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Total Quality Management in Public Transportation

A TCRP Digest on the progress of Project F-3, "Total Quality Management in Public Transportation," prepared by MacDorman & Associates in association with the American Quality Group and the Spire Group. This is a two-phase project, which presents research on Total Quality Management (TQM) in the private and public sectors and in the U.S. public transportation industry. This Digest highlights the results of Phase I. The second phase involves the introduction of TQM at four transit systems and the development of training and educational materials on TQM for use by transit systems nationwide.

INTRODUCTION

At the end of the 20th century, changes in demographic patterns and employee expectations, shifts in societal demands, increased competition and fiscal constraints, and the requirements of adopting new technologies have made many traditional business practices obsolete. To meet these broad challenges, growing numbers of American businesses have adopted the principles of Total Quality Management (TQM) to improve the responsiveness of their products and services. These adopted principles have influenced system changes that may increase customer and employee satisfaction, reduce costs, and improve productivity.

The transit industry faces many of these same challenges. The principles of TQM appear to hold promise as a way to improve transit service, increase ridership, and fulfill transit's broad social mission. However, to date, only a few agencies have introduced innovative TQM-based practices.

WHAT IS TQM?

TQM is a management philosophy concerned with people and work processes that focuses on customer satisfaction and improves organizational performance. TQM requires an enterprise to systematically energize, manage, coordinate, and improve all business activities in the interest of customers.

TQM requires improvements throughout an organization to reduce waste and rework, to lower costs, and to increase productivity. Quality is no longer merely the province of service inspectors, the director of quality assurance, or the work supervisor. It can be defined, measured, and achieved, but such achievement requires that quality is built into all work processes and is understood and applied by all employees. Everyone is responsible for TQM, especially senior management; all employees are involved in solving problems and improving performance.

Like many so-called "new ideas," the components of TQM are not all new. Rather, TQM is new because it embraces and enjoins many existing management and organizational philosophies. TQM has its roots in many disciplines, including economics, industrial engineering, social psychology, mathematical statistics, and management science.

STUDY OBJECTIVES AND SCOPE

The objectives of Project F-3 are to identify, evaluate, and recommend applications of potentially successful methods of implementing TQM in public transportation to increase ridership through improved customer satisfaction, to increase productivity, and to reduce costs.

The project is very timely and important because it provides the public transportation industry the opportunity to

- review the literature, principles, and practices of TQM within and outside the public transportation industry;
- conduct, evaluate, and document pilot TQM initiatives at public transportation agencies;
- prepare informational materials on TQM for board members, managers, and union officials;

- prepare user-friendly educational materials on TQM for public transportation agencies pursuing TQM; and
- identify future research needs on TQM for public transportation.

The results of this project will be documented in a final report that will present the Phase I research results and the Phase II pilot application results. Other products from this project will include materials that may be used in the future by the pilot public transportation agencies to continue their TQM initiatives, and by other public transportation agencies throughout the United States that wish to pursue TQM.

HISTORICAL PERSPECTIVE ON MANAGEMENT

The history of management traces back more than two centuries to the English economist Adam Smith. Smith, and many other economists through the early years of the 20th century, focused on commodities and not on labor. Early economists did not consider management as a central issue in business economics.

J. B. Say, a French economist and early follower of Adam Smith, stressed the importance of the managerial task of making resources more productive. Another Frenchman, the Comte de Saint-Simon, foresaw the emergence of organizations, the building of social structures within organizations and, in particular, the management of tasks.

Organizations and the Management of Work

It was not until large-scale organizations began to emerge in the early 1870s that the structure, management, and behavior of organizations became the subject of discussion, debate, and writings. Henri Fayol, a French mining engineer who headed a relatively large business (coal mine), developed the first rational approach to the functional organization.

Frederick W. Taylor's famous study of shoveling sand in a steel mill focused on increasing individual labor productivity in order to provide employees with a decent livelihood. Later, the husband-and-wife team of Frank and Lillian Gilbreth conducted studies of time and motion productivity that were intended to perfect business behavior through testable work methods.

In the early 1920s, Pierre S. duPont followed by Alfred P. Sloan, the CEO of General Motors Corporation, confronted the issue of the appropriate degree of centralization or decentralization of authority for decisions in large organizations. Sloan developed and implemented the organization principle of decentralization and systematic approaches to business objectives and strategic planning.

Behavior in Organizations

Elton Mayo was the director of the famous Hawthorne studies (1927-1932) and the founding father of the Human Relations movement--the first major impact of social science on management thinking. He emphasized that employees must first be understood as people if they are to be understood as organization members. His work stressed the importance of an adequate communications system, particularly from employees to management.

Douglas McGregor is best known for his discourse of Theory X and Theory Y approaches to management. Theory X was cast as the traditional view of management direction and control. Conversely, Theory Y addresses the integration of individual and organizational goals. McGregor's studies and writings have been the vehicle of much work on "organizational development."

Quality Management

The concern for quality has a long and rich history, extending back to artisans and craftsmen, when master tradesmen inspected the work of apprentices to ensure quality craftsmanship. The introduction of mass production at the beginning of the 20th century was the dawn of a new age. The high numbers of poorly made and noninterchangeable parts, breakdowns, and loss of sales because of unreliable products forced companies to make improvements.

Initially, quality management was a manufacturing concept intended to ship nondefective products. It was the viewpoint of G.S. Radford that inspectors should examine, weigh, and measure each item prior to its leaving the factory. Inspection, measurement, and statistical analysis were the early foundations of quality control. Mistakes were not necessarily prevented, but they were not shipped. Inspection became an industrial safety net.

Quality Pioneers

Quality management advanced, largely, through the writings and teachings of so-called Quality Pioneers or TQM gurus. The pioneers focused on quantitative techniques and methods to control the quality of manufactured products. From its beginnings at Bell Laboratories, TQM evolved and developed while the most renowned pioneers created and promoted the philosophy. Five of the more notable proponents and leaders of TQM are briefly introduced below:

These **Digests** are issued in the interest of providing an early awareness of the research results emanating from projects in the TCRP. By making these results known as they are developed, it is hoped that the potential users of the research findings will be encouraged toward their early implementation Persons wanting to pursue the project subject matter in greater depth may do so through contact with the Cooperative Research Programs Staff, Transportation Research Board, 2101 Constitution Ave., N.W., Washington, DC 20418

- **W. Edwards Deming** is best known for his "Fourteen Points," a broad set of simple but profound quality principles; the "Seven Deadly Diseases," common obstacles to quality improvement; and the "Plan, Do Check, Act (PDCA) cycle," a systematic approach to problem solving. These concepts are well documented in his writings.

- **Joseph Juran** moved quality control forward to the idea of quality assurance and introduced the concept of quality as a means for cost control. Dr. Juran wrote the *Quality Control Handbook*, which has served as the bible in this field. In this book, he articulated that quality is not an expense but an investment in profitability. Like Deming, Juran helped bring TQM to Japan and later to the United States.

- **Kaoru Ishikawa** led the movement in Japan to adapt the teachings of the American quality experts and synthesized these concepts into his *Company Wide Quality Control (CWQC)*, successfully championing the integration of quality methods into Japanese engineering and management education curricula. These methods have been used successfully for several decades, and are an integral part of the Japanese industrial culture.

- **Armand Feigenbaum** advocated expanding quality control beyond inspectors to every employee and vendor. He believed that quality was too central to be delegated to an inspection corps because this was too limited an approach. Rather, a total quality approach requires the participation of all employees in the organization as well as vendors that supply the organization.

- **Philip B. Crosby** espoused "zero defects" and the principle that quality is the conformance to requirements. While initially real, the costs of quality disappear as the very real and measurable benefits of quality emerge.

The rising interest in TQM has made publishing and consulting in quality management a growth industry. Appendix A contains a bibliography and reference guide, which includes many of the more significant books and articles on TQM. The bibliography is organized into nine categories to assist public transportation managers and others interested in learning about TQM: general, leadership and organizational culture, measurement and benchmarking, process management, training and tools, employee empowerment and teams, labor, customer service, and case studies. A glossary of terms frequently used in the TQM literature and by its practitioners is presented in Appendix B.

Principles Espoused by Experts

While the various experts differ with each other in specific areas, a review of TQM principles espoused by experts identified the following areas of general agreement:

- TQM is a fundamental change in how most enterprises manage their business. The change is difficult and takes time.
- Management must lead the total quality initiative.
- All employees must be involved in total quality management.
- Continuous quality improvement is a business imperative.
- Quality control and improvement apply throughout the organization.
- Ongoing education and training are essential for all employees.
- Quality requires an environment of teamwork, respect for the individual, trust, and professional growth.
- Quality has a double benefit. It increases customer satisfaction and revenue by improving the quality of products and services; it reduces costs by improving the quality of processes.

Regardless of the differences and similarities among the TQM gurus, organizations considering the pursuit of TQM need not adopt the philosophy of a single expert nor should they rethink the entire field and build their own philosophy from the ground up. Clearly, there is a middle ground, where each organization can draw on the perspectives of different TQM proponents and tailor their initiative to best serve the needs and priorities of their customers and their organization.

TQM in Japan

It is commonly believed that TQM is a Japanese management philosophy. It was, however, created by Americans, following World War I, and adopted by the Japanese after World War II, as they rebuilt their industries. TQM has flourished in Japan since the early 1950s, evolving and changing somewhat over time.

Deming went to Japan in 1950, at the request of the U.S. government, where the newly formed Japanese Union of Scientists and Engineers (JUSE) asked him to teach statistical quality control to managers of all industries. He declined royalties offered by JUSE for the publication of his lecture notes and in gratitude, JUSE named a newly announced prize for quality after him. Although apparently slow to take hold, the Deming Prize is now a distinguished and prestigious accomplishment. Among other benefits, it is credited with stimulating the race for quality in Japan, as well as the transfer of quality methods and technology.

It was Japan's past reputation for poor product quality and the need to compete in the post-World War II world marketplace that drove the Japanese to implement total quality management concepts as the heart of their business planning. Since the 1970s, Japan has been recognized as the world leader for product and service quality. Earlier than any other country, Japanese companies used the knowledge

from Deming and Juran's teaching to build a quality revolution.

TQM in the United States

World War II created a demand for products and heightened the concern for product quality worldwide. Over time, new dimensions were added to quality management, such as cost reductions from less rework, improved work processes to avoid defects, and meeting customer requirements to keep and increase market share.

The increased number of inspectors and quality engineers in the United States resulted in the formation of an academic and professional society to further spread quality techniques and technology. Formally established in 1945, this group was originally called the Society for Quality Engineers; today it is called the American Society of Quality Control (ASQC). Its efforts have helped legitimize quality management as an integral element of business and industry throughout the United States and worldwide. In the past 20 years, other business associations and professional societies that support quality have been formed.

It has only been since the late 1970s that TQM has come back to the United States as a means to redirect management practices and improve performance. With the increasing concern for competition and global markets, TQM has moved from manufacturing, as its exclusive domain, to many sectors of U.S. business and industry including services, research and development, and health care. More recently, the public sector has adopted TQM as the basis for improved performance.

TQM in the Private Sector

In the past several years, there has been a burgeoning interest in TQM throughout the private sector in the United States. New experts and recognized consulting firms emerge each year to support clients in their pursuit of excellence and quality performance. Awards have been developed to recognize organizations that have achieved or are pursuing quality performance.

- **National Awards for Quality.** The Malcolm Baldrige National Quality Award (Baldrige Award) is the most renowned award for quality in the United States. This award, established in 1987 by the Act of Congress (the Malcolm Baldrige National Quality Improvement Act of 1987, Public Law 100-107), is designed to recognize companies that have successfully implemented total quality management systems. The award is managed by the U.S. Department of Commerce's National Institute of Standards and Technology (NIST) and is administered by the ASQC. Following a rigorous examination process, the award is presented annually to a maximum of six companies, representing manufacturing, service, and small business.

- **The United States Senate Productivity Award.** This national award also recognizes organizations for improvements in business efficiency and productivity. It is presented yearly to companies that demonstrate increases in annual productivity or make a contribution to a community's employment. Each U.S. senator may present one productivity award per year. There are no set criteria that a company must meet in order to win.

- **State and Local Awards for Quality.** The success of the Baldrige Award has led to the creation of similar awards for quality at the state and local levels. While awards for quality are predominantly made to companies in the private sector, half of the states currently offering awards have added a category for nonprofit or government organizations. Similar to the Baldrige Award, the intent of these awards is to both recognize and encourage outstanding performance and excellence in business and government.

TQM in the Public Sector

Total quality management is now being widely adopted by federal, state, and local governments. The primary catalyst for quality improvement in the public sector has been budget pressure, caused by rising costs and dwindling tax revenues.

- **The Federal Government.** TQM in the federal government grew out of productivity programs that started at the Department of Defense in the early 1970s. As a result of DOD's early commitment to this effort, it remains one of the strongest proponents and provides one of the best examples of TQM in the federal government.

In 1986, President Reagan signed an executive order to implement a government-wide productivity initiative under the direction of the Office of Management and Budget. After consultation with private sector leaders, this productivity effort evolved into total quality management initiatives.

The Federal Quality Institute (FQI) was created by the Office of Management and Budget, in 1988, to inform and consult with government agencies involved in TQM programs. It was also charged with administration of the President's Award for Quality and Productivity and the Quality Improvement Prototype Award (QIP) established in 1988.

Early in his administration, President Clinton launched a 6-month National Performance Review of all federal agencies, headed by Vice President Gore. The President announced: "Our goal is to make the entire federal government both less expensive and more efficient, and to change the culture of our national bureaucracy away from complacency and entitlement toward initiative and empowerment. We

intend to redesign, to reinvent, to reinvigorate the entire national government." The Clinton administration's commitment to quality is further evidenced in Vice President Gore's recently published *The Gore Report on Reinventing Government: Creating a Government that Works Better and Costs Less.*

- **State and Local Government.** Many states now have quality awards patterned after the private sector Baldrige Award. More recently, some states have introduced quality programs aimed at rewarding or improving the performance of government agencies. As with the federal government, budget pressure and constituents' demands for improved performance in the public sector have provided an impetus for TQM in state and local government.

Several notable examples of states and local communities that are pursing and recognizing TQM in the public sector currently include Arkansas, Florida, Kansas, Minnesota, and Oregon and the cities of Madison, Wisconsin and Portland, Oregon.

Problems with TQM in the Public Sector

Despite many similarities, the public sector differs significantly from the private sector. Implementers of TQM in government face a number of additional hurdles not found in the private companies. These include a lack of market incentives, a short-term perspective caused by frequent political changeovers, a highly centralized and layered structure, a separation of powers that requires negotiation and consensus building, conflicting needs between various customer groups, and an emphasis on due process over efficiency.[1]

In short, the political process is more complicated and contentious than similar processes in the private sector, and requires careful navigation. Public sector organizations pursuing TQM must remain sensitive to each of these differences to be effective.

TQM IN THE PUBLIC TRANSPORTATION INDUSTRY

The public transportation industry has become interested and involved in TQM only in the past several years. In a confidential *Survey for Chief Executive Officers: Total Quality Management in Public Transportation*--conducted in June 1993 as part of this project--about 85 percent of the 172 respondents indicated they had heard of or knew about TQM.

One hundred three Chief Executive Officers (CEOs) or 60 percent of the respondents said that their organizations were involved in TQM or other quality initiatives. Of the 103 transit organizations, only 17 (27 percent) indicated they started their efforts more than 3 years ago. Figures 1 and 2 illustrate the focus of these initiatives. It is probable that the results of this survey overstate national public transportation industry involvement with TQM, since less than 30 percent of the CEOs (172 out of 590) responded to the survey. (The survey instrument and the results are presented in the Interim and Final reports for this project.)

Concern for Performance and Customers

Concern for performance and interest in customers are not new to the public transportation industry. As the operators of private businesses and later public services, public transportation managers have sought to maximize ridership and revenues by providing clean, safe, and reliable service, while carefully managing costs.

- **Concern for Productivity.** Since the mid 1970s, public transportation agencies, local officials, state governments, and the federal government have displayed heightened interest in transit performance. This interest is the product of several economic, social, and political forces: escalating industry costs; greater competition for limited public funds; fiscal conservatism at the local, state, and national levels; continuing demand for clean, safe, on-time, affordable public transportation services; and increasing interest in accountability of public services.

Numerous factors influence public transportation performance. These factors may be divided into two categories--controllable and noncontrollable. Controllable factors are those influenced by the decisions and actions of the public transportation governing board, its executives, managers, and employees. Uncontrollable factors include both the environmental and economic conditions in which public transportation agencies operate. TQM focuses on the controllable factors.

- **Concern for People.** A report prepared by the American Public Transit Association, Transit 2000 Task Force stated "...we are bound by a traditional preoccupation with accommodating vehicles and inattention to accommodating people....Public transportation is dominated by its human resource and human service character. The performance and success of public transit hinges on how human factors are managed. There are two dimensions of concern--riders and work force...."

- **Industry Leadership: Perspectives and Attitudes.** One of the most interesting findings of the recent *Survey of Chief Executive Officers*, conducted in this project, was the generally high opinion held by CEOs of their organization's public image and their belief that things are going well. (See Figures 3 and 4.) While this positive outlook is praiseworthy, opinion polls show that transit has only an average public image as judged by a national consumer survey conducted by The Conference Board in 1990. From a business perspective, things are not going particularly well

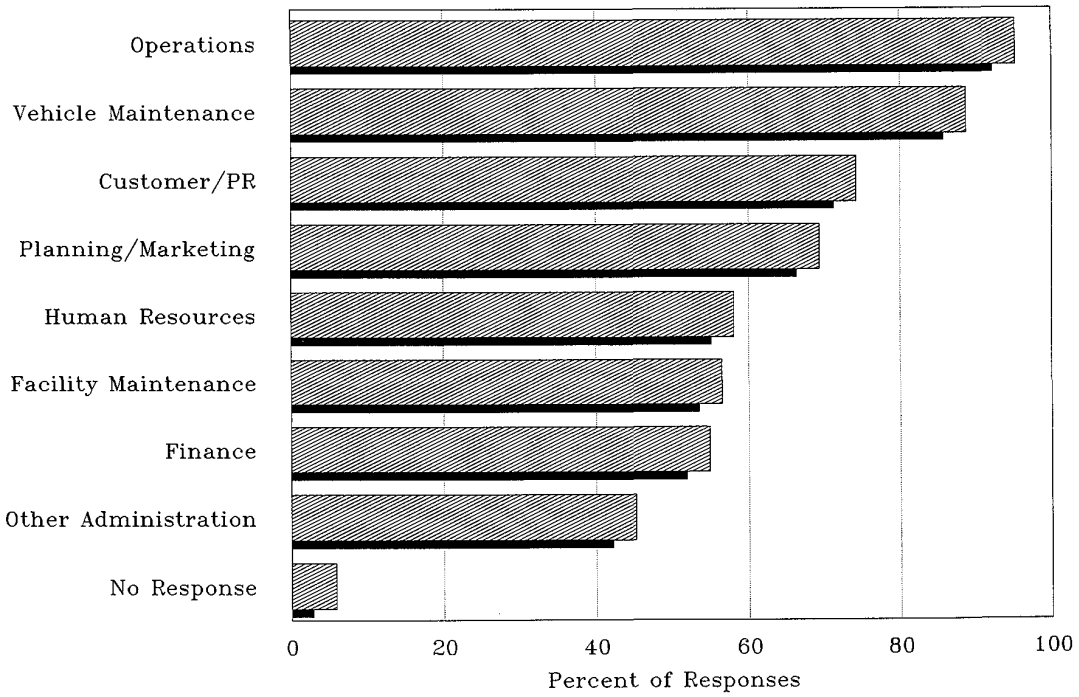


Figure 1. Responses to: Which organizational functions are involved in the quality initiatives?

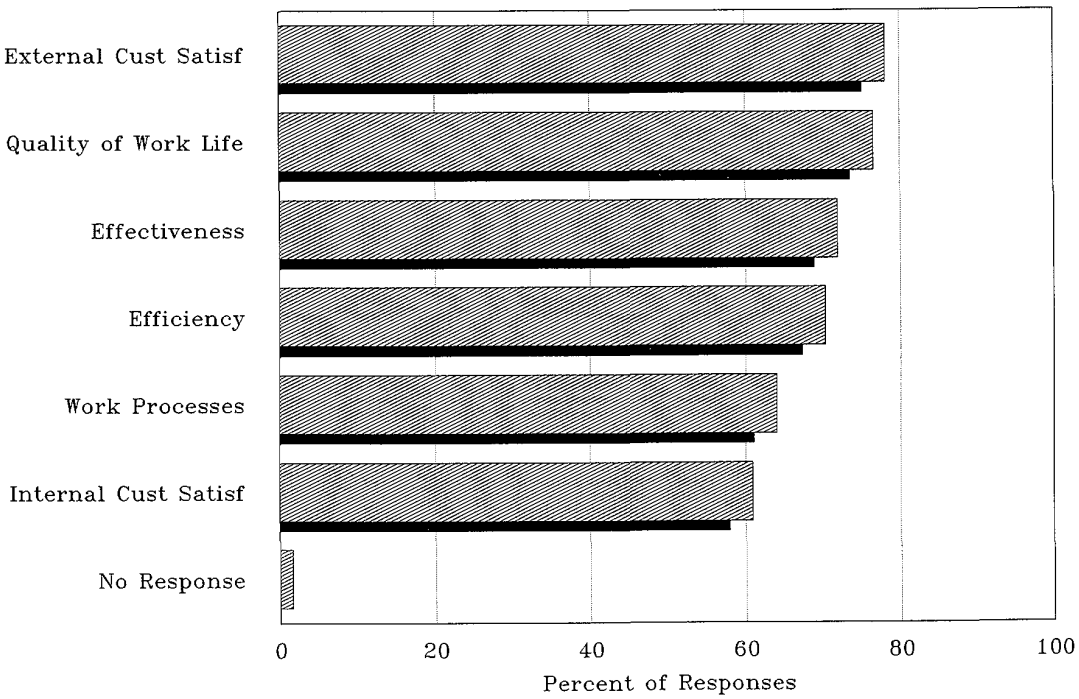
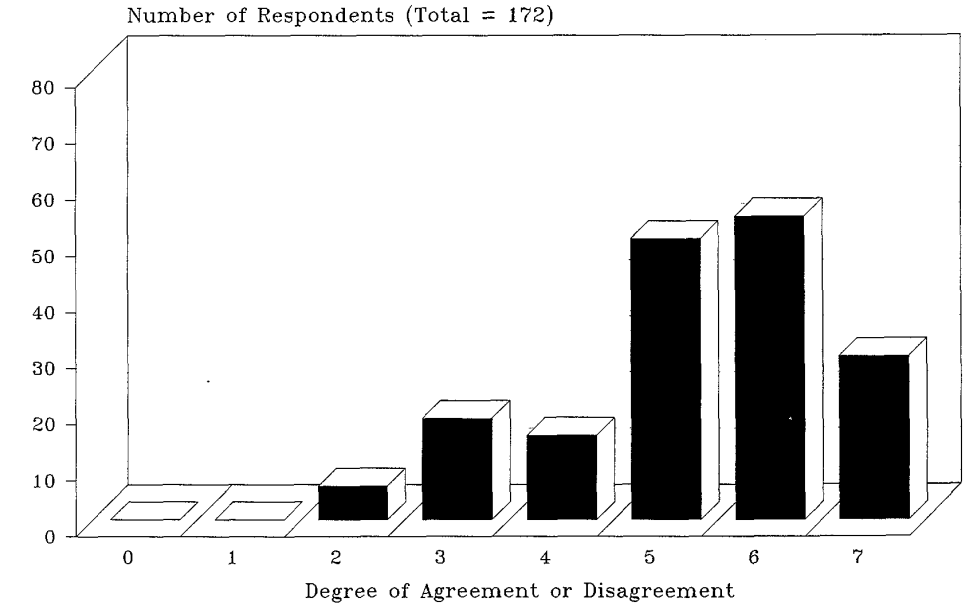
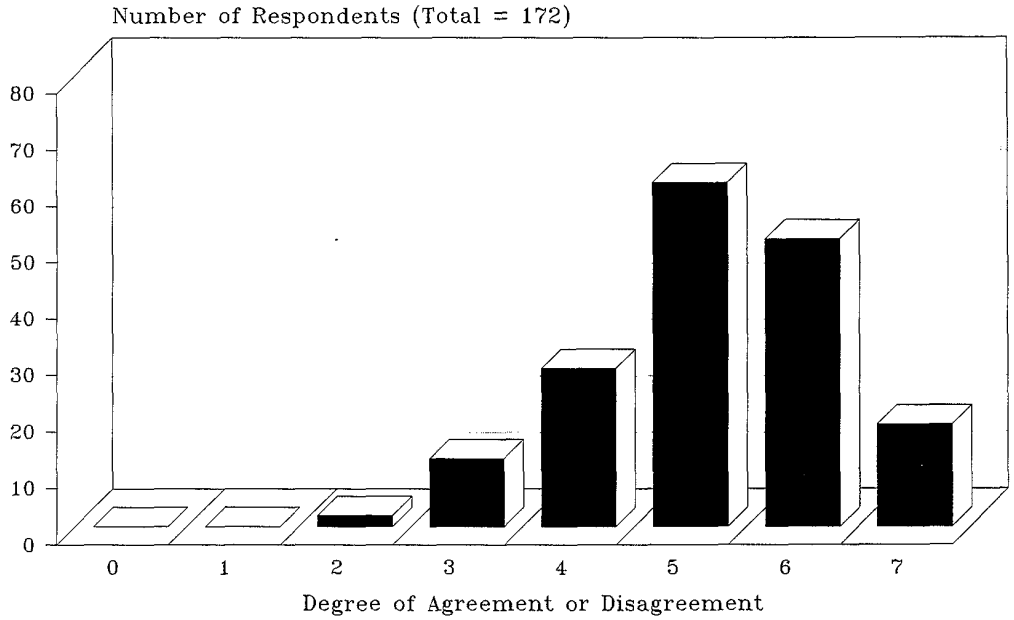


Figure 2. Responses to: What types of performances are the quality initiatives to improve?



Legend: 0 = Don't Know, 1 = Strongly Disagree, 4 = Neither Agree or Disagree, 7 = Strongly Agree

Figure 3. Responses to: Our public image is very positive.



Legend: 0 = Don't Know, 1 = Strongly Disagree, 4 = Neither Agree or Disagree, 7 = Strongly Agree

Figure 4. Responses to: Thins in our organization seem to be going well.

in the U.S. transit industry. According to the *1990 Nationwide Personal Transportation Survey*, the industry, as a whole, continues to lose travel market share even in the more traditional transit arenas that include female consumers and low income residents in urbanized areas.

Profile of Public Transportation Quality Initiatives

Transit systems in the United States have a well-established interest in improving performance--reducing costs to increase efficiency, improving vehicle maintenance to increase service reliability, modifying bus schedules to increase on-time performance, improving marketing and communications to increase customer satisfaction.

A number of U.S. public transportation agencies made a commitment to TQM in the late 1980s. These systems include Madison Metro in Madison, Wisconsin; Port Authority of Allegheny County in Pittsburgh, Pennsylvania; and Ride-On in Montgomery County, Maryland. The efforts of these transit agencies to initiate TQM are presented as case studies in the Interim and Final Reports for this project.

In September 1993, the researchers for this project sent a *Survey of Quality Initiatives and Efforts of Public Transportation Organizations* to 103 public transit organizations. The organizations surveyed were those that responded to the initial *Survey for Chief Executive Officers* and stated that their transit system had "embarked on TQM or other quality initiatives." The primary objective of the survey was to obtain a greater appreciation for the nature and extent of transit industry involvement in TQM and related formal quality initiatives. The responses provide insight regarding the current status of the quality movement in the U.S. transit industry.

The overall conclusion of this second survey is that, while TQM is new to the U.S. transit industry, many transit systems are interested in TQM and have begun to implement quality programs. Transit systems are interested in improved performance and in increased customer satisfaction, particularly for external customers. Information is being gathered by many public transportation organizations through surveys to determine how they can improve performance and increase quality.

The survey results, which are presented in more detail in the Interim Report, indicate that, while transit system CEOs are involved in providing vision and oversight for quality programs, most other foundations for TQM are not yet in place. For example:

- Transit governing boards are not actively involved in quality; neither are union leaders. Policy statements on quality have not been formulated and communicated. (See Figures 5 and 6.)

- Quality coordinators or facilitators have generally not been designated or hired by transit systems to manage and support quality.

- Transit employees are not yet sufficiently trained in tools and techniques for problem solving and conflict resolution. Consequently, employee participation in quality improvement is largely unstructured, through individual ideas and suggestions rather than through well-trained functional and cross-functional teams that meet regularly. (See Figures 7 and 8.)

- Transit employees are infrequently rewarded through formal recognition and reward for contributing to quality improvement.

- The quality programs of the survey respondents do not appear to be very rigorous. Measurement of results is not integral to the pursuit of improvements, nor is benchmarking to emulate excellent performance by other organizations. (See Figures 9 and 10.)

Formalizing TQM requires commitment, time, effort, and resources. It appears it will be some time yet before significant nationwide improvements to performance and customer satisfaction will be realized based on the current status of TQM in the U.S. transit industry.

TQM PRINCIPLES FOR THE PUBLIC TRANSPORTATION INDUSTRY

This section defines seven fundamental principles that provide guidance for TQM implementation and concludes with lessons of TQM success and failure. TQM is a comprehensive, all-encompassing approach to management and requires a systematic approach to long-term growth. These principles should not be viewed independently, but as vital components of a total quality plan.

Principle 1: Put Customers First

"Putting customers first" is the basis for all quality management. TQM requires organizations to adopt the belief that service and product quality should meet--if not exceed--customers' expectations. All people and processes of an organization should be directed to meet this goal.

The success of public transportation depends on customer satisfaction--attracting and retaining customers to use or support its services. Indeed, if there are no customers, there is no need for public transportation services. Similar to many private sector services, public transportation has two types of customers: (1) consumers--the people who ride the service and (2) stockholders--the general public who are tax-paying investors in the service.

By understanding and meeting customer expectations for service and

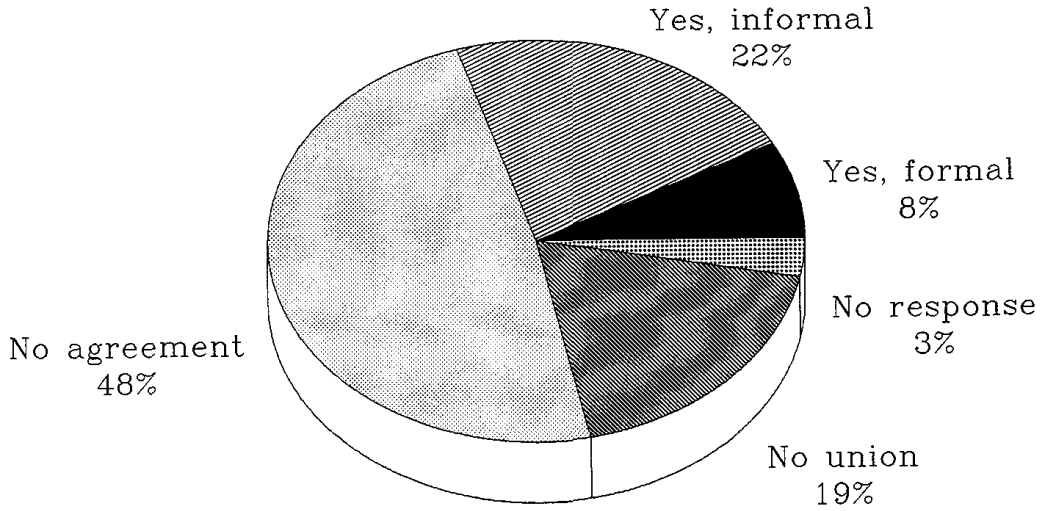


Figure 5. Responses to: Is there an agreement between labor and management regarding quality initiatives?

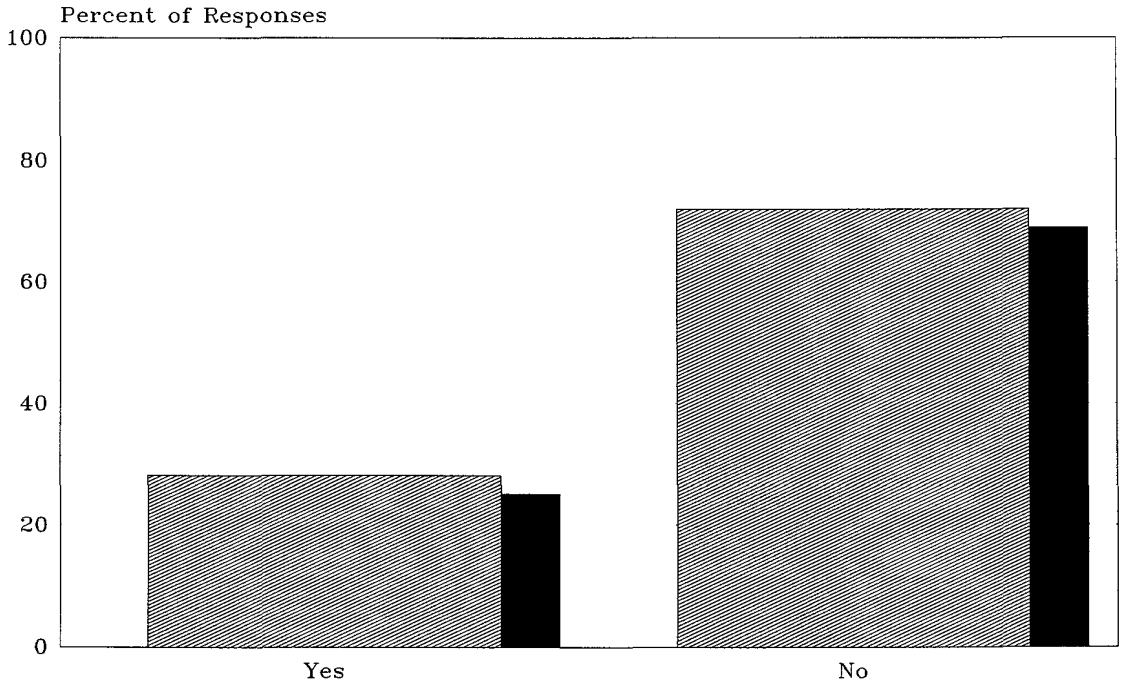


Figure 6. Responses to: Has a written quality policy been prepared and communicated?

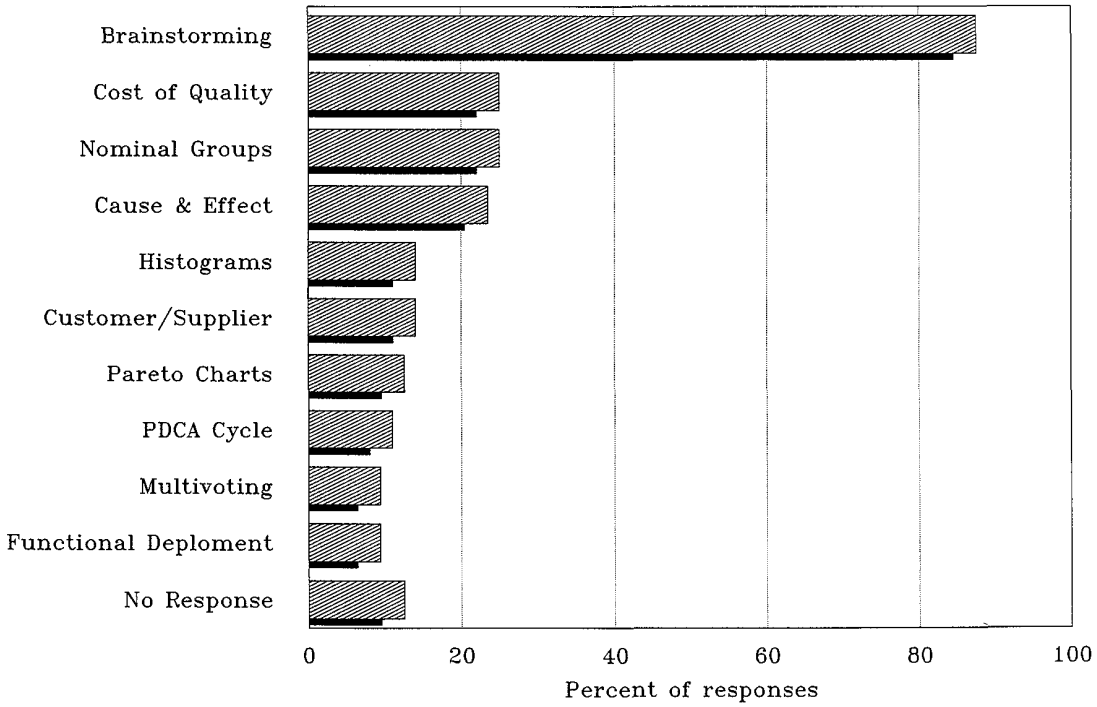


Figure 7. Responses to: Identify the TQM tools and techniques employed in quality initiatives.

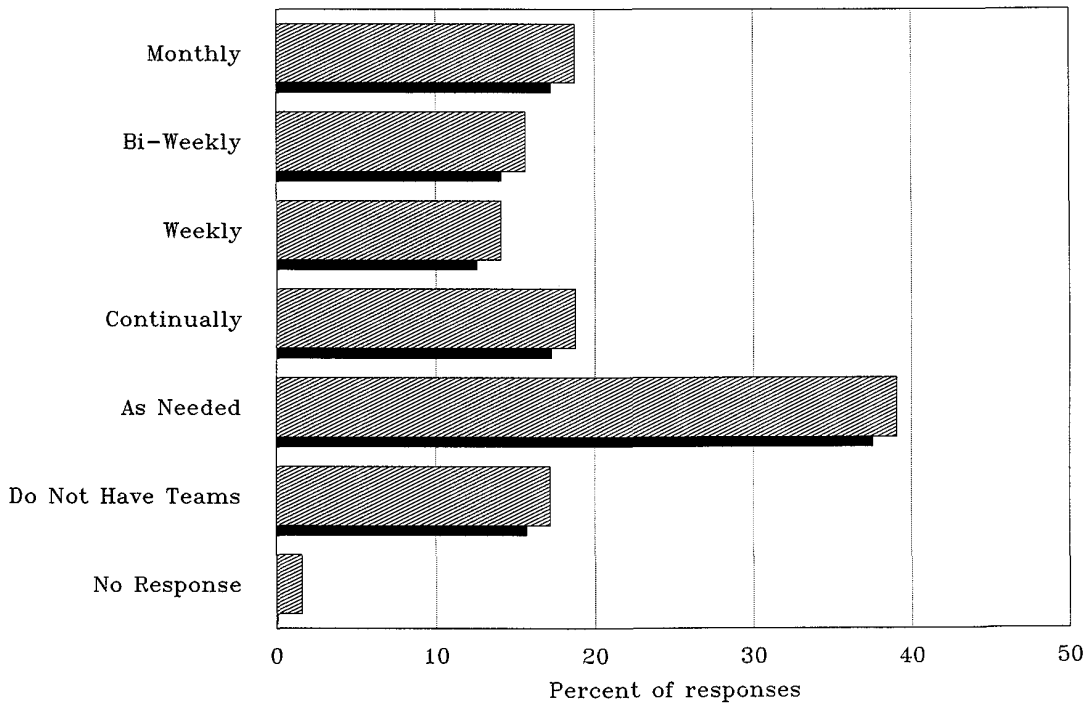


Figure 8. Responses to: How often do employee members of quality teams meet to work on quality issues?

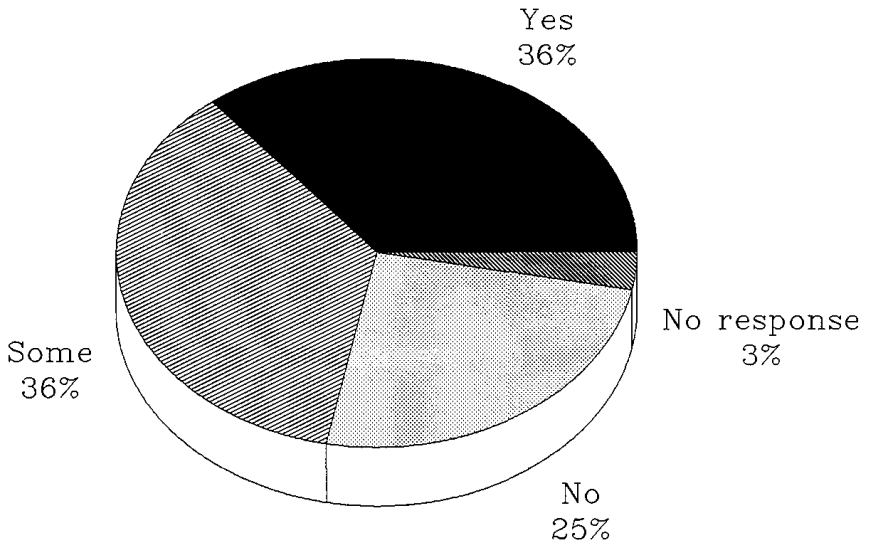


Figure 9. Responses to: Does the organization measure or monitor the results of initiatives?

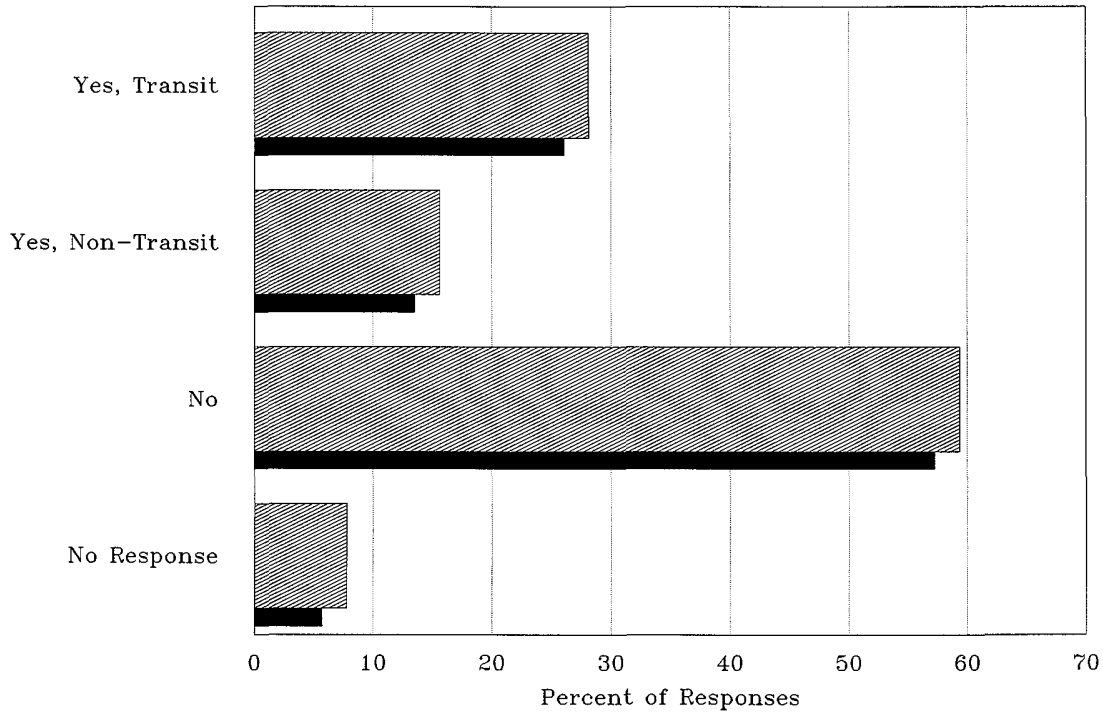


Figure 10. Responses to: Does the organization utilize benchmarking in quality initiatives?

product quality, an organization improves its performance. The effects of successfully satisfying customers are realized in at least three areas for transit systems:

- **Ridership Stability.** By satisfying and delighting customers, customer loyalty and ridership will increase. It is less expensive to keep existing customers than to attract new ones.

- **New Riders.** Transit systems can also attract new customers, resulting in increased market share.

- **Cost Reduction.** By directing processes and people toward meeting customer expectations, operational costs can be lowered and waste eliminated because certain extraneous activities, such as bureaucratic policies and paperwork, that are not essential to customers can be stopped.

Organizations should strive to meet customer expectations in all work functions. Every possible interaction between the customer and the transit system should be flawless and pleasant. Using the service should be easy. It should be accomplished in a timely manner and pleasant environment, with front-line employees who are knowledgeable and helpful. This requires systems and processes behind the scenes that enable employees to offer courteous, efficient, and effective service.

Knowing the Customer. Public transportation agencies should use market research to determine customer expectations and perceptions. They must first define their customers--who are they, why do they use or not use the service, and what competitive alternatives do they have. Next, transit agencies should determine what drives customer satisfaction--what are customers' priorities, and how satisfied are they with the transit services.

There are numerous methods to obtain vital information on customer priorities from sample groups. Researchers use focus groups, interviews, mail surveys, and telephone surveys to solicit information on customer expectations, their current levels of satisfaction, and factors that may influence people to use or not use transit services. Market research should be conducted so that transit directors and managers base their decisions regarding customer priorities on facts, rather than assumptions.

Front-line employees (i.e., vehicle operators, telephone information personnel, ticket agents) are also important resources for understanding customer expectations. Through regular contact with customers, front-line employees are frequently better able to judge customers' reactions to service than senior management or third-party market researchers. To use this information, organizations must open their channels of communication so that front-line employees are able to communicate effectively with managers who will organize follow-up action.

Responding to Customer Expectations. Translating market research results and employee feedback about customers' expectations into actionable procedures is a challenge for every organization. There is no set method that an organization can follow. Every organization must adjust its own culture, systems, and plans to successfully "put customers first."

Organizations must learn to make meeting and exceeding customer expectations a priority in both their day-to-day activities and in their long term-planning. This requires developing customer-focused operational processes and, at a strategic level, committing the resources that position customers, and meeting their expectations, as an asset to the organization's financial well-being.

The following are noteworthy examples of work that is currently being performed by U.S. transit systems to research customer priorities:

- A large public transportation system in the western United States has conducted surveys of area residents for about 5 years to identify the determinants of customer satisfaction. About 2,500 annual riders and nonriders are asked to rate their degree of satisfaction with, and importance of, 26 public transportation service attributes. This process has identified the areas of performance most in need of improvement based on customer priorities and satisfaction levels associated with the 26 attributes.

  In 1991, the survey revealed that customers were most satisfied with the safe operation of the buses, the daytime safety of waiting for buses, the politeness of drivers, and the clarity of the timetables. Customers rated on-time performance, the nighttime safety of waiting for and riding buses, and the mechanical reliability of the buses as the most important service attributes. The greatest gaps between the ratings of customer expectations and perceptions were night-time safety, on-time performance, headways between buses, and travel time to work. These performance gaps provide opportunities to improve service and satisfy customers.

- Another public transportation organization reported that operator behavior makes a difference in the willingness of current and prospective customers to use public transportation services. The survey found, for example, that respondents would be encouraged to use public transportation when the driver is helpful, pleasant, and courteous. Specifically, it noted that passengers appreciate drivers who wait for passengers to be seated before driving off from a stop and who help those with difficulty boarding.

These and other similar efforts are on the cutting edge of performance improvement because they gather relevant and much needed customer-driven information to improve the quality of public transportation services.

Principle 2: Manage and Improve Processes

By improving operations--how work activities are performed--organizations can raise the quality of their services, products, and delivery; increase productivity; improve operational efficiency; and eliminate waste.

Process Management Creates Customer Satisfaction. A widely accepted TQM approach to understanding and improving operations is process management. Process management requires understanding how work is done, how output or results are achieved, and how value is provided to customers. It provides a comprehensive, integrated method of analyzing operations and focusing all work activities on satisfying customers.

All employees in a public transportation system have customers and suppliers, either inside or outside the organization. Individuals and groups (i.e., suppliers) perform work and pass on the results or information to others (i.e., their customers) within or outside the organization. Everyone uses the output of their suppliers and provides input to their customers. Throughout all work processes--to the delivery of service, the goal of public transportation employees is to satisfy all customers and to add value to processes. This requires building quality into work processes to avoid defects and improve performance.

Cross-Functional Approach and Continuous Improvement. Public transportation agencies are almost always organized into specialty areas such as scheduling, operations, maintenance, finance, human resources, and procurement. This arrangement, called functional organization, organizes employees into work groups requiring similar job knowledge and skills. Unfortunately, the results of functional work efforts alone are rarely responsible for satisfying or exceeding customer expectations.

In the planning and development of processes, it is essential that members of all stages and subprocesses be involved. This is called a cross-functional approach. Through a cross-functional approach, public transportation employees can view their responsibilities in the chain of events that leads to service delivery while developing an understanding of the needs and demands of their colleagues. Processes are then created or reorganized to meet customer expectations, rather than having employees complete tasks in their own areas, with little regard for the end results.

Research shows that significant improvements in organizational performance usually involve the efforts of more than one functional activity or group. In cross-functional groups, employees learn the following:

- the many functions within the organization and how they contribute to the end result;
- the relationship among functions and how each affects customer satisfaction;
- the many responsibilities of others within the organization, including time demands, pressures, and potential failure points; and
- important information that other departments and employees may know regarding customer satisfaction and how it may best be achieved.

The development and implementation of process management within the context of cross-functional groups allows for and encourages problem prevention and continuous improvement at every stage of transit service delivery. A shift is made from using traditional quality inspection of end results to recognizing and preventing problems before the product or service is delivered.

Principle 3: Manage by Fact

TQM is a management philosophy that requires the use of facts and data, such as market research and process documentation, to achieve customer satisfaction and improve operational performance. As many TQM proponents say, "If you can't measure it, you can't manage it. If you can't manage it, you can't improve it." Measures serve the dual role of (1) setting the direction for operational and strategic planning and (2) providing feedback on whether organizational goals and objectives are being achieved.

TQM has simultaneous goals of customer satisfaction and improved operations. Consequently, measures critical for TQM are efficiency, effectiveness, and quality.

- **Efficiency** considers the resources (e.g., labor, capital, overhead, materials) necessary to produce output coupled with the quantity, cost, and rate of productivity. Efficiency measures are usually developed by dividing the quantity of output by the cost or quantity of resource input. Increases in cost, because of inflationary factors, must be considered when assessing efficiency.

- **Effectiveness** is the quantity of products or services consumed per unit cost or resource to produce them at a given price and quality. Effectiveness dimensions include the consumption of services or products that are influenced by quality.

- **Quality** plays a major role in both efficiency and effectiveness because of the multiplicity of dimensions it adds to improving and achieving customer satisfaction and by eliminating waste, rework, and defects. Critical dimensions of quality include accuracy, reliability, security, responsiveness, courtesy, competence, timeliness, appearance, information, communication, and accessibility or ease of use.

Criteria for and Uses of Measures. The following criteria should be used to successfully implement measures and ensure their acceptance by employees.

Otherwise, measurement will be viewed as "extra work" rather than as an enhancement to the TQM effort. Good measures are

- **Valid**. Data are sampled by methods that are unquestionably credible by all parties and are unaffected by artificial manipulation.
- **Complete**. Measures adequately gauge the activity rather than only some aspect of the activity.
- **Manageable**. Measures provide sufficient information on which to base management decisions.
- **Timely**. Data and information should be collected and reported soon after the processes' actual occurrence.
- **Visible**. Measures should be openly tracked by those who manage them.
- **Inexpensive.** Measures make use of data easily obtained or already collected for some other purpose.
- **Interpretable.** Measures should be easy to understand and readily comparable to other time periods or organizations.
- **Benchmarked.** Comparable measures from other organizations are available and current.
- **Motivational.** Measures should generate the desired balance between competitive spirit and collaborative teamwork.

Benchmarking. Benchmarking is a measurement-based method used in TQM to make operational improvements. It is defined as a process of measuring products, services, and practices against those of competitors and "best-in-class" organizations, for the purpose of improvement. Benchmarking is an approach that goes outside of one's organization to observe how outstanding organizations accomplish certain activities.

There are two approaches to benchmarking:

- **Competitive benchmarking** measures organizational performance against competing organizations. Competitive benchmarking tends to concentrate on the relative performance of competitors using a select set of industry measures.
- **Process benchmarking** identifies and measures the best, i.e., world-class, practice for conducting a particular business process. Once the best practice is identified, measured, and understood, it may be adapted and improved for application to another organization. For example, L.L. Bean is often benchmarked by companies in other industries for its warehousing capabilities.

There are a number of benefits to benchmarking that can help improve operations. For example, benchmarking builds organizational awareness of the best practices in a particular process; identifies the measure of excellence for a targeted process; enhances goal-setting and performance assessment; and challenges "business as usual" or "if it ain't broke, don't fix it" attitudes.

Information Technology. The increasing availability of sophisticated information technology has a profound effect on business processes. Satellites, cellular telephones, modems, teleconferencing, and facsimiles are examples of recent improvements in information technology. Available information technology for public transportation includes automatic passenger counters, automatic vehicle location systems, and passenger information systems. Using information technology to support the real-time activities of front-line employees and customers should be of primary interest to public transportation agencies.

An important challenge to public transportation is to identify where existing and near-developed information technology can improve performance. Public transportation agencies must learn to process real-time information to efficiently make decisions to improve customer satisfaction. Becoming managers of "public mobility" instead of managers of public transportation will, to a large extent, rely on developments in information technology.

Public transportation agencies need to (1) import information efficiently; (2) move information to the right place in the organization where it can be analyzed, digested, and acted upon; (3) make the necessary internal transformations to take account of new information; and (4) get feedback on the impacts of its new responses.

Principle 4: Cultivate Organizational Learning

Without learning, organizations and their members repeat old behavior and practices. Solving problems, changing procedures to meet customers' changing needs, understanding the importance of satisfying customers, and designing or reengineering processes all require learning that work can be performed in different, better ways.

Creating a learning environment requires commitment from senior management. Senior management should set the example by continuing to learn themselves, involving others in the learning process, and creating policies and recognition programs that encourage employees to develop new ideas. All employees should be encouraged to participate and should feel their participation is valued. Because employees have operational experience, they often have the best knowledge of where improvements should be made. Further, employee involvement and participation is essential to translate new ideas into action.

There should be a plan that incorporates learning into everyday activities. The following are elements of an organizational learning plan that

help create a culture of knowledge generation, sharing, and development:

- **Solve problems systematically.** First, employees should understand the value of basing decisions on data rather than assumptions. Simple statistical tools should be used to organize and analyze data. The use of data and analytic tools is critical to detecting and preventing problems.
- **Experiment.** Experimentation is essential for cultivating learning. Experiments involve searching for and testing new ideas. Experimentation should be performed as part of a plan to achieve a desired end result, such as testing methods to improve customer satisfaction.
- **Learn from the past.** Organizations must learn to track their attempts at implementing new ideas and evaluate their successes or failures. From this information, organizations can make future decisions and create programs based on success and not repeat failures.
- **Learn from others.** This is an important element of TQM and should be encouraged through the development of teams. Through employees working together in teams, knowledge is shared and built upon throughout the organization. Employees learn from one another based on their hands-on, operational experience and performance. Teamwork is essential in TQM for sharing ideas and also for incorporating all work functions' needs, requirements, knowledge, and views into decision making and planning.
- **Transfer knowledge.** Knowledge gained through problem solving, experimentation, and teamwork should be transferred quickly and efficiently throughout the organization to educate all workers about the lessons learned.

Principle 5: Train, Empower, and Recognize Employees

Employees are a transit system's most important asset. Their value must be protected and enhanced. This means training employees to identify and solve problems that cause customer dissatisfaction; empowering employees to take actions to satisfy customers; and recognizing employees for their efforts and contributions that improve performance.

Training. TQM starts and ends with training. Employees must be trained to work together as a team, focused on meeting and exceeding customers' needs and expectations. There should be continual retraining to meet ever-changing requirements for the future, particularly with the increasing availability of sophisticated information technology.

Training is not only important for basic job skills, but also important for problem identification and problem solving. Ongoing training creates a knowledgeable work force, which has flexible skills and the ability to engage in multiple jobs. Management should consider the potential for increasing compensation as employees increase their skills in multiple job activities.

Empowerment. Empowerment means giving employees the authority to do what it takes to satisfy customers. Often, this means moving decision making closer to the front line of the organization, rather than keeping it solely in the hands of management. This requires a knowledgeable work force and an environment of trust, accountability, and support.

Empowerment benefits customers. Often, empowerment reduces the amount of time required to solve a problem or grant a special request. In traditional vertical organizations, such as public transportation, decisions are typically made by management. This approach to decision making requires front-line employees to consult their managers to solve problems or grant requests. Through empowerment, there are increased opportunities for employees to make decisions in real time, without having to go through the chain of command.

There are many benefits to empowerment. Empowerment provides a sense of ownership and control over processes and job activities. Employees feel a personal responsibility for meeting the expectations of their customers. Employees are motivated by knowing they are entrusted to make the right decisions.

Recognition. Recognition is a powerful tool to reinforce and maintain quality improvement. Ongoing recognition increases employee involvement and helps employees feel commitment to their work environment. Recognition also reinforces desired behaviors, builds self-esteem, nurtures trust and respect, says "thank you," renews enthusiasm, affirms self-worth and value, empowers, confirms quality values, and celebrates success.

Both individual employees and teams should be recognized for improving performance and increasing customer satisfaction. Organizations with formal recognition programs build employee support and ownership in quality improvement efforts.

Principle 6: Improve Labor-Management Teamwork

Polarized positions--us versus them--have long characterized the relationships between organized labor and management in the U.S. public transportation industry, as well as other industries. Labor agreements and work rules often overly define and limit employee responsibilities and emphasize punishment for breaking rules. In many transit agencies, more attention is paid to the arbitration of grievances than working together to improve performance and satisfy customers.

A continuous and lasting TQM program is not possible without the involvement of employees. In organizations with represented employees, this means involvement by union officials in policy decision making and participation by represented employees to improve performance and satisfy customers. Employee teams with represented and nonrepresented members must be concerned with the processes that focus on customer satisfaction.

Under the National Labor Relations Act (NLRA) law, labor-management committees cannot address grievances, labor disputes, rates of pay, hours of employment, or conditions of work. These areas are the sole concern of formal labor negotiations. To avoid conflicts with the National Labor Relations Board (NLRB), the following steps should be taken:

- Establish a written policy that clearly states TQM goals in terms of quality enhancement and customer satisfaction. The policy should expressly forbid teams from working on initiatives related to wages, rates of pay, hours of employment, or conditions of work.

- Alert team leaders and facilitators to avoid discussions related to designated topics.

- Advise management personnel who work with teams which topics are appropriate and which are inappropriate.

- Periodically audit and review actual practices to make certain that violations are not occurring.

Principle 7: Lead the Change in Organizational Culture

The success of TQM is largely determined by leadership and organizational culture. Leaders must be committed to TQM to sustain a longterm effort to improve performance. They must change the organizational culture and provide increased opportunity for everyone to satisfy customers.

TQM requires cultural change and transformation of organizational rules and attitudes. For many employees, especially those who have worked in an organization for many years, this new approach may be difficult to adjust to or accept. Employees may be resistant to the change because they feel that the old way is better--it's worked in the past, why won't it work in the future?"--"TQM is simply a fad," or "despite the current enthusiasm, management will not commit or follow-through." Leaders will meet with resistance to change on many different fronts throughout the organization.

How Cultures Develop and Change. Organizational cultures generally develop from three sources: (1) the beliefs, values, and philosophy of the founders or early leaders; (2) the learning experiences of group members as their organization evolves; and (3) new beliefs, values, and philosophy brought in by new members and leaders. The philosophies of leaders are tested early and are often the root of success or failure. Even in large, well-established organizations, culture can often be traced to the beliefs and values of the founders and early leaders.

Leaders create organizational culture and then perpetuate the culture by determining the criteria for leadership and thus, who will or will not be future leaders. Understanding an organization's culture, its strengths and weaknesses, is desirable for all employees, but is essential for organization leaders.

Importantly, leaders must recognize the need to change their organization culture, when warranted. Next, they must get the members of their organization to accept the need for change and begin the often difficult transition process. Ultimately, leaders must provide a path and process for cultural change and assure members of the organization that constructive change is necessary and possible.

Leadership and TQM. Implementing TQM requires clear, long-term leadership commitment. Leadership must believe that long-term relationships with satisfied customers are critical assets to the success of the organization. Leaders must incorporate this value into strategic planning and set customers as the top priority of all employees.

It is essential that customer satisfaction be incorporated in the vision, mission, and value statements. These statements define strategic direction--what goals will be pursued and how they will be accomplished. The statements incorporate strategy along with operational techniques and activities that are essential to success. They are written commitments that establish a basis for quality planning, priority setting, and follow-up feedback.

Leadership is also responsible for creating "customer-focused support systems" such as measurement, rewards and recognition for satisfying customers, and training on working with and achieving positive relationships with customers. These and other programs will demonstrate to employees that senior management is committed to TQM.

Leaders must demonstrate that TQM is essential. By witnessing leaders acting as role-models, employees will be more apt to take initiative to meet or exceed customers' expectations. This requires leaders to participate in education sessions and to work with employees, demonstrating that everyone is responsible for "putting customers first."

LESSONS OF SUCCESS AND FAILURE IN TQM

Much has been said and written about TQM--both its success and failure. This section summarizes TQM's current track record, based on the writings of management experts.

Is TQM Overrated?

The track record of TQM programs has been mixed, with many high-profile successes and an almost equal number of failures. According to Thomas Hout, Vice President at the Boston Consulting Group: "The majority of quality efforts fizzle out early, or give some improvements but never fulfill their initial promise."[2]

The *Harvard Business Review* recently reported that, of 300 electronics companies surveyed, 73 percent had TQM efforts underway, but only 37 percent had achieved more than a 10 percent reduction in product defects. McKinsey & Company, a consulting firm, found that two-thirds of the quality programs at major corporations are failing or stalled. Another consulting firm, Arthur D. Little, surveyed 500 executives and found that only 36 percent believed TQM improved competitiveness.[3]

While experts believe that TQM principles are sound, many companies have simply not implemented the concepts properly. According to Christopher Hart, President of the Spire Group and a former Harvard Business School professor:

> Twenty years ago, the data processing function was being taken to a new conceptual level under the label 'management information systems.' Did any companies back then spend millions of dollars developing systems that didn't work? Yes; horror stories abound. Does that mean that the MIS concept was relegated to the scrap heap? No! It means that MIS was a complicated, rapidly emerging field with tremendous opportunities for learning--in other words, many mistakes were made--and learning over the years has minimized problems. TQM is in the same situation as MIS was twenty years ago. Quality is here to stay! It makes sense for the customer; it makes sense for the company; it makes sense for the employee, and it's the moral thing to do.[4]

When Does TQM Fail?

Companies have experienced a variety of specific problems with TQM implementation. First, because TQM is a unifying philosophy that transforms businesses, it sometimes results in internal debates over basic strategy. Furthermore, there are numerous TQM methods and implementation approaches, some of which may be incompatible. Finally, because senior managers may delegate quality leadership, some organizations develop internal TQM bureaucracies that are just as ineffective and insulated as other functional departments.[5]

Other possible reasons for failure according to the American Quality Foundation include the following: "Americans react poorly to programs geared to perfection," "70 percent of American workers are afraid to speak up with suggestions or to ask for clarification," and "Americans prefer to jump into a project without heavy planning."[6]

When Does TQM Succeed?

In 1993, Ernst & Young and the American Quality Foundation published the *Best Practices Report*, resulting from their ongoing International Quality Study. They found that three types of initiatives had a significant impact on successful performance: (1) process improvement, (2) full deployment of strategic plans, and (3) supplier chain participation. Process improvement, as discussed elsewhere in this digest, means changing the way things are done. Deployment of strategy means everyone must understand and share the same vision. Supplier chain participation means encouraging suppliers to adopt TQM methods themselves, to ensure that the 'input' received will not cause problems.[7]

Brad Stratton, editor of *Quality Progress* magazine, said that the following conditions are necessary for a successful TQM program. First, the corporate culture must be prepared and ready for change. Second, people must be rewarded for new thinking and encouraged to report bad news. Third, TQM must have a strong champion who is willing and able to exert leadership. Fourth, implementation must be from the top down, with active and sustained participation by senior management. Fifth, every employee should be trained and involved. Sixth, organizations must continuously improve their training programs, adding new and more sophisticated tools to employees' skills repertoires to sustain momentum. Seventh, organizations need to establish a proper "balance of statistical and social skills." Finally, people must be patient. Meaningful change takes time.[8]

PILOT TQM INITIATIVES

Important objectives of Project F-3 included identifying up to four transit systems interested in initiating or advancing TQM and providing support for their efforts. The four transit agencies should be diverse in size, services provided, geographic location, and labor environment. By initiating and subsequently evaluating TQM in these diverse transit settings, information and insights should be gained that may benefit the U.S. transit industry as a whole.

Conducting the four pilot TQM initiatives serves a number of purposes:

- Provides an opportunity to apply and test TQM principles in public transportation environments, which to date have largely been applied in the private sector or other parts of the public sector.

- Tailors TQM principles to better serve the needs and unique character of public transportation through field testing.

- Ensures the preparation of more meaningful informational and educational materials on TQM, which

will be useful to transit agencies that pursue TQM in the future.

This digest briefly discusses the selection of the pilot participants, provides highlights of the four transit agencies, and reviews their interest in TQM at the outset of the pilot initiatives.

Identification of Candidate Public Transportation Agencies

The *Survey of Chief Executive Officers,* which included 590 public transportation systems throughout the United States, served as the primary basis for identifying four candidate transit agencies for the TQM pilot initiatives. In this confidential survey, the CEOs were asked a number of questions regarding their transit system's environment, their general interest in TQM, their efforts to pursue excellence and quality, and their interest in being a candidate for a TQM initiative under this project.

Of the 172 respondents to the survey, 30 public transportation agencies were identified as candidates using the following criteria:

- **Labor-management relations.** "We have considerable trust and respect between labor and management." CEO responses to this statement were required to range from neutral to strongly agree. While TQM can render assistance in improving the trust and respect between labor and management, overcoming poor relations between the parties is not the principal focus of the quality effort.

- **Interest in participation.** "I am very interested in having our organization participate in a TQM pilot program as described in your correspondence." CEO responses to this statement were required to range from highly to strongly agree. Since TQM begins at the top, it was important that the CEO responded enthusiastically.

- **Labor agreement expiration date.** This project is not intended to compete for the attention of labor and management leadership during collective bargaining. TQM initially requires labor and management leadership to focus on the plans and future events associated with quality efforts. The pilot initiatives are, in themselves, difficult to successfully launch. Therefore, collective bargaining agreements of the pilot participants could not expire between February 1994 and June 1995.

The Project Panel requested that transit agencies with fewer than 50 vehicles operating in peak periods not be considered as pilot TQM candidates. This decision reduced the number of candidate transit systems from 30 to 12. A public transportation organization with less than 50 peak vehicles was considered not sufficiently complex to test and evaluate TQM.

The Project Panel requested that the CEOs of the 12 final candidate transit agencies be interviewed by telephone to better determine their interest in the project and their willingness and ability to commit the time and resources required from participants. Questions were sent to each CEO in advance of the telephone interviews. The responses from the interviews were subsequently sent to each Panel member for review and selection of the four finalists.

Four Pilot Participants

The Project Panel selected the following participants: the Chicago Transit Authority (CTA)--one of the largest rail and bus transit systems in the United States; the Pee Dee Regional Transportation Authority (PDRTA)--a multicounty, mostly rural, southeastern U.S. system, which largely provides paratransit services; the Southwest Ohio Regional Transit Authority (Metro)--a mid-to-large-size bus service in the mid-west; and the Spokane Transit Authority (STA)--a mid-size, west-coast bus system.

Table 1 briefly describes the agencies, highlighting these characteristics.

Once the pilot participants were selected, the research team scheduled a meeting with each of the four selected transit agencies, and requested that each meeting be attended by, at least, the CEO, the chair of the governing board, and the president(s) of the local labor union(s). The purpose of each meeting was to provide a more in-depth presentation of the objectives and requirements of the pilot initiatives, answer questions concerning participation, and permit withdrawal from participation by any party. Following these meetings, all four transit agencies made a year-long commitment and agreed to the terms and requirements for participation in the pilot TQM initiatives.

Initiation of the TQM Pilots

At the outset of the pilot activities, each of the four transit agencies was at a different stage in its thinking and consideration of TQM. Senior management at CTA had formulated ideas about changing its corporate philosophy to a customer-focused culture. Metro had been active, with good results, for about 2 years with its visioning process and employee participation program. STA management was aware of TQM and was learning about what it took to initiate its effort. PDRTA had no prior involvement in quality programs.

To provide a common point of departure for the pilot activities, Leadership Workshops were held to introduce and discuss TQM, establish a foundation for the pilot activities, clarify roles and responsibilities, and prepare a draft TQM action plan for each participating agency. The workshops, which each lasted from 1½ to 2 days, included presentations, group discussions, and video tapes about quality. Manuals were prepared and distributed to each participant, as a workshop guide.

Table 1 Public transportation agency participants in the TQM pilot initiatives

Transit Agency and Location	Organization	Service Characteristics	Involvement in Quality
Chicago Transit Authority (CTA) Chicago, IL	CTA was created in 1945 to provide public transportation in Chicago. It has about 12,800 employees; about 80 percent are represented by one of 18 unions. (Nearly 10,000 employees are represented by either ATU Local 241 or 308.)	CTA is the second largest transit system in the U.S. Its 220-sq mi (570 km^2) service area includes the city of Chicago and 38 suburbs and about 3.7 million residents. In 1993, the 24-hour a day service provided 445 million passenger trips. CTA operates 2,170 buses on 138 routes, serving 23,600 daily bus trips. The rail service, which operates more than 1,200 rapid transit cars on 6 routes and 260 mi (418 km) of track, serves more than 1,850 train trips each day.	Prior to this pilot project, CTA management made a commitment to become more customer-oriented to reverse long-term ridership losses. It retained the University of Illinois at Chicago to assist in *Developing a Customer Culture for CTA*. Through this, it planned meetings and a retreat with labor and management leaders to develop a new corporate vision and mission statement and establish broad goals. Next, CTA will pursue implementation and evaluation.
Pee Dee Regional Transportation Authority (PDRTA) Florence, SC	Formed in 1974 as the first regional transportation authority in South Carolina. It has 110 full- and part-time employees with no union representation.	PDRTA serves about 350,000 residents in a 4,000-sq mi, (10,360 km^2) seven-county area. Fixed-route and demand-responsive service is provided with 126 active vehicles, traveling about 2.3 million annual revenue miles (3.7 million km). About 96 percent of the service is demand responsive. In 1992, PDRTA served about 488,000 passenger trips.	Prior to its participation in this project, PDRTA had no involvement in quality programs. PDRTA formed a Quality Improvement Council and designated a Quality Coordinator for this project. The Quality Council will oversee and guide PDTRA's TQM program. As a first step, the Council intends to prepare mission and vision statements.
Southwest Ohio Regional Transit Authority (Metro) Cincinnati, OH	Metro was formed in 1968 and began operation in 1973 as the principal provider of public transportation in Cincinnati. It employs about 900 employees, who are largely represented by ATU local 627. ATE Management and Services, Inc. manages the system.	Metro serves a 232-sq mi (601 km^2) area with 708,000 residents. In FY92, it provided motorbus and demand-response service for nearly 28 million passenger trips with an active fleet of 412 vehicles, traveling nearly 12 million revenue miles (19.3 million km).	For the past 2 years, Metro has been changing its organizational culture through an initiative called *Vision at Work*. This initiative is consistent with TQM principles since it emphasizes employee involvement, excellence, and improvement. Vision statements and broad objectives have been developed. Action teams have been formed for grass-root improvement activities.
Spokane Transit Authority (STA) Spokane, WA	Private transit services were transferred to the City of Spokane in 1968 to receive public funding. STA has about 475 employees; 80 percent are represented by one of three unions.	STA serves a 371-sq mi (961 km^2) area and about 311,000 residents of Spokane County. In FY92, STA provided fixed-route, demand-response, and ridesharing service for more than 7.4 million passenger trips. STA operates 227 vehicles and has an average of 20 passenger boardings per vehicle revenue hour.	STA was aware of and interested in TQM prior to this project. It has established a Leadership Team, including top labor and management, to advance and advocate TQM. It has developed a vision statement and is seeking feedback from employees. Three committees, composed of volunteers, have been formed to address customer input, employee input and quality improvement project selection. Teams will be formed to address specific opportunities for improvement.

During the balance of this research project, assistance will be provided to the participating transit systems to further develop and implement their pilot TQM initiatives; provide training to a designated quality coordinator or facilitator at each system, as well as members of quality improvement teams; support and guide each TQM pilot to achieve its objectives; trouble shoot, as needed; and evaluate and document the four pilot TQM initiatives.

RESEARCH RESULTS, DOCUMENTATION, AND PRODUCTS

A number of products resulting from this project will serve different audiences and meet different objectives. These products include the following:

- **Final report.** This report will (1) present the research results including the literature search, investigation of TQM in the public and private sectors, and principles for TQM in public transportation; and (2) document the pilot TQM initiatives, including the selection of participants, plan development, training, facilitation, support, and evaluation of each effort.

- **Informational materials.** These materials will be designed for transit executives, union leadership, and board members to introduce TQM. A brochure and video tape are currently being considered as the media for presenting material, which should help individuals responsible for public transportation management and performance decide to further investigate or make a commitment to TQM.

- **Educational materials.** A user-friendly TQM *Guidebook for Public Transportation* will be prepared that expands on the informational materials, including a TQM road map, sample meeting agenda, customer surveys, and additional TQM resources.

All final products will be available through the TCRP in the fall of 1995. An Interim Phase I Research Report is available at this time. To request a copy, contact:

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APPENDIX A
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In this book, Mary Walton describes how the Deming Method is used by firms and organizations from all over the industrial spectrum, including service industries and manufacturing. The six organizations featured are Florida Power & Light; Hospital Corporation of America; Tri-Cities, Tennessee; The United States Navy; Bridgestone (USA) Incorporated; and Globe Metallurgical Incorporated.

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LEADERSHIP AND ORGANIZATIONAL CULTURE

Block, P., *Stewardship,* Berrett-Koehler Publishers, San Francisco, CA (1993).
Organizations that practice stewardship will succeed in their marketplace by choosing service over self-interest and by a far-reaching redistribution of power, purpose, and wealth. Without this, little real change will result. In place of the "managerial class system" the author says, we need to reintegrate the managing of work with the doing of work. Everybody manages and everybody does real work.

Belasco, J.A., *Teaching the Elephant to Dance: The Manager's Guide to Empowering Change,* Penguin Books, New York, NY (1991).
This book gives every manager a step-by-step guide to making the impossible happen and is filled with illuminating case histories of companies large and small that have maneuvered out of stagnation to get back into the competitive mainstream. It shows how to devise new corporate vision and strategies, how to overcome inertia and inbred adherence to "how it has always been done," and how to make both management and labor trail-blazers rather than road-blockers to new standards of excellence.

Covey, S.R., *Principle-Centered Leadership,* Summit Books, Fort Worth, TX (1990).
How do you transform the paradigms of people and organizations from reactive, control-centered management to proactive, empowerment-oriented leadership? While Deming's theory of total quality explains the "what" to do and gives a partial explanation of "why' it should be done, Covey supplies the missing "how-to-do-it." The Seven Habits are foundation principles that, when applied consistently in practice, become behaviors enabling fundamental transformations of individuals, relationships, and organizations.

Garvin, D.A., *Managing Quality: The Strategic and Competitive Edge,* The Free Press, New York, NY (1988).
This critical yet enlightening analysis illustrates how America must improve quality to win back lost markets and gain long-term competitive advantage. Comparing quality management in Japanese and American plants producing the same products, Garvin provides the evidence relating to quality to such variables as process, productivity, and profitability. His focused study of 9 Japanese and 11 American factories makes clear what the Japanese have done better than even the best U.S. companies.

Schein, E.H., *Organizational Culture and Leadership,* Jossey-Bass Publishers, San Francisco, CA (1992).
This second edition transforms the abstract concept of culture into a tool that managers and students have continually used to better understand the dynamics of organizations and change. The author presents critical new learnings and practices in the field. He defines culture--what it is, how it is created, how it evolves, and how it can be changed--and clearly demonstrates the crucial role leaders play in successfully applying the principles of culture to increase organizational effectiveness.

Senge, P.M., *The Fifth Discipline: The Art and Practice of the Learning Organization,* Doubleday, New York, NY (1990).
Author Peter Senge presents a system of thinking and acting that, if followed correctly, can be the basis for reducing the "learning disabilities" in any organization. Senge illustrates his ideas, based on both research and practical experience, with compelling examples. With the help of stories, diagrams, and self-administered exercises, readers not only learn, they learn how to learn.

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MEASUREMENT/BENCHMARKING

Camp, R.C., *Benchmarking: The Search for Industry Best Practices that Lead to Superior Performance,* American Society for Quality Control, Quality Press, Milwaukee, MI (1989).

Find answers to the questions: What is benchmarking? How do I perform benchmarking? What are the results of successful applications? Case histories provide examples of actual benchmarking investigations from beginning to end.

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This book explains poor-quality cost concepts and gives simple, step-by-step guidelines for the implementation of a poor-quality cost identification and reporting system. This work includes analyzed data collected from a vast number of corporations and disciplines and provides many examples of how poor-quality cost concepts are put into practice.

Zeithaml, V.A., Parasuraman, A., and Berry, L.L., *Delivering Quality Service: Balancing Customer Perceptions and Expectations,* The Free Press, New York, NY (1990).

The authors' grounding model, which tracks the five attributes of quality service--reliability, empathy, assurance, responsiveness, and tangibles--goes right to the heart of the tendency to overpromise. By comparing customer perceptions with expectations, the model provides planning and marketing managers with a two-part measure of received quality that, for the first time, enables them to segment a market into groups with different service expectations.

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PROCESS MANAGEMENT

Davenport, T.H., *Process Innovation: Re-engineering Work Through Information Technology,* Harvard Business School Press, Cambridge, MA (1993).

This book is breakthrough thinking on how to exploit the real potential of Information Technology (IT). Davenport offers a pathway for the serious general manager who must incorporate IT into his or her strategic management repertoire. Whereas traditional TQM techniques usually result in incremental improvement, re-engineering can bring about radical change to an organization.

Hammer, M. and Champy, J., *Re-engineering the Corporation: A Manifesto for Business Revolution,* Harper Business, New York, NY (1993).

This book describes the principles behind a new and systematic approach to structuring and managing work. Written in clear, readable prose, the book describes the what, the why, and the how of business re-engineering.

Harrington, H.J., *Business Process Improvement: The Breakthrough Strategy for Total Quality, Productivity, Competitiveness,* McGraw-Hill, New York, NY (1991).

Harrington offers a no-nonsense blueprint for restructuring our antiquated "business-as-usual" approach. The blueprint is not about automating processes that already don't work nor is it about importing some exotic Japanese management technique that only serves to further confuse everyone. It is about effecting a major change in the way we manage our organizations by applying new approaches to the business community as a whole, particularly service industries.

Process Quality Management & Improvement Guidelines, AT&T Quality Steering Committee, Indianapolis, IN (1988).

This book describes a customer-focused, seven-step cycle for management, control and improvement of business processes. It illustrates process management concepts with images from *Alice's Adventures in Wonderland.*

Rummler, G.A. and Brache, A.P., *Improving Performance: How to Manage the White Space on the Organization Chart,* Jossey-Bass Publishers, San Francisco, CA (1990).

Rummler and Brache provide a practical framework for understanding how various departments and functions in an organization interrelate and show how to manage this interaction to enhance the organization's effectiveness. Three avenues of approach for dealing with performance issues are explored: through organizational strategies, structures and management practices; through the processes used to get work done; and through individual jobs and employees.

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Memory Jogger II is the successor book to The Memory Jogger first written and produced in 1985. It is an outstanding reference and guide to basic tools and techniques used by individuals and teams in identifying and solving problems. The book contains the basic Seven Quality Control Tools and the Seven Management and Planning Tools with excellent graphics and examples. The book also contains a complete case study that details Stop'N Go Pizza's using the Improvement Storyboard model.

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This manual is a road map for the quality manager. It examines the evolution of quality in the organization and recommends tools, references, and resources to help the quality professional support and sustain the organization in implementing a world-class quality system.

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EMPLOYEE EMPOWERMENT AND TEAMS

Block, P., *The Empowered Manager: Positive Political Skills at Work*, Jossey-Bass Publishers, San Francisco, CA (1987).

Empowerment is not a set of techniques--it is a choice. Is this a business strategy you believe in? The promise of empowerment is that it will dramatically increase the sense of responsibility and ownership at every level of the organization, especially at the bottom where products and services are delivered and customers are served. "As you give employees more and more freedom," Block says, "expect a very mixed response. There is a part of us that does not want more autonomy, choice, or responsibility. We want to be taken care of." The goal of his book is to present a way of being political that balances the hope for transforming organizations with the risk in attempting change, in a realistic and helpful way.

Blanchard, K., Carew, D., and Parisi-Carew, E., *The One-Minute Manager: Builds High Performance Teams*, William Morrow and Company, Inc., New York, NY (1990).

Benefit from learning how to develop through the four stages of team development. This book is essential for anyone who works with groups and wants to improve group effectiveness.

Lawler, E.E., III, *High-Involvement Management: Participative Strategies for Improving Organizational Performance*, Jossey-Bass Publishers, San Francisco, CA (1986).

Lawler answers the important questions about participative management--quality circles, self-managing teams, job enrichment, gainsharing--including how each approach works, how much they raise quality and performance, which approach works best, the advantages and disadvantages of each, and how they are successfully implemented.

Zenger, J.H., Musselwhite, E., Hurson, K., and Perrin, C., *Leading Teams: Mastering the New Role*, Business One Irwin, Homewood, IL (1994).

Implementing successful teams presents the challenge of training team members to take more responsibility for their work. But the greater challenge for managers and supervisors is preparing for their new role. The book is a comprehensive guide to the art of shared leadership--helping the team to perform activities that managers once performed alone.

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LABOR

Bluestone, B. and Bluestone, I., *Negotiating the Future: A Labor Perspective on American Business*, Basic Books, New York, NY (1992).

This book describes labor-management experiments to show that Enterprise Compacts are not impractical utopias, but promising means for making firms more efficient and profitable, improving employment security and the quality of working life, and restoring America's competitive edge. The authors argue that America will continue to lag behind its competitors as long as corporate decision making is blocked by an outworn, adversarial system of labor-management relations that no longer serves the interests of workers, stockholders, and the nation.

Cohen-Rosenthal, E. and Burton, C.E., *Mutual Gains: A Guide to Union-Management Cooperation*, ILR Press, 2nd ed, rev., Ithaca, NY (1993).

While quality efforts can be an excellent way to showcase how union-management cooperation, both parties should be vigilant to the real hazards, risks, and potential losses associated with them. The key to success is to position quality efforts solidly within the collective bargaining relationship on a foundation of union-management cooperation. A management and union can do almost

anything that they set out to do, when they summon their imaginations and are dedicated to having the highest-quality cooperation in order to provide the highest quality service.

Applebaum, E. and Batt, R., *The New American Workplace: Transforming Work Systems in the United States*, ILR Press, Ithaca, NY (1994).

There are two basic routes that get you to a high-performance workplace. These authors review several decades of U.S. and international cases to identify two distinct and coherent models of high-performance work systems--what is referred to in the book as an American version of lean production and an American version of team production. The two systems produce similar results and improvements in performance. While the outcomes for companies may be similar, the outcomes for employees are apt to be quite different. The lean model is the one used predominately by U.S. employers: a centralized, top-down approach to employee relations which is reinforced by the criteria of the Baldrige Award. Only 15 percent of the Award formula deals in improvement in human resource development and management, just 2 percent with employee involvement, and 2.5 percent with morale.

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CUSTOMER SERVICE

Davidow, W.H. and Uttal, B., *Total Customer Service: The Ultimate Weapon: A Six-Point Plan for Giving Your Business the Competitive Edge in the 1990s*, Harper & Row Publishers, New York, NY (1989).

Drawing on in-depth case histories of service leaders who have triumphed and of laggards who have lost, Davidow and Uttal have devised a six-point plan that any company--regardless of what business it is in--can utilize to secure a decisive competitive edge: devise a service strategy; get managers to behave like customer service fanatics; concentrate on motivating and training employees; design products and services that make good customer service possible; invest in service infrastructure; and constantly monitor achievement of customer service goals.

Hart, C.W.L., *Extraordinary Guarantees: A New Way* to *Build Quality Throughout Your Company and Ensure Satisfaction for Your Customers*, American Management Association, New York, NY (1993).

In this innovative book, Hart describes the power of the extraordinary guarantee--one that does not merely limit a customer's risk but promises exceptional, uncompromising quality and customer satisfaction, and backs that promise with a payout intended to recapture the customer's good will and continued business. The book examines different types of guarantees and discusses their benefits from a marketing and an operational standpoint.

Heskett, J.L., Sasser, W.E., and Hart, C.W.L., *Service Breakthroughs: Changing the Rules of the Game*, The Free Press, New York, NY (1990).

Based on five years of research in 14 service industries, Heskett, Sasser, and Hart show exactly what enables one or two companies in each industry to constantly set new standards for quality and value that force competitors to adapt or fail. At the heart of breakthrough performance, the authors contend, is a sometimes intuitive but thorough understanding of the "self-reinforcing service cycle" that replaces traditional management of "trade-offs." The "cycle" is a paradigm derived from the research results suggesting direct links between heightened customer satisfaction, increased customer retention, augmented sales and profit, improved quality and productivity, greater service value per unit cost, improved satisfaction of service providers, increased employee retention, and further heightened customer satisfaction.

Reichheld, F.E. and Sasser, W.E., Jr., "Zero Defections: Quality Comes to Services," *Harvard Business Review*, Cambridge, MA (Sept.-Oct. 1990), pp. 105-111.

This article provides a compelling rationale for both guarantees and service recovery, by spelling out the hard costs of losing dissatisfied customers.

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CASE STUDIES IN QUALITY

European Conference of Ministers of Transport, *Round Table 92: Marketing and Service Quality in Public Transport,* Organisation for Economic Co-operation, Paris, France (1993).

Faced with mounting deficits, public transport is in search of a new image. Above all, service quality must be adapted to customer needs. A whole range of possibilities exist to make public transport more appealing: more frequent and punctual service, better equipment, improved customer relations, electronic payment facilities and more convenient connections are just a few of these.

Papers and presentations that are provided in the book include case studies from Barcelona, Spain; Gothenburg, Sweden; Lyons, France; and Munich, Germany.

Peters, T.J. and Waterman, R.H., Jr., *In Search of Excellence: Lessons from America's Best-Run Companies,* Warner Books, New York, NY (1982).

The authors studied 43 successful American companies and discovered that these companies shared eight basic principles of management that are readily transferable. The book illustrates with anecdotes and examples the experiences of these best-run companies to make them accessible and practical for readers to use.

Sasser, W.E., Hart, C.W.L., and Heskett, J.L., *The Service Management Course: Cases and Readings,* The Free Press, New York, NY (1991)

This book can supplement *Service Breakthroughs* or be used on its own. The 37 case studies and 10 readings offer a multitude of breakthrough management thinking. Sasser, Hart, and Heskett explore how companies such as Club Med, Nordstrom, Florida Power & Light, UPS and many more rise above their competitors and become industry leaders. The authors carefully describe how breakthrough managers develop "counterintuitive" visions and how they define service.

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JOURNALS, PERIODICALS, AND NEWSLETTERS

Commitment Plus
Newsletter, monthly
Quality and Productivity Management Association (QPMA)
300 Martingale Road, Suite
230 Schaumburg, IL 60173
(708) 619-2909

Journal for Quality and Participation
Journal, six times/year
Association for Quality and Participation (AQP)
801-B West 8th Street, Suite 501
Cincinnati, OH 45203-1601
(513) 381-1959

Quality
Magazine, monthly
Hitchcock Publishing Co.
191 S. Gary Avenue
Carol Stream, IL 60188
(312) 655-1000

Quality Digest
Magazine, monthly
QCI International
1425 Vista Way
Red Bluff, CA 96080
(916) 527-8875

Quality Progress
Magazine, monthly
American Society for Quality Control (ASQC)
310 West Wisconsin Avenue
Milwaukee, WI 53203
(404) 272-8575

Additional

Continuous Journey
Magazine, six times/year
American Productivity & Quality Center
123 North Post Oak Lane, Suite 300
Houston, TX 77024-7797
(713) 681-4020

Government Productivity News
Newsletter, 10 times/year
P.O. Box 27435
Austin, TX 78755-0435

National Productivity Review
Magazine, quarterly
Executive Enterprises Co., Inc.
22 West 21st Street
New York, New York 10010-6904
(800)332-8804; (212) 645-7880, ext. 208

Productivity Inc.
Newsletter, monthly
P.O. Box 3007
Cambridge, MA 02140
(617) 497-5146

Quality Assurance Bulletin
Newsletter, semi-monthly
National Forman's Institute
24 Rope Ferry Road
Waterford, CT 06386
(203) 442-4365

The Letter
Newsletter, monthly
American Productivity & Quality Center
123 North Post Oak Lane, Suite 300
Houston, TX 77024-7797
(713) 681-4020

The Service Edge
Newsletter, monthly
Lakewood Publications
50 South Ninth Street
Minneapolis, MN 55402
(800) 328-4329; (612) 333-0471

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School of Engineering and Applied Science
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Washington, D.C. 20052
(800) 424-9773

Productivity Press
Productivity, Inc.
P.O. Box 3007
Cambridge, MA 02140
(800) 274-9911

Quality Press
American Society for Quality Control (ASQC)
310 West Wisconsin Avenue
Milwaukee, WI 53203
(800) 952-6587

PROFESSIONAL SOCIETIES

American Society for Quality Control (ASQC)
310 West Wisconsin Avenue
Milwaukee, WI 53203
(414) 272-8575

Conferences, educational courses, seminars, *The Quality Review* magazine, and *Quality Progress* journal, book service, professional certification, technical divisions, and committees, and local chapters.

American Productivity & Quality Center (APQC)
123 North Post Oak Lane, Suite 300
Houston, TX 77024-7797
(713) 681-4020

Educational and advisory services to organizations in the private and public sectors, courses, case studies, research publications, *The Letter* newsletter, *Continuous Journey* magazine, resource guide, library, and consulting.

Quality and Productivity Management Association (QPMA)
300 Martingale Road, Suite 230
Schaumburg, IL 60173
(708) 619-2909

Network of North American quality and productivity coordinators, operating managers and staff managers, conferences, workshops, *Commitment Plus* newsletter, resources guide, and local chapters.

Association for Quality and Participation (AQP)
801-B West 8th Street, Suite 501
Cincinnati, OH 45203-1601
(513) 381-1959

Focus on quality circles, self-managing teams, union-management committees, and other aspects of employee involvement. Conferences, library and selected research service, *Quality and Participation* newsletter, resource guide, and local chapters.

APPENDIX B
Glossary

appraisal costs
The costs associated with inspecting the product to ensure that it meets the customer's (either internal or external) needs and requirements.

approach
One of the three evaluative dimensions used in Baldrige scoring, "approach" refers to the methods a company uses to achieve the purpose stated in the criteria. Some specific components of the approach concept are the degree to which it is systematic, integrated, consistently applied, and prevention-based.

acceptable quality level (AQL)
A concept used with sampling procedures applied to arms-and-ammunition suppliers during World War II, AQL is the poorest quality that a supplier can provide and still be considered "acceptable" or satisfactory. The concept--that some errors or defects are normal--is the antithesis of "zero defects," which holds that the only allowable standard for quality is error-free work.

audit
An assessment to determine the extent to which certain standards or requirements have been met, usually conducted independently of personnel responsible for implementing the standards or requirements.

Baldrige Award
See Malcolm Baldrige National Quality Award.

benchmarking
The practice of setting operating targets for a particular function by selecting the top performance levels, either within or outside a company's own industry. In a broader sense, benchmarking involves searching around the world for new ideas and best practices for the improvement of processes, products, and services.

best of class (or best in class)
When overall performance, in terms of effectiveness, efficiency, and adaptability, is superior to all comparables.

brainstorming
A technique used by a group of people for thought generation. The aim is to elicit as many ideas as possible within a given time frame.

catchball
In policy deployment, extensive communication across management levels when setting annual objectives The analogy to tossing a ball back and forth emphasizes the nature of the interaction

cause
An established reason for the existence of a defect.

common cause
A source of variation in the process output that is inherent to the process and will affect all the individual results or values of process output.

companywide quality control (CWQC)
An expression used widely in Japan, CWQC means the application of quality principals to all processes in a company and the involvement of all employees at all levels in the quality-improvement process. The concepts of continuous improvement and customer satisfaction are also embedded in the approach. CWQC in the equivalent of "total quality management (TQM)" in the United States, where the term "management" has roughly the same meaning as the word "control" in Japan.

conjoint analysis
Also called "tradeoff analysis," conjoint analysis is a method for providing a quantitative measure of the relative importance of one product or service over another. In performing this type of analysis, customers are asked to make tradeoff judgments: Is one feature desirable enough to sacrifice another? Conjoint analysis is particularly useful in situations where customer preferences are in conflict and where the problem is to develop a compromise set of attributes

control
A term applied to the management of processes indicating that quality requirements, standards, or goals are being met and that the output of the process is predictable.

correction
The totality of actions to minimize or remove variations and their causes.

corrective action
The implementation of effective solutions that result in the elimination of identified product, service, and process problems.

cost of poor quality
The overall financial loss to the business due to quality problems; the cost of poor quality includes all costs of rework, lost value and other forms of waste that might be prevented through quality methods

cost of quality
The sum of the cost of prevention, appraisal, and failure The key financial measurement tool that ties process control and process optimization into a total process-management effort. It can be used both as an indicator and a signal for variation (more often, for patterns of variation), as well as a measure of productivity and efficiency.

cross-functional process
A process spanning organizational boundaries and involving work groups and people who do not normally interact.

cross-functional teams
Teams similar to quality teams but whose members are from several work units that interface with one another. These teams are particularly useful when work units are dependent upon one another for materials, information, etc.

culture
A prevailing pattern of activities, interactions, norms, sentiments, beliefs, attitudes, values, and products in an organization.

customer
The recipient or beneficiary of the outputs of your work efforts or the purchaser of your products and services. May be either internal or external to the organization, and must be satisfied with the outputs of your work efforts.

customer expectations
Customer perceptions of the value they will receive from the purchase of a product or service. Customers form expectations by analyzing available information, which may include experience, word-of-mouth, and advertising and sales promises.

customer, external
The purchaser of a product or service.

customer, internal
A downstream internal operation that depends on outputs or results of a given process, or an employee of the business who depends on these outputs or results.

customer satisfaction
The degree to which a customer's experience with a product or service meets customer expectations for that product or service.

customer service process
A business process related to selling, delivering, or otherwise supporting primary products and services.

customer/supplier model
A representation of tasks and work flows in terms of a process, its customers, and its suppliers, linked through information flows in the form of requirements and feedback.

cycle time
The amount of time it takes to complete a particular task. Shortening the cycle times of critical functions within a company is usually a source of competitive advantage and a key quality-improvement objective

data
Information or a set of facts presented in descriptive form There are two basic kinds of data: measured (also known as variable data) and counted (also known as attribute data).

defect
Any state of nonconformance to requirements.

Deming Prize
In 1950, W. Edwards Deming was invited to Japan by the Union of Japanese Scientists and Engineers (JUSE) to lecture on the applicability of using quality control in manufacturing companies. The impact of Deming's teaching was widespread and swift to take root. In 1951, JUSE instituted the Deming Prize to honor Deming for his friendship and achievements in industrial quality control. Today, Japanese companies wishing to improve the level of quality within their organization compete for the Deming Prize, not only to achieve the honor and prestige of winning, but also the improvements that come from implementing his quality principles.

deployment
One of the evaluative dimensions used in Baldrige scoring, "deployment" refers to the extent to which a company's approaches are applied in all relevant areas and activities For example, reward and-recognition programs need to be applied to all categories of employees, from hourly workers to top managers

descriptors
Descriptors are relatively specific methods, organizational features, or system/process characteristics that illustrate or help interpret each area to address in the application.

differentiation
The unique value of a product or service that distinguishes it from competing products or services.

effectiveness
How closely an organization's output meets its goal and/or meets the customer's requirements.

efficiency
Production of required output at perceived minimum cost. It is measured by the ratio of the quantity of resources expected or planned to be consumed in meeting customer requirements to the resources actually consumed.

Employee Involvement/Quality of Work Life
Program for employee participation aimed at improving customer satisfaction, productivity, and employee satisfaction. Union and management work together to foster this program.

empowerment
Investment in employees of authority and responsibility for making decisions and taking actions, particularly to satisfy customers and improve processes. Empowerment requires that employees be enabled through training, information, resources, and advice.

external failure costs
The costs incurred when an external customer receives a defective product.

failure mode and effect analysis (FMEA)
A technique for systematically reviewing the ways in which a process, product, or service can fail and the impact such failures could have on customers, employees, or other processes. Using this analysis, quality engineers can predict field-failure rates, design recovery systems, and estimate the need for additional parts or personnel

feedback
information from a customer about how process output meets the needs of process customers.

feedback loop
A system for communicating information about the performance of processes, products, or services Feedback loops are essential for continuous improvement

firefighting
Remedial approach to process problems, focusing on "fixing" rather than prevention

fishbone diagrams
A diagram that depicts the characteristics of a problem or process and the factors or root causes that contribute to them

force field analysis
A technique involving the identification of forces "for" and "against" a certain course of action. The nominal group technique could be used in conjunction with force field analysis. The group might prioritize the forces for and against by assessing their magnitude and probability of occurrence. The group might then develop an action plan to minimize the forces against and maximize the forces for.

frequency distribution
Of a discrete variable is the count of the number of occurrences of individual values over a given range. Of a continuous variable is the count of cases that lie between certain predetermined limits over the range of values the variable may assume

functional administrative control technique
A tool designed to improve performance through a process combining time management and value engineering The process involves breaking activities down into functions and establishing action teams to target and solve problems in each function.

functional organization
An organization responsible for one of the major organizational functions such as marketing, sales, design, manufacturing, and distribution.

gainsharing
A reward system that shares productivity gains between owners and employees Gainsharing is generally used to provide incentive for group efforts toward improvement.

goal
A statement of attainment/achievement that one proposes to accomplish or attain with an implication of sustained effort and energy directed to it over the long term.

guideline
A suggested practice that is not mandatory in programs intended to comply with a standard.

hoshin planning
See policy deployment.

hypothesis
An assertion made about the value of some parameter of a population.

indicators
Measurable characteristics of products, services, and processes that best represent quality and customer satisfaction.

input
Materials, energy, or information required to complete the activities necessary to produce a specified output (work product).

internal failure costs
The costs generated by defects found within the enterprise prior to the product reaching the external customer.

just-in-time inventory management (JIT)
Approach to achieving and maintaining minimal in-process inventory. The approach includes application of Total Quality Control to eliminate quality problems as in-process inventory is being reduced.

kaizen
A Japanese expression referring to continuous improvement in all phases of business.

key business process
Process designated by management as critical to customer satisfaction, competitive effectiveness, or the achievement of strategic goals. Key business processes are generally cross-functional, spanning major functional organizations such as marketing, design, manufacturing, and distribution.

leadership
Communicating a clear purpose and vision and enabling and inspiring people to develop commitment to help in achieving that purpose. Leaders provide a strategy, clear expectations of others, support, personal involvement and resolve, and reinforcement of values needed to achieve the purpose.

lessons learned
A phrase coined by Joseph Juran to describe a structured approach to analyzing past experience in an endeavor and applying the results of that analysis to improving the quality of future efforts.

linkages
interactions among the tasks in a process that determine how effectively the tasks coordinate, share information, and provide mutual support toward meeting common process objectives.

Malcolm Baldrige National Quality Award
United States national quality award recognizing companies for leadership in quality. The award is managed by the National Institute of Standards and Technology, U.S. Department of Commerce. Award criteria also serve as the standard for the AT&T Chairman's Quality Award and as a basis for self-evaluation of quality systems.

Management by Objective (MBO)
A business planning approach in which each employee works with his or her manager to set annual objectives Employee performance is evaluated based on the extent to which objectives are met.

mean time between failures (MTBF)
The average time between successive failures of a given product.

measurement
The act or process of measuring to compare results to requirements. A quantitative estimate of performance.

natural work team
A group of people who work together on a regular basis, such as a manager and the people who report to him or her

need
A lack of something requisite, desired, or useful; a condition requiring provision or relief. Usually expressed by users or customers.

nominal group technique
A tool for idea generation, problem solving, mission, and key result area definition, performance measure definition, goals/objectives definition.

normative performance measurement technique
Incorporates structured group processes so that work groups can design measurement systems suited for their own needs. This approach considers behavioral consequences of measurement to foster acceptance of measurement effort

objective
A statement of the desired result to be achieved within a specified time By definition, an objective always has an associated schedule.

objectives
Verifiable improvement targets for processes, suppliers, organizations, and people.

output
The specified end result. Required by the recipient.

outputs
Materials or information provided to others (internal or external customers).

perceived quality
A firm's market reputation for continuing excellence of products and services and for customer satisfaction; the firm's good will among customers

pareto analysis
A system of analysis based on the principle that, in any phenomenon, relatively few factors account for the majority of effects. Juran uses the phrase "vital few" to suggest that it is more efficient and less costly to concentrate on the most important sources or types of failures, customers, and so on.

performance
A term used both as an attribute of the work product itself and as a general process characteristic. The broad performance characteristics that are of interest to management are quality (effectiveness), cost (efficiency), and schedule. Performance is the highly effective common measurement that links the quality of the work product to efficiency and productivity.

plan
A specified course of action designed to attain a stated objective.

policy
A statement of principles and beliefs, or a settled course, adopted to guide the overall management of affairs in support of a stated aim or goal. It is mostly related to fundamental conduct and usually defines a general framework within which other business and management actions are carried out.

policy deployment
A discipline approach to business-wide planning and implementation; involves setting long-term goals and annual priorities, deploying priorities through the management structure for refinement into detailed objectives, developing implementation plans, and tracking regular progress and annual results.

population
A large collection of items (product observations, data) about certain characteristics of which conclusions and decisions are to be made for purposes of process assessment and quality improvement.

prevention
Activities and practices aimed at anticipating and removing sources of potential problems; for example, training or supplier qualification.

problem
A question or situation proposed for solution. The result of not conforming to requirements, which can create a potential task resulting from the existence of defects.

process
The system of tasks, work flows, information flows, and other interdependencies that produce some specific outputs or results. How work is done, how outputs or results are achieved, and how value is provided to the business or customer.

process capability
The ability of a process to meet operating goals or internal- or external-customer requirements. "Capability" may differ from actual performance due to "special causes"--conditions or events due purely to chance and not the production system itself.

process control
Activities undertaken to acquire and use information during process execution to ensure--with a reasonable degree of confidence--that the process will meet its requirements and that these requirements will continue to reflect the needs of process customers.

process flow analysis
A technique for identification and analysis of key processes, and for areas and methods of possible improvement. It is particularly useful for roadblock removal.

process flow diagramming
A visual, systematic way of examining a process by diagramming all its inputs, outputs, and activities

process improvement
The set of activities employed to detect and remove common causes of variation in order to improve process capability. Process improvement leads to quality improvement.

process management
Activities aimed at process planning, process control, identifying improvement opportunities, and initiating improvement. Planning involves setting process requirements, characterizing the process, establishing in-process and supplier requirements, and planning for control.

process optimization
The major aspect of process management that concerns itself with the efficiency and productivity of the process; that is, with economic factors.

process owner
A designated person within the process, who has the authority to manage the process and responsibility for its overall performance.

process performance
A measure of how effectively and efficiently a process satisfies customer requirements

Process Quality Management and Improvement (PQMI)
Seven-step methodology for process management and continuous process improvement.

process review
An objective assessment of how well the methodology has been applied to your process. Emphasizes the potential for long-term process results rather than the actual results achieved.

productivity
Refers both to the efficiency of tasks or operations and to their effectiveness in meeting the needs of other internal operations; some productivity-related measures include cost of poor quality and unit output costs.

project
A process executed over time, rather than repeatedly.

quality
The extent to which products and services produced conform to customer requirements. Customers can be internal as well as external to the organizational system (e.g., products or services may flow to the person at the next desk or work area rather than to people outside of the immediate organization). The Federal Quality Institute defines quality as meeting the customer requirements the first time every time. The Department of Defense (DOD) defines quality as conformance to a set of customer requirements that , if met, result in a product that is fit for its intended use.

Quality Approach
Overall strategy for managing quality in an organization; "blueprint" for the organization's quality system.

quality assurance (QA)
A phase in the evolution of the quality discipline, QA differed from statistical quality control, its predecessor, in that all functional groups, not just engineers and workers on the shop floor, were involved in the quality effort. However, QA is more narrowly focused than its successor, total quality management (TQM), which emphasizes senior-executive involvement, the management of quality for competitive advantage, and a strong customer orientation.

quality circles
A group of workers and their supervisors who voluntarily meet to identify and solve job-related problems. Structured processes are used by the group to accomplish their task.

quality consultant
A person with expertise in quality-related methods and tools who advises both business managers and quality teams.

Quality Council
The senior management team in a business unit or division acting in their role of managing for quality.

quality function deployment (QFD)
A disciplined approach to solving quality problems before the design phase of a product. The foundation of QFD is the belief that products should be designed to reflect customer desires; therefore, marketers, design engineers, and manufacturing personnel must work closely together from the beginning to ensure a successful product. The approach involves finding out what features are important to customers, ranking them in importance, identifying conflicts, and translating them into engineering specifications.

Quality Improvement Cycle (QIC)
Eight-step methodology for implementing process improvements.

Quality Manager
Manager appointed to assist the Quality Council in managing for quality and also to coordinate overall quality support for the business.

quality of working life
The extent to which the organizational culture provides employees with information, knowledge, authority, and rewards to enable them to perform safely and effectively, be compensated equitably, and maintain a sense of human dignity.

quality professionals
Part- or full-time quality experts on quality methods and tools, who provide quality consulting and training for an organization. Quality professionals work with both managers and teams.

quality system
Everything associated with implementation of the Quality Approach, including responsibilities, plans, activities, behaviors, and incentives.

quality system audit
Systematic assessment of the quality system against a standard such as the Baldrige Award criteria or ISO 9000 series of standards.

quality teams
Also referred to as Performance Action Teams or Quality Improvement Teams. They might be composed of volunteers who meet regularly to review progress toward goal attainment, plan for changes, decide upon corrective actions, etc. Members are usually from the same work unit.

range
The difference between the maximum and the minimum value of data in a sample.

recognition
Public or private acknowledgement--other than compensation or promotion--of significant achievement or effort

recovery
The actions taken by an organization, particularly its front-line employees, in response to unexpected customer problems such as an unusual request or the inconvenience caused by a canceled airplane flight Less severe than a crises, recovery situations can result from an error committed by the company or the customer or from an uncontrollable event like the weather.

reengineering
A method for systematically overhauling or revamping an entire process, organization, or function.

reliability
The probability that a product entity will perform its specified function under specified conditions, without failure, for a specified period of time

reliability engineering
A broad-based discipline for ensuring better product performance by predicting more accurately when and under what conditions a product can fail. Based on the results of such an analysis, engineers can improve designs, set operating limits for equipment, and create backups in case of system failure. Reliability programs also incorporate feedback loops for analyzing product performance in the field and, in particular, product failures

requirement
A formal statement of need, and the expected manner in which it is met.

requirements
What process should achieve in terms of output characteristics, costs, timeliness; determined based on customer needs, competitor performance, and overall business direction or strategy.

reward
Salary increases, bonuses, and promotions given on the basis of performance.

roadblock identification analysis
A tool that focuses on identifying roadblocks to performance improvement and/or problems that are causing the group to be less productive than it could be. This tool uses the nominal group technique to identify and prioritize performance roadblocks. Action teams are formed to analyze barriers and develop proposals to remove roadblocks The proposals are implemented, tracked, and evaluated.

root cause (cause-and-effect) analysis
A deductive approach to analyzing problems by working backwards from the "effect" to the cause or causes. One of so-called "Seven Quality Tools," root-cause analysis is often facilitated using a "fishbone diagram" in which all the inputs to the process are arrayed in visual format like the bones of a fish.

sample
A finite number of items taken from a population

Scanlon committees
Committees comprised of managers, supervisors, and employees who work together to implement a philosophy of management/labor cooperation that is believed to enhance productivity. There are a number of principles and techniques involved, with employee participation being a major component.

service
(Service offering) a process or operation directed at fulfilling a need or demand, rather than delivering a physical product. Examples of service processes include maintenance, purchasing, market research, and training.

simulation
The technique of observing and manipulating an artificial mechanism (model) that represents a real world process that, for technical or economical reasons, is not suitable or available for direct experimentation.

simultaneous engineering (SE)
Also known as concurrent engineering, SE is a general approach to production in which concept development, design, manufacturing, and marketing are carried out in unison. In contrast to a linear, sequential approach in which communication between functions is poor and the production process is marred by rework, scrap, poor quality, and frustration, simultaneous engineering

maximizes communication, reduces errors, and shortens cycle times.

six-sigma
A statistical way of measuring quality, six-sigma is equivalent to 3.4 defects per million units of output--a virtually defect-free level of performance. The ambitious, companywide goal of "six-sigma quality" has been adopted, most notably, by Motorola, a 1988 Baldrige Award winner.

special cause
An "abnormal" source of variation that does not arise from the production process itself, but which is extraneous and unpredictable.

specification
A document containing a detailed description or enumeration of particulars Formal description of a work product and the intended manner of providing it (the provider's view of the work product).

standard deviation
A parameter describing the spread of the process output, denoted by the Greek letter sigma. The positive square root of the variance.

statistic
Any parameter that can be determined on the basis of the quantitative characteristics of a sample. A descriptive statistic is a computed measure of some property of a set of values, making possible a definitive statement about the meaning of the collected data. An inferential statistic indicates the confidence that can be placed in any statement regarding its expected accuracy, the range of its applicability, and the probability of its being true. Consequently, decisions can be based on inferential statistics.

statistical process control (SPC)
Based on the principle that no two units of output of a process are likely to have the exact same specifications, SPC involves the mathematical determination of acceptable limits of variation. Graphs are used by workers to plot output variables and visually determine when a process is "in" or "out of" control.

statistical control
The status of a process from which all special causes of variation have been removed and only common causes remain. Such a process is also said to be stable.

statistical estimation
The analysis of a sample parameter in order to predict the values of the corresponding population parameter

statistical methods
The application of the theory of probability to problems of variation. There are two groups of statistical methods. Basic statistical methods are relatively simple problem-solving tools and techniques, such as control charts, capability analysis, data summarization and analysis, and statistical inference. Advanced statistical methods are more sophisticated specialized techniques of statistical analysis, such as the design of experiments, regression and correlation analysis, and the analyses of variance.

statistical quality control (SQC)
A relatively early development in the evolution of the quality discipline, SQC relies on statistical concepts and tools (e.g., sampling techniques) to control production quality. SQC techniques are used in total quality management, although the emphasis in TQM is on "building quality in," rather than error detection.

statistics
The branch of applied mathematics that describes and analyzes empirical observations for the purpose of predicting certain events in order to make decisions in the face of uncertainty Statistics, in turn, are based on the theory of probability. The two together provide the abstraction for the mathematical model underlying the study of problems involving uncertainty.

strategy
A broad course of action, chosen from a number of alternatives, to accomplish a stated goal of uncertainty

stretch goal
An ambitious, usually long-term quality goal that requires extraordinary effort, innovation, and planning to achieve.

subprocesses
The internal processes that make up a process.

supplier
Source of material and/or information input to a process, which may be internal or external to the company, organization, or group.

team building
A process of developing and maintaining a group of people who are working toward a common goal. Team building usually focuses on one or more of the following objectives: (1) clarifying role expectations and obligations of team members, (2) improving superior-subordinate or peer relationships, (3) improving problem solving, decision making, resource utilization, or planning activities, (4) reducing conflict, and (5) improving organizational climate

timeliness
The promptness with which quality products and services are delivered, relative to customer expectations.

total quality control (TQC)
An expression coined by Armand Feigenbaum, TQC involves the application of quality principles in all processes and at all levels of a company.

total quality management (TQM)
TQM, as embodied in the Baldrige criteria, represents the latest phase in the evolution of the quality discipline. Distinctive features are a strong and pervasive customer orientation and a view toward managing quality for competitive advantage. The term "TQM" is roughly equivalent to TQC and CWQC in Japan, where the word "control" has the same connotations as "management" in this country.

transactional analysis
A process that helps people change to be more effective on the job and can also help organizations to change. The process involves several exercises that help identify organizational scripts and games that people may be playing. The results help point the way toward change.

transfer to operations
An activity or series of activities in which operating personnel are trained in the performance of a new manufacturing or service-delivery process.

value
The extent to which a product or service meets a customer's needs or wants, which can be measured (though not easily) in willingness to pay. Also, the benefit, or utility, a customer receives from a product or service.

variable
A data item that takes on values within some range with a certain frequency or pattern. Variables may be discrete, that is, limited in value to integer quantities (e.g., the number of bolts produced in a manufacturing process). Discretevariables relate to attribute data. Variables may also be continuous, that is, measured to any desired degree of accuracy (e.g., the diameter of a shaft). Continuous variables relate to variables data.

variance
In quality management terminology, any nonconformance to specifications. In statistics, it is the square of the standard deviation.

vision
The desired future state of business.

world-class
Ranking among the best across all comparable products, services, or processes (not just direct competitors) in terms of critical performance or features

zero defects
An approach to quality improvement, based primarily on increasing worker motivation and attentiveness, in which the only acceptable quality standard is defect-free output or service execution.