employee involvement, continuous improvement efforts, statistical methods, and relationship with suppliers, across levels of implementation.

Conclusion of hypotheses 17-22 Conclusions for each hypothesis are as follows:

Hypothesis 17:

It can be concluded, based upon the findings presented in Tables 40 and 41, that there was no significant difference in employees' mean perceptions of ideal "leadership" practices.

Hypothesis 18:

Based upon the findings presented in Tables 42 and 43, there was no significant difference in employees' mean perceptions of ideal practices of "customer orientation."

Hypothesis 19:

It can be concluded, based upon the findings presented in Tables 44 and 45, that there was no significant difference in employees' mean perceptions of ideal

"employee involvement" practices.

Hypothesis 20:

It also can be concluded, based upon the findings presented in Tables 46 and 47, that there was no significant difference in employees' mean perceptions of ideal practices of "continuous improvement efforts."

Hypothesis 21:

It can be concluded, based upon the findings presented in Tables 48 and 49, that there was no significant difference in employees' mean perceptions of ideal practices of "statistical methods."

Hypothesis 22:

Based upon the findings presented in Tables 50 and 51, there was no significant difference in employees' mean perceptions of ideal practices of "relationship with suppliers."

Discussion of hypotheses 17-22 There were no significantly different mean responses to ideal practices on the six dimensions of the TQMP. Employees at all companies had similar perceptions regarding ideal TQM practices.

Conclusion of the results of a two-way ANOVA for the composite scores

Based on the results presented in Tables 52 to 58, the fourth dimension, "continuous improvement effort," produced

significantly different responses based on company size. Medium companies, compared to small and large companies, reported more positive current levels of performance on this dimension.

Three dimensions, "leadership," "customer orientation," and "relationships with suppliers," have significantly different responses based on level of implementation. Companies with a shorter implementation period reported more positive current levels of performance on all three dimensions. No significant interactions between sizes and levels were found.

Discussion of the results of a two-way ANOVA for the composite scores

For the dimension of "continuous improvement effort," medium companies have the most positive performance regarding this practice. Medium companies seem to have a properly structured TQM training program and employees at these companies have greater opportunity to participate in the quality improvement process. Small companies have less positive performance on this dimension compared to medium and large companies. They did not have an adequately organized TQM training program and have a rare chance to take part in the quality improvement process.

Three dimensions, "leadership," "customer orientation,"

and "relationship with suppliers," show significantly different mean responses based on level of implementation. Employees at companies with shorter implementation have more a positive current level of performance on all three dimensions. Employees of these companies may have perceived TQM more positively because they did not have enough knowledge about the concepts of TQM. The deficiency of knowledge influence them to respond based on their own interpretation about the quality improvement practices. On the other hand, employees at companies with longer implementation have less positive perceptions of the current performance on those three dimensions. Employees of these companies may have perceived TQM less positively because they possessed better knowledge about the concepts of TQM. This allowed them to distinguish better the differences between what actually is happening in the company and the knowledge which is gained from the training program.

## Recommendations

The recommendations of this study are based upon the findings and conclusions that were presented.

1. Further investigations are needed to explore the differences found in current practices on the six dimensions of TQM.

2. Future research needs to be focused on the perceptions of different levels or categories of employees and to identify differences in their perceptions. This will provide more insight regarding a particular organization.
3. It is recommended that future research focus on organizations other than manufacturing organizations such as construction and service organizations.
4. It is recommended that future research may include highly recognized companies, e.g., winners of the Malcolm Baldridge Award for implementing quality improvement practices.
5. It is recommended that further research should include different geographical areas. Further studies need to be conducted to see whether the findings in this study can be generalized to populations beyond the scope of this study.
6. A factor analysis of the correlation matrix of the six dimensions yielded one dominant factor. It is recommended such a factor analysis of composite dimensions be repeated utilizing a larger manufacturing sample, in order to provide a more definitive appraisal.

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# APPENDIX A: GUIDELINES FOR ITEM DEVELOPMENT

## Guide line for the Instrument Item Construction

**1. Dimensions**

1) Leadership
2) Customer
3) Involvement
4) Continuous Improvement
5) Value of Statistical Methods
6) Relationship with Suppliers

**2. Elements**

1) Leadership:

   a. Employees' perception of the levels of commitment to quality by management.
   b. Employees' perception of the levels of commitment to customers by management.
   c. Employees' perception of the levels of communication channel between upper management and first line workers.

2) Customer:

   a. Employees' attitude toward the loyalty of customers.
   b. Employees' attitude toward the customers satisfaction.
   c. Employees' perception toward the handling procedure of customers feedback.

3) Involvement:

   a. Perception by the employees about whether their opinions are valid into the decision making process.
   b. Perception by the employees about the information sharing practice within the organization.
   c. Perception by the employees about the participation toward the product design and production stage.

4) Continuous Improvement:

   a. Employees' perception toward the goals of their organization.
   b. Employees' perception toward the education and training programs in the organization.

5) Value of Statistical Methods:

   a. Employees' perception toward the application of statistical methods.

6) Relationship with Suppliers:

   a. Employees' perception toward the suppliers involvement.
   b. Employees' perception toward existence of certification process for the suppliers.

# APPENDIX B: LIST OF PANEL OF EXPERTS

**LIST OF PANEL OF EXPERTS**

1 Dale H. Besterfield, Ph.D.
Principle,
Besterfield and Associates
700 S. Illinois Ave. Suite 106.
Carboldale, IL 62901

2 Ronald W. Butterfield

Deming's 14 points: Applied to service, Training, March 1991.

2405 W. 28th Street.
Sioux Falls, SD 57105

3 Robert Cole

What was Deming's real influence? Across the Board, Jan./Feb. 1987.

Dept. of Sociology & Business Administration
University of Michigan
525 Church,
Ann Arbor, Michigan

4 Kevin J. Dooley

The United States' Baldrige award and Japan's Deming Prize: Two guidelines for Total Quality Control.

Department of Mechanical Engineering
University of Minnesota,
Minneapolis, MN 55455

5 Maling Ebrahimpour, Ph.D.

Quality management practice of..., Production & Inventory Management Journal, 4th quarter, 1988.

Dept. of Management Science & Information System,
University of Rhode Island,
Kingston, RI 02881

6 Charles Leader

Making TQM work: Lessons from industry, Aviation Week & Space Technology, October 30, 1989.

(216)-696-1313
McKinsey & Co.,
100 Erieview Plaza Building
Cleveland, OH

7 Sang M. Lee, Ph.D.

Quality management practice of..., Production & Inventory Management Journal, 4th quarter, 1988.

Dept. of Management
University of Nebraska at Lincoln,
Lincoln, NE 68588

8 Thedore J. Marchese

TQM reaches the academy, AAHE Bulletin, November 1991.

Vice President
American Association for Higher Education
One Dupont Circle, Suite 600
Washington, D.C. 20036

9 Michael E. Milakovich

Through application of TQM...

Associate Professor
Dept. of Political Science
School of Business Administration
University of Miami,
Coral Gables, FL

10 Daniel T., Seymour

TQM on campus, AAHE Bulletin, November 1991.

100 South Sunrise Way,
Suite 350,
Plam Springs, CA 92262

11 Laurel M. Sheppard

TQM in the ceramic industry, Ceremic Bulletin, November 1991.

Editor
American Ceremic Society
757 Brooksedge Plaza Drive,
Westerville, OH 43081-6136

12 Hannah A. Stires

TQM, participatroy management

Room 111,
Public Services Division,
Beltsville, MD 20705-2351

# APPENDIX C: LETTERS TO PANEL

July 3, 1992

Dr. Robert Cole
Department of Sociology & Business Admin.,
University of Michigan,
525 Church,
Ann Arbor, Michigan

Dear Dr. Cole,

As a person who is knowledgeable about Total Quality Management (TQM), I am requesting your assistance in the development of an instrument designed to measure the impacts of TQM training on manufacturing organizations in the United States. Please examine the enclosed instrument and provide suggestions regarding included items, overall approach, and any area that have been overlooked.

Your suggestions will be incorporated with others from your colleagues. The instrument then will be pilot tested to determine its readability and revised. After completion of these steps, the instrument will be used at a minimum of 12 manufacturing settings.

If you would like to have information regarding progress at any step in this process or have questions, please call me at (515) 233-6911. Thank you for your help as we attempt to develop better measures to understand the culture change precipitated by a TQM program.

Sincerely,

Jai W. Hong
Graduate Student
Dept. of Industrial
Ed. & Technology
Iowa State Univ.,
Ames, IA 50011
(515) 233-6911

Dr. John C. Dugger
Major Professor,
Dept. of Industrial
Ed. & Technology
Iowa State Univ.,
Ames, IA 50011
(515) 294-1033

# APPENDIX D: LIST OF COMMENTS MADE BY PANEL

**List of Comments made by Experts**

| Item Numbers | Comments |
|---|---|
| 2 | "No. 2 could be changed to 'upper management is the driving force behind our quality improvement efforts." |
| 4 | "I would use the word 'strongly' or 'committed' instead 'totally'." |
| 5 | "Who is the customer?" |
| 8 | "TQ is not only about quality, it is about overall (i.e. the whole) organization. Just quality policy won't do." |
| 19 & 20 | "19 and 20 seem similar, perhaps combine into one question." |
| 23 | "Why only quality! A good system should relay all types. Not just quality." |
| 30 & 31 | "perhaps combine 30 and 31" |
| 33 | "concentrates on the process"<br>"Quality of final product or overall organization performance and customer satisfaction." |
| 34 | "why 2 years" |

# APPENDIX E: LIST OF ADDITIONAL ITEMS SUGGESTED BY PANEL

**List of additional items suggested by experts**

1. Aspect III (Involvement)

   Employees at all levels actively support our quality improvement effort.

   Our quality improvement efforts have helped remove barriers between departments in our organization.

2. Aspect VI (Relationship with Suppliers)

   Our suppliers are actively involved in our quality improvement process.

   Employees feedback regarding suppliers service and product quality is actively requested.

   Our organization provides suppliers with regular feedback regarding their products and services.

# APPENDIX F: FINAL DRAFT OF TQMP

## TOTAL QUALITY MANAGEMENT (TQM) PROFILE

**PURPOSE:**

The purpose of this instrument is to measure your perceptions regarding Total Quality Management (TQM) as practiced in your organization.

Your responses will be kept strictly confidential. Please do not place your name on any part of this instrument.

**INSTRUCTIONS:**

1. Read each statement carefully.
2. Decide the extent to which you agree or disagree with each statement.
3. Indicate your decision by placing an "X" in the box to the right of the statements.
4. a) The meaning of **CURRENT** in the statement below is: What is currently happening in your organization toward quality improvement efforts.

   b) The meaning of **IDEAL** in the statement below is: What is an ideal situation for your organization to improve the quality of your products or services.
5. Make sure to complete <u>both</u> (**CURRENT & IDEAL**) columns and mark only <u>one</u> response for each column.

<u>For Example</u>:

| | **<u>CURRENT</u>** | | | | | | **<u>IDEAL</u>** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree | | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
| Our supervisor treats all of his/her subordinates equally. | [ ] | [ ] | [ ] | [ ] | [X] | • | [ ] | [ ] | [ ] | [ ] | [X] |

6. This instrument contains 38 statements.

**PART I** (Demographic Information):

Please indicate your department and job title in the space provided below;

* Department:_____

* Job Title :_____

**PART II**

*Please complete both columns (CURRENT & IDEAL)*

| | | CURRENT | | | | | | IDEAL | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree | | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
| 1. | Upper management is visibly involved in the development of an effective quality culture. | [ ] | [ ] | [ ] | [ ] | [ ] | * | [ ] | [ ] | [ ] | [ ] | [ ] |
| 2. | Upper management is the driving force behind our quality improvement efforts. | [ ] | [ ] | [ ] | [ ] | [ ] | * | [ ] | [ ] | [ ] | [ ] | [ ] |
| 3. | Upper management allocates adequate resources (finance, time, equipment, and people) to quality improvement. | [ ] | [ ] | [ ] | [ ] | [ ] | * | [ ] | [ ] | [ ] | [ ] | [ ] |
| 4. | Upper management is strongly committed to improving product quality to meet our customers' expectations. | [ ] | [ ] | [ ] | [ ] | [ ] | * | [ ] | [ ] | [ ] | [ ] | [ ] |
| 5. | Our organization is using a systematic technique (e.g., '800' toll free number) to obtain external customer feedback on our products. | [ ] | [ ] | [ ] | [ ] | [ ] | * | [ ] | [ ] | [ ] | [ ] | [ ] |
| 6. | Upper management believes that quality of our products must be judged by the customer. | [ ] | [ ] | [ ] | [ ] | [ ] | * | [ ] | [ ] | [ ] | [ ] | [ ] |
| 7. | Our organization is using effective methods of communicating quality goals to all employees. | [ ] | [ ] | [ ] | [ ] | [ ] | * | [ ] | [ ] | [ ] | [ ] | [ ] |
| 8. | Our organization's quality policy or statement has been written and is available to all employees. | [ ] | [ ] | [ ] | [ ] | [ ] | * | [ ] | [ ] | [ ] | [ ] | [ ] |
| 9. | The quality improvement process being utilized in our organization clearly facilitates coordination between different levels of management. | [ ] | [ ] | [ ] | [ ] | [ ] | * | [ ] | [ ] | [ ] | [ ] | [ ] |

*Please complete both columns (CURRENT & IDEAL)*

| | | CURRENT | | | | | | IDEAL | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree | | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
| 10. | Our organization is using a systematic process to define customers' requirements and expectations. | ☐ | ☐ | ☐ | ☐ | ☒ | * | ☐ | ☐ | ☐ | ☐ | ☒ |
| 11. | Our organization is using a systematic and effective process for translating customers' requirements into the planning process to improve existing products. | ☐ | ☐ | ☐ | ☒ | ☐ | * | ☐ | ☐ | ☐ | ☐ | ☒ |
| 12. | Our organization serve our customers by establishing a fair value for the price of our products. | ☐ | ☐ | ☐ | ☐ | ☒ | * | ☐ | ☐ | ☐ | ☐ | ☒ |
| 13. | Our organization has product guarantees that customers believe are superior to those of our competitors. | ☐ | ☐ | ☐ | ☒ | ☐ | * | ☐ | ☐ | ☐ | ☒ | ☐ |
| 14. | Our customers have an overall high level of customer satisfaction with our product. | ☐ | ☐ | ☐ | ☐ | ☒ | * | ☐ | ☐ | ☐ | ☐ | ☒ |
| 15. | There has been a steady decrease in the number of customer complaints recently. | ☒ | ☐ | ☐ | ☐ | ☐ | * | ☐ | ☐ | ☐ | ☐ | ☒ |
| 16. | There is a process for obtaining information about the customers' satisfaction with or complaints about our product. | ☐ | ☐ | ☐ | ☒ | ☐ | * | ☐ | ☐ | ☐ | ☒ | ☐ |
| 17. | Customer feedback is used as the basis for product design. | ☐ | ☐ | ☐ | ☐ | ☒ | * | ☐ | ☐ | ☐ | ☐ | ☒ |
| 18. | Our organization has an effective way of handling customer service and complaints. | ☐ | ☒ | ☐ | ☐ | ☐ | * | ☐ | ☐ | ☐ | ☒ | ☐ |
| 19. | Our organization has a procedure for the utilization of employees' ideas for improvement purposes. | ☐ | ☐ | ☒ | ☐ | ☐ | * | ☐ | ☐ | ☐ | ☐ | ☒ |
| 20. | Our organization involves all employees in the quality improvement process. | ☐ | ☐ | ☐ | ☒ | ☐ | * | ☐ | ☐ | ☐ | ☒ | ☐ |
| 21. | There is an effective process for routinely obtaining employees' opinions and suggestions. | ☐ | ☒ | ☐ | ☐ | ☐ | * | ☐ | ☐ | ☐ | ☐ | ☒ |
| 22. | Upper management is always willing to spend time with subordinates to discuss quality-related issues. | ☐ | ☐ | ☒ | ☐ | ☐ | * | ☐ | ☐ | ☒ | ☐ | ☐ |

*Please complete both columns (CURRENT & IDEAL)*

| | | CURRENT | | | | | | IDEAL | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree | | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
| 23. | Our organization effectively communicates quality information throughout the organization. | ☐ | ☐ | ☐ | ☐ | ☐ | * | ☐ | ☐ | ☐ | ☐ | ☐ |
| 24. | Our quality improvement efforts have helped remove barriers between departments in our organization. | ☐ | ☐ | ☐ | ☐ | ☐ | * | ☐ | ☐ | ☐ | ☐ | ☐ |
| 25. | All employees are routinely engaged in team problem-solving techniques. | ☐ | ☐ | ☐ | ☐ | ☐ | * | ☐ | ☐ | ☐ | ☐ | ☐ |
| 26. | Many of us participate in the planning process for our products. | ☐ | ☐ | ☐ | ☐ | ☐ | * | ☐ | ☐ | ☐ | ☐ | ☐ |
| 27. | Employees at all levels feel free to express their opinions. | ☐ | ☐ | ☐ | ☐ | ☐ | * | ☐ | ☐ | ☐ | ☐ | ☐ |
| 28. | Our organization has developed plans that list overall quality goals and strategies for accomplishing those goals. | ☐ | ☐ | ☐ | ☐ | ☐ | * | ☐ | ☐ | ☐ | ☐ | ☐ |
| 29. | Our organization has developed methods for monitoring progress toward quality goals. | ☐ | ☐ | ☐ | ☐ | ☐ | * | ☐ | ☐ | ☐ | ☐ | ☐ |
| 30. | Our organization has a structured training program for all employees in quality improvement concepts and tools. | ☐ | ☐ | ☐ | ☐ | ☐ | * | ☐ | ☐ | ☐ | ☐ | ☐ |
| 31. | All employees spend adequate time learning about quality improvement techniques and principles. | ☐ | ☐ | ☐ | ☐ | ☐ | * | ☐ | ☐ | ☐ | ☐ | ☐ |
| 32. | We are using statistical techniques to ensure the quality of the production process. | ☐ | ☐ | ☐ | ☐ | ☐ | * | ☐ | ☐ | ☐ | ☐ | ☐ |
| 33. | We are using statistical techniques to improve the quality of overall organization performance. | ☐ | ☐ | ☐ | ☐ | ☐ | * | ☐ | ☐ | ☐ | ☐ | ☐ |
| 34. | Our organization has shown steady improvement in product quality recently. | ☐ | ☐ | ☐ | ☐ | ☐ | * | ☐ | ☐ | ☐ | ☐ | ☐ |
| 35. | Our organization has a certification program for suppliers to obtain quality products from them. | ☐ | ☐ | ☐ | ☐ | ☐ | * | ☐ | ☐ | ☐ | ☐ | ☐ |
| 36. | Our organization has plans for ensuring that suppliers are able to meet our quality requirements. | ☐ | ☐ | ☐ | ☐ | ☐ | * | ☐ | ☐ | ☐ | ☐ | ☐ |

*Please complete both columns (CURRENT & IDEAL)*

| | | CURRENT | | | | | | IDEAL | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree | | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
| 37. | Our suppliers are involved in the product planning process. | [ ] | [ ] | [ ] | [ ] | [X] | * | [ ] | [ ] | [ ] | [ ] | [X] |
| 38. | Our organization provides suppliers with regular feedback regarding their products and services. | [ ] | [X] | [ ] | [ ] | [ ] | * | [ ] | [ ] | [ ] | [X] | [ ] |

** This is the end of the instrument **
* Thank you for your participation *

# APPENDIX G: A LETTER TO TOP MANAGEMENT

September 2, 1992

Dear Sir/Madam,

As you know, Total Quality Management (TQM) is receiving a tremendous amount of interest among industries in the United States. I am conducting a study to develop and validate an instrument. This will enable researchers in TQM to measure the progress toward TQM within your organization and how much progress the organization has made towards implementing TQM. The result of study will be able to helping identify employees' perception toward quality improvement effort.

This instrument contains thirty-eight statements which describe six basic elements within the TQM. These are: leadership, customer, involvement, continuous improvement effort, value of statistical methods, and relationship with suppliers. The response that your employees provide will be kept strictly confidential. All response will be collected and summarized as a group thus protecting your employees confidentiality and identity.

The survey will require about 20 minutes of your employees time to complete. The result of data analysis will be provided upon your request. If you agree, I would like to administer this process. If you have any questions about this process, please call me at (515) 233-6911. Thank you for your help as we attempt to develop better measures to understand the quality improvement effort in your organization.

Sincerely,

Hong, Jai W.

Graduate Student
Dept. of Industrial
Ed. & Technology
Iowa State University
Ames, Iowa 50011
(515) 233-6911

Dr. John C. Dugger
Major Professor
Chairman,
Dept. of Industrial
Ed. & Technology
Iowa State University
Ames, Iowa 50011
(515) 294-1033

# APPENDIX H: A LETTER TO THE EMPLOYEE

September 8, 1992

Dear Sir/Madam,

As you know, Total Quality Management (TQM) is receiving a tremendous amount of interest among industries in the United States. I am conducting a study to develop and validate an instrument. This will enable researchers in TQM to measure the progress toward TQM within your organization and how much progress the organization has made towards implementing TQM. The result of study will be able to helping identify your perception toward quality improvement effort in your organization.

This instrument contains thirty-eight statements which describe six basic elements within the TQM. These are: leadership, customer, involvement, continuous improvement effort, value of statistical methods, and relationship with suppliers. The response that you provide will be kept strictly confidential. All response will be collected and summarized as a group thus protecting your confidentiality and identity.

The survey will require about 20 minutes of your time to complete. If you have any questions about this process, please do not hesitate to ask. Thank you for your help as we attempt to develop better measures to understand the quality improvement effort in your organization.

Sincerely,

Hong, Jai W.

Graduate Student
Dept. of Industrial
Ed. & Technology
Iowa State University
Ames, Iowa 50011
(515) 233-6911

Dr. John C. Dugger
Major Professor
Chairman,
Dept. of Industrial
Ed. & Technology
Iowa State University
Ames, Iowa 50011
(515) 294-1033

# APPENDIX I: INSTRUMENT EVALUATION FORM

**INSTRUMENT EVALUATION FORM**

**DIRECTIONS:** Please rate each item on the instrument by using the categories provided. You may also write directly on the instrument if you desire. After completing the general questions, please return the instrument and evaluation form in the self-addressed, stamped envelop provided.

**1. Aspect I. Leadership**

| Appropriateness | Item Number | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| Crucial | | | | | | | | | |
| Appropriate, but not crucial | | | | | | | | | |
| Not Appropriate | | | | | | | | | |

Any comments or additional items?

_____

_____

_____

**2. Aspect II. Customer Orientation**

| Appropriateness | Item Number | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| Crucial | | | | | | | | | |
| Appropriate, but not crucial | | | | | | | | | |
| Not Appropriate | | | | | | | | | |

Any comments or additional items?

_____

_____

_____

**3. Aspect III. Employees Involvement**

| Appropriateness | Item Number | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 |
| Crucial | | | | | | | | | |
| Appropriate, but not crucial | | | | | | | | | |
| Not Appropriate | | | | | | | | | |

Any comments or additional items?

_____

_____

_____

**4. Aspect IV. Continuous Improvement**

| Appropriateness | Item Number | | | |
|---|---|---|---|---|
| | 28 | 29 | 30 | 31 |
| Crucial | | | | |
| Appropriate, but not crucial | | | | |
| Not Appropriate | | | | |

Any comments or additional items?

_____

_____

_____

**5. Aspect V. Statistical Methods**

| Appropriateness | Item Number | | |
|---|---|---|---|
| | 32 | 33 | 34 |
| Crucial | | | |
| Appropriate, but not crucial | | | |
| Not Appropriate | | | |

Any comments or additional items?

_____

_____

_____

## 6. Aspect VI. Relationship with Suppliers

| Appropriateness | Item Number | | | |
|---|---|---|---|---|
| | 35 | 36 | 37 | 38 |
| Crucial | | | | |
| Appropriate, but not crucial | | | | |
| Not Appropriate | | | | |

Any comments or additional items?

_____

_____

_____

# APPENDIX J: HUMAN SUBJECTS RESEARCH APPROVAL FORM

**Checklist for Attachments and Time Schedule**

**The following are attached (please check):**

12. [XX] Letter or written statement to subjects indicating clearly:
    a) purpose of the research
    b) the use of any identifier codes (names, #'s), how they will be used, and when they will be removed (see item 17)
    c) an estimate of time needed for participation in the research and the place
    d) if applicable, location of the research activity
    e) how you will ensure confidentiality
    f) in a longitudinal study, note when and how you will contact subjects later
    g) participation is voluntary; nonparticipation will not affect evaluations of the subject

13. [ ] Consent form (if applicable)

14. [ ] Letter of approval for research from cooperating organizations or institutions (if applicable)

15. [X] Data-gathering instruments

16. Anticipated dates for contact with subjects:

| First Contact | Last Contact |
|---|---|
| Sept. 21, 1992 | Oct. 9, 1992 |
| Month / Day / Year | Month / Day / Year |

17. If applicable: anticipated date that identifiers will be removed from completed survey instruments and/or audio or visual tapes will be erased:

Dec. 31, 1992
Month / Day / Year

18. Signature of Departmental Executive Officer | Date | Department or Administrative Unit

John C. Lugg | 9/8/92 | I.E.C.T.

19. Decision of the University Human Subjects Review Committee:

[X] Project Approved [ ] Project Not Approved [ ] No Action Required

P.M. Keith | 9-22-92 | P.M. Keith
Name of Committee Chairperson | Date | Signature of Committee Chairperson