Quality Glossary

Every quality professional needs a handy reference of quality terms, acronyms and key people in the history of quality. This glossary derives from a variety of sources, including books, periodicals, Web sites and quality experts.

If you believe important terms are missing, please send the term, along with its complete definition and source, to cjohnson@asq.org, and we will consider including it in any future updated versions.

A

Academic Quality Improvement Project (AQIP): A forum for institutions to review each other's action projects.

Acceptable quality level (AQL): In a continuing series of lots, a quality level that, for the purpose of sampling inspection, is the limit of satisfactory process average.

Acceptance number: The maximum number of defects or defectives allowable in a sampling lot for the lot to be acceptable.

Acceptance sampling: Inspection of a sample from a lot to decide whether to accept that lot. There are two types: attributes sampling and variables sampling. In attributes sampling, the presence or absence of a characteristic is noted in each of the units inspected. In variables sampling, the numerical magnitude of a characteristic is measured and recorded for each inspected unit; this involves reference to a continuous scale of some kind.

Acceptance sampling plan: A specific plan that indicates the sampling sizes and associated acceptance or nonacceptance criteria to be used. In attributes sampling, for example, there are single, double, multiple, sequential, chain and skip-lot sampling plans. In variables sampling, there are single, double and sequential sampling plans. (For detailed descriptions of these plans, see the standard *ANSI/ISO/ASQ A3534-2, Statistics—Vocabulary and Symbols—Statistical Quality Control.*)

Accreditation: Certification by a duly recognized body of the facilities, capability, objectivity, competence and integrity of an agency, service, or operational group or individual to provide the specific service or operation needed.

Accuracy: The characteristic of a measurement that tells how close an observed value is to a true value.

Action plan: A specific method or process to achieve the results called for by one or more objectives. May be a simpler version of a project plan.

Activity network diagram: An arrow diagram used in planning and managing processes and projects.

Advanced Product Quality Planning (APQP): Segment of QS-9000 process that uses tools to offer the opportunity to get ahead of problems and solve them before the problems affect the customer.

Affinity diagram: A management tool used to organize information

(usually gathered during a brainstorming activity).

Alignment: The actions taken to ensure a process or activity supports the organization's strategy, goals and objectives.

American Association for Laboratory Accreditation (A2LA): An organization that formally recognizes another organization's competency to perform specific tests, types of tests or calibrations.

American Customer Satisfaction Index (ACSI): Released for the first time in October 1994, an economic indicator and cross industry measure of the satisfaction of U.S. household customers with the quality of the goods and services available to them—both those goods and services produced within the United States and those provided as imports from foreign firms that have substantial market shares or dollar sales. The ACSI is co-sponsored by the University of Michigan Business School, ASQ and the CFI Group.

American National Standards Institute (ANSI): ANSI is a private, nonprofit organization that administers and coordinates the U.S. voluntary standardization and conformity assessment system. It is the United States' member body in the International Organization for Standardization, known as ISO.

American Society for Nondestructive Testing (ASNT): The world's largest technical society for nondestructive testing (NDT) professionals.

American Society for Quality (ASQ): A professional, not-for-profit association that develops, promotes and applies quality related information and technology for the private sector, government and academia. The Society serves more than 108,000 individuals and 1,100 corporate members in the United States and 108 other countries.

American Society for Quality Control (ASQC): Name of the Society from 1946 through the middle of 1997; then changed to ASQ.

American Society for Testing and Materials (ASTM): Not-for-profit organization that provides a forum for the development and publication of voluntary consensus standards for materials, products, systems and services.

American Society for Training and Development (ASTD): A membership organization providing materials, education and support related to workplace learning and performance.

American standard code for information interchange (ASCII): Basic computer characters accepted by all American machines and many foreign ones.

Analysis of means (ANOM): A statistical procedure for troubleshooting industrial processes and analyzing the results of experimental designs with factors at fixed levels. It provides a graphical display of data. Ellis R. Ott developed the procedure in 1967 because he observed that nonstatisticians had difficulty understanding analysis of variance. Analysis of means is easier for quality practitioners to use because it is an extension of the control chart. In 1973, Edward G. Schilling further extended the concept, enabling analysis of means to be used with non-normal distributions and attributes data where the normal approximation to the binomial distribution does not apply. This is referred to as analysis of means for treatment effects.

Analysis of variance (ANOVA): A basic statistical technique for analyzing experimental data. It subdivides the total variation of a data set into meaningful component parts associated with specific sources of variation in order to test a hypothesis on the parameters of the model or to estimate variance components. There are three models: fixed, random and mixed.

Appraisal cost: The cost involved in ensuring an organization is continually striving to conform to customers' quality requirements.

Arrow diagram: A planning tool to diagram a sequence of events or activities (nodes) and the interconnectivity of such nodes. It is used for scheduling and especially for determining the critical path through nodes.

AS9100: An international quality management standard for the aerospace industry published by the Society of Automotive Engineers; also published by other organizations worldwide, as EN9100 in Europe and JIS Q 9100 in Japan. The standard is controlled by the International Aerospace Quality Group (see listing).

Assessment: A systematic process of collecting and analyzing data to determine the current, historical or projected status of an organization.

Assignable cause: A name for the source of variation in a process that is not due to chance and therefore can be identified and eliminated. Also called "special cause."

Association for Quality and Participation (AQP): Affiliate organization of the American Society for Quality (ASQ) dedicated to improving workplaces through quality and participation practices.

Attribute data: Go/no-go information. The control charts based on attribute data include percent chart, number of affected units chart, count chart, count per unit chart, quality score chart and demerit chart.

Attributes, method of: Measurement of quality by the method of attributes consists of noting the presence (or absence) of some characteristic (attribute) in each of the units under consideration and counting how many units do (or do not) possess it. Example: go/no-go gauging of a dimension.

Audit: The inspection and examination of a process or quality system to ensure compliance to requirements. An audit can apply to an entire organization or may be specific to a function, process or production step.

Automotive Industry Action Group (AIAG): The originator and sole source of the QS-9000 series of standards. ASQ's Automotive Division maintains a liaison to this group.

Availability: The ability of a product to be in a state to perform its designated function under stated conditions at a given time.

Average chart: A control chart in which the subgroup average, X-bar, is used to evaluate the stability of the process level.

Average outgoing quality (AOQ): The expected average quality level of outgoing product for a given value of incoming product quality.

Average outgoing quality limit (AOQL): The maximum average outgoing quality over all possible levels of incoming quality for a given acceptance sampling plan and disposal specification.

Average run lengths (ARL): On a control chart, the number of subgroups expected to be inspected before a shift in magnitude takes place.

Average sample number (ASN): The average number of sample units inspected per lot in reaching decisions to accept or reject.

Average total inspection (ATI): The average number of units inspected per lot, including all units in rejected lots

(applicable when the procedure calls for 100% inspection of rejected lots).

B

Baldrige Award: See "Malcolm Baldrige National Quality Award."

Baseline measurement: The beginning point, based on an evaluation of the output over a period of time, used to determine the process parameters prior to any improvement effort; the basis against which change is measured.

Benchmarking: An improvement process in which a company measures its performance against that of best in class companies, determines how those companies achieved their performance levels and uses the information to improve its own performance. The subjects that can be benchmarked include strategies, operations, processes and procedures.

Benefit-cost analysis: An examination of the relationship between the monetary cost of implementing an improvement and the monetary value of the benefits achieved by the improvement, both within the same time period.

Best practice: A superior method or innovative practice that contributes to the improved performance of an organization, usually recognized as "best" by other peer organizations.

Big Q, Little Q: A term used to contrast the difference between managing for quality in all business processes and products (big Q) and managing for quality in a limited capacity—traditionally only in factory products and processes (little q).

Black Belt (BB): Full-time team leader responsible for implementing process improvement projects—define, measure, analyze, improve and control (DMAIC) or define, measure, analyze, design and verify (DMADV)—within the business to drive up customer satisfaction levels and business productivity.

Blemish: An imperfection severe enough to be noticed but that should not cause any real impairment with respect to intended normal or reasonably foreseeable use (see also "defect," "imperfection" and "nonconformity").

Block diagram: A diagram that shows the operation, interrelationships and interdependencies of components in a system. Boxes, or blocks (hence the name), represent the components; connecting lines between the blocks represent interfaces. There are two types of block diagrams: a functional block diagram, which shows a system's subsystems and lower level products and their interrelationships and which interfaces with other systems; and a reliability block diagram, which is similar to the functional block diagram except that it is modified to emphasize those aspects influencing reliability.

Board of Standards Review (BSR): An American National Standards Institute board responsible for the approval and withdrawal of American National Standards.

Body of knowledge (BOK): The prescribed aggregation of knowledge in a particular area an individual is expected to have mastered to be considered or certified as a practitioner.

Bottom line: The essential or salient point; the primary or most important consideration. Also, the line at the bottom of a financial report that shows the net profit or loss.

Box, George E.P.: A native of England, Box began his career during World War II with the British Army Engineers, where he learned statistics. He studied at University College, became head of the statistical techniques research section at Imperial Chemical Industrials and obtained a doctorate. He moved to the United States and was a founder of *Technometrics,* published by ASQ and the American Statistical Association. A professor at the University of Wisconsin, Box is an Honorary Member of ASQ.

Brainstorming: A technique teams use to generate ideas on a particular subject. Each person in the team is asked to think creatively and write down as many ideas as possible. The ideas are not discussed or reviewed until after the brainstorming session.

Breakthrough improvement: A dynamic, decisive movement to a new, higher level of performance.

Brumbaugh, Martin A. (deceased): The founder and first editor of *Industrial Quality Control* magazine. A former professor of statistics at the University of Buffalo, Brumbaugh published regularly on applied statistics. Brumbaugh was instrumental in getting two separate quality organizations—the Federated Societies and the Society for Quality Control—merged into one national organization: ASQ (then ASQC). Brumbaugh was an ASQ Honorary Member.

BS 7799: British commerce, government and industry stakeholders wrote BS 7799 to address information security management issues, including fraud, industrial espionage and physical disaster. May become ISO standard.

Business process reengineering (BPR): The concentration on the improvement of business processes that will deliver outputs that will achieve results meeting the firm's objectives, priorities and mission.

C

C chart: See "count chart."

Calibration: The comparison of a measurement instrument or system of unverified accuracy to a measurement instrument or system of known accuracy to detect any variation from the required performance specification.

Capability maturity model: A framework that describes the key elements of an effective software process. It's an evolutionary improvement path from an immature process to a mature, disciplined process. The CMM covers practices for planning, engineering and managing software development and maintenance. When followed, these key practices improve the ability of organizations to meet goals for cost, schedule, functionality and product quality.

Cascading: The continuing flow of the quality message down to, not through, the next level of supervision until it reaches all workers. Same concept as "deploying."

Cause: An identified reason for the presence of a defect or problem.

Cause and effect diagram: A tool for analyzing process dispersion. It is also referred to as the "Ishikawa diagram," because Kaoru Ishikawa developed it, and the "fishbone diagram," because the complete diagram resembles a fish skeleton. The diagram illustrates the main causes and subcauses leading to an effect (symptom). The cause and effect diagram is one of the "seven tools of quality." (See listing).

Centerline: A line on a graph that represents the overall average (mean) operating level of the process.

Central tendency: The tendency of data gathered from a process to cluster toward a middle value somewhere between the high and low values of measurement.

Certification: The result of meeting the established criteria set by an accrediting or certificate granting organization.

Certified mechanical inspector (CMI): An ASQ certification.

Certified quality auditor (CQA): An ASQ certification.

Certified quality auditor (CQA)-biomedical: An ASQ certification.

Certified quality auditor (CQA)-hazard analysis and critical control point (HACCP): An ASQ certification.

Certified quality engineer (CQE): An ASQ certification.

Certified quality improvement associate (CQIA): An ASQ certification.

Certified quality manager (CQM): An ASQ certification.

Certified quality technician (CQT): An ASQ certification.

Certified reliability engineer (CRE): An ASQ certification.

Certified Six Sigma Black Belt (CSSBB): An ASQ certification.

Certified software quality engineer (CSQE): An ASQ certification.

Chain reaction: A chain of events described by W. Edwards Deming: improve quality, decrease costs, improve productivity, increase market with better quality and lower price, stay in business, provide jobs and provide more jobs.

Chain sampling plan: In acceptance sampling, a plan in which the criteria for acceptance and rejection apply to the cumulative sampling results for the current lot and one or more immediately preceding lots.

Champion: A business leader or senior manager who ensures that resources are available for training and projects, and who is involved in project tollgate reviews; also an executive who supports and addresses Six Sigma organizational issues.

Change agent: An individual from within or outside an organization who facilitates change within the organization. May or may not be the initiator of the change effort.

Characteristic: The factors, elements or measures that define and differentiate a process, function, product, service or other entity.

Chart: A tool for organizing, summarizing and depicting data in graphic form.

Charter: A written commitment approved by management stating the scope of authority for an improvement project or team.

Checklist: A tool used to ensure all important steps or actions in an operation have been taken. Checklists contain items important or relevant to an issue or situation. Checklists are often confused with check sheets (see individual entry).

Check sheet: A simple data recording device. The check sheet is custom designed by the user, which allows him or her to readily interpret the results. The check sheet is one of the "seven tools of quality." (See listing). Check sheets are often confused with checklists (see individual entry).

Classification of defects: The listing of possible defects of a unit, classified according to their seriousness. Note: Commonly used classifications: class A, class B, class C, class D; or critical, major, minor and incidental; or critical, major and minor. Definitions of these classifications require careful preparation and tailoring to the product(s) being sampled to enable accurate assignment of a defect to the proper classification. A separate acceptance sampling plan is generally applied to each class of defects.

Closed-loop corrective action (CLCA): A sophisticated engineering system designed to document, verify and diagnose failures, recommend and initiate corrective action, provide follow-up and maintain comprehensive statistical records.

Code of conduct: Expectations of behavior mutually agreed on by a team.

Collier, Simon (deceased): An ASQ president who led the Society during a critical growth period in 1952-53. His term was marked by numerous milestone events, including a membership increase of 22% and the formation of 11 new sections and the first divisions. Collier, an ASQ Honorary Member, was a chemist who began his career at the National Bureau of Standards (now the National Institute of Standards and Technology). Later he worked at Johns-Manville Corp., where he produced a quality training film used by more than 300 companies.

Common causes: Causes of variation that are inherent in a process over time. They affect every outcome of the process and everyone working in the process (see also "special causes").

Company culture: A system of values, beliefs and behaviors inherent in a company. To optimize business performance, top management must define and create the necessary culture.

Complaint tracking: Collecting data, disseminating data to appropriate persons for resolution, monitoring complaint resolution progress and communicating results.

Compliance: The state of an organization that meets prescribed specifications, contract terms, regulations or standards.

Computer aided design (CAD): Software used by architects, engineers, drafters and artists to create precision drawings or technical illustrations. CAD software can be used to create two-dimensional (2-D) drawings or three-dimensional (3-D) models.

Computer aided engineering (CAE): A broad term used by the electronic design automation industry for the use of computers to design, analyze and manufacture products and processes. CAE includes CAD (see listing) and computer aided manufacturing (CAM), which is the use of computers for managing manufacturing processes.

Concurrent engineering (CE): A way to reduce cost, improve quality and shrink cycle time by simplifying a product's system of life cycle tasks during the early concept stages.

Conflict resolution: The management of a conflict situation to arrive at a resolution satisfactory to all parties.

Conformance: An affirmative indication or judgment that a product or service has met the requirements of a relevant specification, contract or regulation.

Conformitè Europeënne Mark (CE Mark): Conformity European Union mark. The European Union created the CE Mark to regulate the goods sold within its borders. The mark represents a manufacturer's declaration products comply with the EU's New Approach Directives. These directives apply to any country that sells products within the EU.

Consensus: A state in which all the members of a group support an action or decision, even if some of them don't fully agree with it.

Consultant: An individual who has experience and exper-

tise in applying tools and techniques to resolve process problems and who can advise and facilitate an organization's improvement efforts.

Consumer: The external customer to whom a product or service is ultimately delivered; Also called end user.

Consumer's risk: Pertains to sampling and the potential risk that bad product will be accepted and shipped to the consumer.

Continuous flow production: Means that items are produced and moved from one processing step to the next one piece at a time. Each process makes only the one piece that the next process needs, and the transfer batch size is one.

Continuous improvement (CI): Sometimes called continual improvement. The ongoing improvement of products, services or processes through incremental and breakthrough improvements.

Continuous quality improvement (CQI): A philosophy and attitude for analyzing capabilities and processes and improving them repeatedly to achieve the objective of customer satisfaction.

Continuous sampling plan: In acceptance sampling, a plan, intended for application to a continuous flow of individual units of product, that involves acceptance and rejection on a unit by unit basis and employs alternate periods of 100% inspection and sampling, the relative amount of 100% inspection depending on the quality of submitted product. Continuous sampling plans usually require that each t period of 100% inspection be continued until a specified number, i, of consecutively inspected units are found clear of defects. Note: For single level continuous sampling plans, a single d sampling rate (for example, inspect 1 unit in 5 or 1 unit in 10) is used during sampling. For multilevel continuous sampling plans, two or more sampling rates may be used: The rate at any time depends on the quality of submitted product.

Control chart: A chart with upper and lower control limits on which values of some statistical measure for a series of samples or subgroups are plotted. The chart frequently shows a central line to help detect a trend of plotted values toward either control limit.

Control limits: The natural boundaries of a process within specified confidence levels, expressed as the upper control limit (UCL) and the lower control limit (LCL).

Control plan (CP): A document that describes the required characteristics for the quality of a product or service, including measures and control methods.

Coordinate measuring machine (CMM): A device that dimensionally measures 3-D products, tools and components with an accuracy approaching 0.0001 in.

Corrective action: The implementation of solutions resulting in the reduction or elimination of an identified problem.

Corrective action recommendation (CAR): The full cycle corrective action tool that offers ease and simplicity for employee involvement in the corrective action/process improvement cycle.

Correlation (statistical): A measure of the relationship between two data sets of variables.

Cost of poor quality (COPQ): The costs associated with providing poor quality products or services. There are four categories of costs: internal failure costs (costs associated with defects found before the customer receives the product or service), external failure costs (costs associated with defects found after the customer receives the product or service), appraisal costs (costs incurred to determine the degree of conformance to quality requirements) and prevention costs (costs incurred to keep failure and appraisal costs to a minimum).

Cost of quality (COQ): A term coined by Philip Crosby referring to the cost of poor quality.

Count chart: A control chart for evaluating the stability of a process in terms of the count of events of a given classification occurring in a sample.

Count per unit chart: A control chart for evaluating the stability of a process in terms of the average count of events of a given classification per unit occurring in a sample.

C_p: The capability index for a stable process, defined as

$$\frac{USL - LSL}{6(est)}$$

C_{pk} index: A capability index that measures capability at the specification limit that has the highest chance of a part beyond the limit. Defined as the minimum CPL, CPU.

C_{pm}: Process capability index that considers variation between the process average and the target average, as well as the process standard deviation.

$$C_{pm} = \frac{USL - LSL}{6(2+)(-T)2}$$

Critical processes: Processes that present serious potential dangers to human life, health and the environment or that risk the loss of very large sums of money or customers.

Crosby, Philip (deceased): The founder and chairman of the board of Career IV, an executive management consulting firm. Crosby also founded Philip Crosby Associates Inc. and the Quality College. He wrote many books including *Quality Is Free*, *Quality Without Tears*, *Let's Talk Quality*, and *Leading: The Art of Becoming an Executive*. Crosby, who originated the zero defects concept, was an ASQ Honorary Member and past president.

Cross functional: A term used to describe a process or an activity that crosses the boundary between functions. A cross functional team consists of individuals from more than one organizational unit or function.

Cross pilot: See "scatter diagram."

Cultural resistance: A form of resistance based on opposition to the possible social and organizational consequences associated with change.

Culture change: A major shift in the attitudes, norms, sentiments, beliefs, values, operating principles and behavior of an organization.

Culture, organizational: A common set of values, beliefs, attitudes, perceptions and accepted behaviors shared by individuals within an organization.

Cumulative sum control chart (CUSUM): A control chart on which the plotted value is the cumulative sum of deviations of successive samples from a target value. The ordinate of each plotted point represents the algebraic sum of the previous ordinate and the most recent deviations from the target.

Current good manufacturing practices (CGMP): Regulations enforced by the U.S. Food and Drug Administration for food and chemical manufacturers and packagers.

Customer: See "external customer" and "internal customer."

Customer delight: The result of delivering a product or service that exceeds customer expectations.

Customer relationship management (CRM): A strategy used to learn more about customers' needs and behaviors to develop stronger relationships with them. It brings together

information about customers, sales, marketing effectiveness, responsiveness and market trends. It helps businesses use technology and human resources to gain insight into the behavior of customers and the value of those customers.

Customer satisfaction (CS): The result of delivering a product or service that meets customer requirements.

Customer-supplier model (CSM): A model depicting inputs flowing into a work process that, in turn, add value and produce outputs delivered to a customer. Also called customer-supplier methodology.

Customer supplier partnership: A long-term relationship between a buyer and supplier characterized by teamwork and mutual confidence. The supplier is considered an extension of the buyer's organization. The partnership is based on several commitments. The buyer provides long-term contracts and uses fewer suppliers. The supplier implements quality assurance processes so incoming inspection can be minimized. The supplier also helps the buyer reduce costs and improve product and process designs.

Cycle time: The elapsed time between the start and completion of a task or an entire process; for example, in order processing it can be the time between receipt and delivery of an order.

D

Data: A set of collected facts. There are two basic kinds of numerical data: measured or variable data, such as "16 ounces," "4 miles" and "0.75 inches," and counted or attribute data, such as "162 defects."

D chart: See "demerit chart."

Decision matrix: A matrix used by teams to evaluate problems or possible solutions. After a matrix is drawn to evaluate possible solutions, for example, the team lists them in the far left vertical column. Next, the team selects criteria to rate the possible solutions, writing them across the top row. Third, each possible solution is rated on a scale of 1 to 5 for each criterion, and the rating is recorded in the corresponding grid. Finally, the ratings of all the criteria for each possible solution are added to determine its total score. The total score is then used to help decide which solution deserves the most attention.

Defect: A product's or service's nonfulfillment of an intended requirement or reasonable expectation for use, including safety considerations. There are four classes of defects: class 1, very serious, leads directly to severe injury or catastrophic economic loss; class 2, serious, leads directly to significant injury or significant economic loss; class 3, major, is related to major problems with respect to intended normal or reasonably foreseeable use; and class 4, minor, is related to minor problems with respect to intended normal or reasonably foreseeable use (see also "blemish," "imperfection" and "nonconformity").

Defective: A defective unit; a unit of product that contains one or more defects with respect to the quality characteristic(s) under consideration.

Delighter: A feature of a product or service that a customer does not expect to receive but that gives pleasure to the customer when received.

Demerit chart: A control chart for evaluating a process in terms of a demerit (or quality score), in other words, a weighted sum of counts of various classified nonconformities.

Deming cycle: Sometimes called the Shewhart cycle (see "plan-do-check-act cycle").

Deming Prize: Award given annually to organizations that, according to the award guidelines, have successfully applied companywide quality control based on statistical quality control and will keep up with it in the future. Although the award is named in honor of W. Edwards Deming, its criteria are not specifically related to Deming's teachings. There are three separate divisions for the award: the Deming Application Prize, the Deming Prize for Individuals and the Deming Prize for Overseas Companies. The award process is overseen by the Deming Prize Committee of the Union of Japanese Scientists and Engineers in Tokyo.

Deming, W. Edwards (deceased): A prominent consultant, teacher and author on the subject of quality. After Deming shared his expertise in statistical quality control to help the U.S. war effort during World War II, the War Department sent him to Japan in 1946 to help that nation recover from its wartime losses. Deming published more than 200 works, including the well-known books *Quality, Productivity*, and *Competitive Position* and *Out of the Crisis*. Deming, who developed the 14 points for managing, was an ASQ Honorary Member.

Dependability: The degree to which a product is operable and capable of performing its required function at any randomly chosen time during its specified operating time, provided that the product is available at the start of that period. (Nonoperation related influences are not included.) Dependability can be expressed by the ratio: time available divided by (time available + time required).

Deployment: Dispersion, dissemination, broadcasting or spreading of a communication throughout an organization, downward and laterally.

Design of experiments (DOE): A branch of applied statistics dealing with planning, conducting, analyzing and interpreting controlled tests to evaluate the factors that control the value of a parameter or group of parameters.

Design for Six Sigma (DFSS): See "DMADV."

Designing in quality vs. inspecting in quality: See "prevention vs. detection."

Deviation: In numerical data sets, the difference or distance of an individual observation or data value from the center point (often the mean) of the set distribution.

Diagnosis: The activity of discovering the cause(s) of quality deficiencies; the process of investigating symptoms, collecting and analyzing data, and conducting experiments to test theories to determine the root cause(s) of deficiencies.

Diagnostic journey and remedial journey: A two-phase investigation used by teams to solve chronic quality problems. In the first phase, the diagnostic journey, the team journeys from the symptom of a chronic problem to its cause. In the second phase, the remedial journey, the team journeys from the cause to its remedy.

Dissatisfiers: The features or functions a customer expects that either are not present or are present but not adequate; also pertains to employees' expectations.

Distribution (statistical): The amount of potential variation in the outputs of a process, typically expressed by its shape, average or standard deviation.

DMADV: A data driven quality strategy for designing products and processes, it is an integral part of a Six Sigma quality initiative. It consists of five interconnected phases:

define, measure, analyze, design and verify.

DMAIC: A data driven quality strategy for improving processes and an integral part of a Six Sigma quality initiative. DMAIC is an acronym for define, measure, analyze, improve and control.

Dodge, Harold F. (deceased): An ASQ founder and Honorary Member. His work with acceptance sampling plans scientifically standardized inspection operations and provided controllable risks. Although he usually is remembered for the Dodge-Romig sampling plans developed with Harry G. Romig, Dodge also helped develop other basic acceptance sampling concepts (consumer's risk, producer's risk, average outgoing quality level) and several acceptance sampling schemes.

Dodge-Romig sampling plans: Plans for acceptance sampling developed by Harold F. Dodge and Harry G. Romig. Four sets of tables were published in 1940: single sampling lot tolerance tables, double sampling lot tolerance tables, single sampling average outgoing quality limit tables and double sampling average outgoing quality limit tables.

Driving forces: Forces that tend to change a situation in desirable ways.

E

Edwards, George D. (deceased): First president of ASQ. Edwards was noted for his administrative skills in forming and preserving the Society. He was the head of the inspection engineering department and the director of quality assurance at Bell Telephone Laboratories. He also served as a consultant to the Army Ordnance Department and the War Production Board during World War II. Edwards was an ASQ Honorary Member.

Effect: What results after an action has been taken; the expected or predicted impact when an action is to be taken or is proposed.

Effectiveness: The state of having produced a decided upon or desired effect.

Efficiency: The ratio of the output to the total input in a process.

Efficient: A term describing a process that operates effectively while consuming the minimum amount of resources (such as labor and time).

Eighty-twenty (80-20): A term referring to the Pareto principle, which was first defined by J. M. Juran in 1950. The principle suggests most effects come from relatively few causes; that is, 80% of the effects come from 20% of the possible causes.

Electric data interchange (EDI): The electronic exchange of data between customers and suppliers and vice versa.

Employee involvement (EI): A practice within an organization whereby employees regularly participate in making decisions on how their work areas operate, including making suggestions for improvement, planning, goal setting and monitoring performance.

Empowerment: A condition whereby employees have the authority to make decisions and take action in their work areas without prior approval. For example, an operator can stop a production process if he or she detects a problem, or a customer service representative can send out a replacement product if a customer calls with a problem.

EN 46000: Medical device quality management systems standard. EN 46000 is technically equivalent to ISO 13485:1996, an international medical device standard. So few differences exist between the two that if an organization is prepared to comply with one, it may easily comply with the other as well.

EN 9100: An international quality management standard for the aerospace industry (see AS9100).

Environmental Auditors Registration Association (EARA): Merged with the Institute of Environmental Management and the Institute of Environmental Assessment to form IEMA.

Ethics: The practice of applying a code of conduct based on moral principles to day-to-day actions to balance what is fair to individuals or organizations and what is right for society.

Exciter: See "delighter."

Expectations: Customer perceptions about how an organization's products and services will meet their specific needs and requirements.

Experimental design: A formal plan that details the specifics for conducting an experiment, such as which responses, factors, levels, blocks, treatments and tools are to be used.

External customer: A person or organization that receives a product, service or information but is not part of the organization supplying it. (See also "internal customer.")

External failure: Nonconformance identified by the external customers.

F

Facilitator: A specifically trained person who functions as a teacher, coach and moderator for a group, team or organization.

Failure: The inability of an item, product or service to perform required functions on demand due to one or more defects.

Failure cost: The cost resulting from the occurrence of defects.

Failure mode analysis (FMA): A procedure to determine which malfunction symptoms appear immediately before or after a failure of a critical parameter in a system. After all the possible causes are listed for each symptom, the product is designed to eliminate the problems.

Failure mode effects analysis (FMEA): A procedure in which each potential failure mode in every subitem of an item is analyzed to determine its effect on other subitems and on the required function of the item.

Failure mode effects and criticality analysis (FMECA): A procedure that is performed after a failure mode effects analysis to classify each potential failure effect according to its severity and probability of occurrence.

Feedback: Communication from customers about how delivered products or services compare with customer expectations.

Feigenbaum, Armand V.: The founder and president of General Systems Co., an international engineering company that designs and implements total quality systems. Feigenbaum originated the concept of total quality control in his book, *Total Quality Control*, published in 1951. The book has been translated into many languages, including Japanese, Chinese, French and Spanish. Feigenbaum is an ASQ

Honorary Member and served as ASQ president for two consecutive terms.

Fishbone diagram: See "cause and effect diagram."

Fitness for use: A term used to indicate that a product or service fits the customer's defined purpose for that product or service.

Five Ss: Five terms beginning with "S" utilized to create a workplace suited for visual control and lean production. *Seiri* means to separate needed tools, parts, and instructions from unneeded materials and to remove the latter. *Seiton* means to neatly arrange and identify parts and tools for ease of use. *Seiso* means to conduct a cleanup campaign. *Seiketsu* means to conduct *seiri*, *seiton*, and *seiso* at frequent, indeed daily, intervals to maintain a workplace in perfect condition. *Shitsuke* means to form the habit of always following the first four Ss.

Five whys: A technique for discovering the root causes of a problem and showing the relationship of causes by repeatedly asking the question, "Why?"

Flowchart: A graphical representation of the steps in a process. Flowcharts are drawn to better understand processes. The flowchart is one of the "seven tools of quality."

Focus group: A group, usually of 8 to 10 persons, that is invited to discuss an existing or planned product, service or process.

Force field analysis: A technique for analyzing the forces that aid or hinder an organization in reaching an objective. An arrow pointing to an objective is drawn down the middle of a piece of paper. The factors that will aid the objective's achievement, called the driving forces, are listed on the left side of the arrow. The factors that will hinder its achievement, called the restraining forces, are listed on the right side of the arrow.

14 Points: W. Edwards Deming's 14 management practices to help companies increase their quality and productivity: 1. create constancy of purpose for improving products and services, 2. adopt the new philosophy, 3. cease dependence on inspection to achieve quality, 4. end the practice of awarding business on price alone; instead, minimize total cost by working with a single supplier, 5. improve constantly and forever every process for planning, production and service, 6. institute training on the job, 7. adopt and institute leadership, 8. drive out fear, 9. break down barriers between staff areas, 10. eliminate slogans, exhortations and targets for the workforce, 11. eliminate numerical quotas for the workforce and numerical goals for management, 12. remove barriers that rob people of pride of workmanship, and eliminate the annual rating or merit system, 13. institute a vigorous program of education and self-improvement for everyone and 14. put everybody in the company to work to accomplish the transformation.

Frequency distribution (statistical): A table that graphically presents a large volume of data so the central tendency (such as the average or mean) and distribution are clearly displayed.

FS 9100: A quality management standard developed by the FS 9000 Association for the financial services industry.

Function: A group of related actions contributing to a larger action.

Funnel experiment: An experiment that demonstrates the effects of tampering. Marbles are dropped through a funnel in an attempt to hit a flat surfaced target below. The experiment shows that adjusting a stable process to compensate for an undesirable result or an extraordinarily good result will produce output that is worse than if the process had been left alone.

G

Gain sharing: A reward system that shares the monetary results of productivity gains among owners and employees.

Gantt chart: A type of bar chart used in process planning and control to display planned work and finished work in relation to time.

Gap analysis: The comparison of a current condition to the desired state.

Gatekeeper: A timekeeper; in team meetings, a designated individual who helps in monitoring the team's use of allocated time.

Gauge repeatability and reproducibility (GR&R): The evaluation of a gauging instrument's accuracy by determining whether the measurements taken with it are repeatable (there is close agreement among a number of consecutive measurements of the output for the same value of the input under the same operating conditions) and reproducible (there is close agreement among repeated measurements of the output for the same value of input made under the same operating conditions over a period of time).

Geometric dimensioning and tolerancing (GD&T): A method to minimize production costs by showing the dimensioning and tolerancing on a drawing while considering the functions or relationships of part features.

George M. Low Trophy: The trophy presented by NASA to those NASA aerospace industry contractors, subcontractors and suppliers that consistently maintain and improve the quality of their products and services. The award, which was formerly called the NASA Excellence Award for Quality and Productivity, is given in two categories: small business and large business. George M. Low was the NASA administrator for nearly three decades.

Goal: A broad statement describing a desired future condition or achievement without being specific about how much and when.

Golomski, William (deceased): ASQ past president and Honorary Member and president of W.A. Golomski and Associates, a technical and management consulting firm. He was an educator, consultant and author of more than 300 papers and 10 books. Golomski also co-founded the ASQ Food, Drug & Cosmetics Division, was founding editor of ASQ's *Quality Management Journal* and served on the initial judging panel for the Malcolm Baldrige National Quality Award. He developed quality systems in many industries.

Go/no-go: State of a unit or product. Two parameters are possible: go (conforms to specifications) and no-go (does not conform to specifications).

Good laboratory practices (GLP) or 21 CFR, part 58: 144 requirements that control the procedures and operations of toxicology laboratories.

Good manufacturing practices (GMP) or 21 CFR, parts 808, 812, and 820: Requirements governing the quality procedures of medical device manufacturers.

Grant, Eugene L.(deceased): Grant was part of a small team of professors assigned during World War II to introduce statistical quality control concepts to improve manufacturing production. He wrote many textbooks, including *Principles of Engineering Economy* and *Statistical Quality Control*, editions of which he co-authored with W. Grant Ireson and Richard S. Leavenworth. He was an ASQ Honorary Member and a pro-

fessor of economics engineering at Stanford University.

Green Belt (GB): A business team leader responsible for managing projects and implementing improvement in his or her organization. An employee of an organization who has been trained on the improvement methodology of Six Sigma and will lead a process improvement or quality improvement team as part of his or her full-time job.

Group dynamic: The interaction (behavior) of individuals within a team meeting.

Groupthink: A situation in which critical information is withheld from the team because individual members censor or restrain themselves, either because they believe their concerns are not worth discussing or because they are afraid of confrontation.

H

Hawthorne effect: The concept that every change results (initially, at least) in increased productivity.

Hazard analysis and critical control point (HACCP): A quality management system for effectively and efficiently ensuring farm to table food safety in the United States. HACCP regulations for various sectors are established by the United States Department of Agriculture and the Food and Drug Administration.

***Heijunka*:** The act of leveling the variety or volume of items produced at a process over a period of time. Used to avoid excessive batching of product types and volume fluctuations, especially at a pacemaker process.

Highly accelerated life test (HALT): A process developed to uncover design defects and weaknesses in electronic and mechanical assemblies using a vibration system combined with rapid high and low temperature changes. The purpose of HALT is to optimize product reliability by identifying the functional and destructive limits of a product. HALT addresses reliability issues at an early stage in product development.

Highly accelerated stress audits (HASA): A technique in which a sample of parts (as opposed to 100% of the production as in HASS, below) is taken and subjected to stresses similar to the levels and duration for HALT. In monitoring the production process, the intent of HASA is to detect slight shifts in the attributes of the product so corrective actions can be taken and implemented before the performance of outgoing product approaches the specifications.

Highly accelerated stress screening (HASS): A technique for production screening that rapidly exposes process or production flaws in products. Its purpose is to expose a product to optimized production screens without affecting product reliability. Unlike HALT, HASS uses nondestructive stresses of extreme temperatures and temperature change rates with vibration.

Histogram: A graphic summary of variation in a set of data. The pictorial nature of the histogram lets people see patterns that are difficult to detect in a simple table of numbers. The histogram is one of the "seven tools of quality."

Hoshin planning: Breakthrough planning. A Japanese strategic planning process in which a company develops up to four vision statements that indicate where the company should be in the next five years. Company goals and work plans are developed based on the vision statements. Periodic audits are then conducted to monitor progress.

House of quality: A product planning matrix, somewhat resembling a house, that is developed during quality function deployment and shows the relationship of customer requirements to the means of achieving these requirements.

Hunter, J. Stuart: An Honorary Member of ASQ, Hunter is a professor emeritus at Princeton University. His work as an educator and author helped enhance quantitative understanding. He wrote or co-wrote many papers, books and technical reports and is a founding editor of *Technometrics*.

I

Imagineering: Developing in the mind's eye a process without waste.

Imperfection: A quality characteristic's departure from its intended level or state without any association to conformance to specification requirements or to the usability of a product or service (see also "blemish," "defect" and "nonconformity").

Improvement: The positive effect of a process change effort.

In-control process: A process in which the statistical measure being evaluated is in a state of statistical control; in other words, the variations among the observed sampling results can be attributed to a constant system of chance causes (see also "out-of-control process").

Incremental improvement: Improvements that are implemented on a continual basis.

Indicators: Established measures used to determine how well an organization is meeting its customers' needs as well as other operational and financial performance expectations.

Inputs: The products, services, material and so forth obtained from suppliers and used to produce the outputs delivered to customers.

Inspection: Measuring, examining, testing and gauging one or more characteristics of a product or service and comparing the results with specified requirements to determine whether conformity is achieved for each characteristic.

Inspection cost: The cost associated with inspecting a product to ensure it meets the internal or external customer's needs and requirements; an appraisal cost.

Inspection, curtailed: Sampling inspection in which inspection of the sample is stopped as soon as a decision is certain. Thus, as soon as the rejection number for defectives is reached, the decision is certain and no further inspection is necessary. In single sampling, however, the whole sample is usually inspected in order to have an unbiased record of quality history. This same practice usually is followed for the first sample in double or multiple sampling.

Inspection lot: A collection of similar units or a specific quantity of similar material offered for inspection and acceptance at one time.

Inspection, normal: Inspection in accordance with a sampling plan that is used under ordinary circumstances.

Inspection, 100%: Inspection of all the units in the lot or batch.

Inspection, reduced: Inspection in accordance with a sampling plan requiring smaller sample sizes than those used in normal inspection. Reduced inspection is used in some inspection systems as an economy measure when the level of

submitted quality is sufficiently good and other stated conditions apply. Note: The criteria for determining when quality is "sufficiently good" must be defined in objective terms for any given inspection system.

Inspection, tightened: Inspection in accordance with a sampling plan that has stricter acceptance criteria than those used in normal inspection. Tightened inspection is used in some inspection systems as a protective measure when the level of submitted quality is sufficiently poor. It is expected the higher rate of rejections will lead suppliers to improve the quality of submitted product. Note: The criteria for determining when quality is "sufficiently poor" must be defined in objective terms for any given inspection system.

Instant pudding: A term used to illustrate an obstacle to achieving quality or the supposition that quality and productivity improvement are achieved quickly through an affirmation of faith rather than through sufficient effort and education. W. Edwards Deming used this term, which was initially coined by James Bakken of Ford Motor Co., in his book *Out of the Crisis*.

Intermediate customers: Organizations or individuals who operate as distributors, brokers or dealers between the supplier and the consumer / end user.

Internal customer: The recipient (person or department) within an organization of another person's or department's output (product, service or information) (see also "external customer").

Internal failure: A product failure that occurs before the product is delivered to external customers.

International Aerospace Quality Group: A cooperative organization of the global aerospace industry that is mainly involved in quality, cost reduction and process improvement efforts.

International Organization for Standardization, known as ISO: A network of national standards institutes from 140 countries working in partnership with international organizations, governments, industry, business and consumer representatives to develop and publish international standards. Acts as a bridge between public and private sectors.

Interrelationship digraph: A management tool that depicts the relationship among factors in a complex situation. Also called a "relations diagram."

Intervention: The action of a team facilitator when interrupting a discussion to state observations about group dynamics or the team process.

Ishikawa diagram: See "cause and effect diagram."

Ishikawa, Kaoru (deceased): A pioneer in quality control activities in Japan. In 1943, he developed the cause and effect diagram. Ishikawa, an ASQ Honorary Member, published many works, including *What Is Total Quality Control?*, *The Japanese Way*, *Quality Control Circles at Work* and *Guide to Quality Control*. He was a member of the quality control research group of the Union of Japanese Scientists and Engineers while also working as an assistant professor at the University of Tokyo.

ISO 14000: An environmental management standard related to what organizations do that affects their physical surroundings. In the process of being made compatible with ISO 9000.

ISO 9000 series standards: A set of international standards on quality management and quality assurance developed to help companies effectively document the quality system elements to be implemented to maintain an efficient quality system. The standards, initially published in 1987, are not specific to any particular industry, product or service. The standards were developed by the International Organization for Standardization, known as ISO, a specialized international agency for standardization composed of the national standards bodies of 91 countries. The standards underwent major revision in 2000 and now include ISO 9000:2000 (definitions), ISO 9001:2000 (requirements) and ISO 9004:2000 (continuous improvement).

ISO/TS 16949: The International Organization for Standardization, known as ISO, international technical specification for quality management systems, with particular requirements for the application of ISO 9001:2000 for automotive production and relevant service part organization. Now in its second edition.

J J

JIS Q 9100: An international quality management standard for the aerospace industry (see AS 9100).

Joint Committee for the Accreditation of Healthcare Organizations (JCAHO): JCAHO sets standards for, evaluates and accredits nearly 18,000 healthcare organizations and programs in the United States.

Juran, Joseph M.: The chairman emeritus of the Juran Institute and an ASQ Honorary Member. Since 1924, Juran has pursued a varied career in management as an engineer, executive, government administrator, university professor, labor arbitrator, corporate director and consultant. Specializing in managing for quality, he has authored hundreds of papers and 12 books, including *Juran's Quality Control Handbook*, *Quality Planning and Analysis* (with F. M. Gryna) and *Juran on Leadership for Quality*.

Juran trilogy: Three managerial processes identified by J.M. Juran for use in managing for quality: quality planning, quality control and quality improvement.

Just-in-time (JIT) manufacturing: An optimal material requirement planning system for a manufacturing process in which there is little or no manufacturing material inventory on hand at the manufacturing site and little or no incoming inspection.

Just-in-time training: The provision of training only when it is needed to all but eliminate the loss of knowledge and skill caused by a lag between training and use.

K K

***Kaizen*:** A Japanese term that means gradual unending improvement by doing little things better and setting and achieving increasingly higher standards. Masaaki Imai made the term famous in his book, *Kaizen: The Key to Japan's Competitive Success.*

***Kanban*:** A Japanese term for one of the primary tools of a just-in-time system. It maintains an orderly and efficient flow of materials throughout the entire manufacturing process. It is usually a printed card that contains specific information

such as part name, description and quantity.

Key performance indicator (KPI): A statistical measure of how well an organization is doing. A KPI may measure a company's financial performance or how it is holding up against customer requirements.

Key process: A major system level process that supports the mission and satisfies major consumer requirements.

Key results area: A major category of customer requirements that is critical for the organization's success.

Kruskal-Wallis test: The Kruskal-Wallis test is a nonparametric test to compare three or more samples. It tests the null hypothesis that all populations have identical distribution functions against the alternative hypothesis that at least two of the samples differ only with respect to location (median), if at all. It is the analogue to the F-test used in analysis of variance. While analysis of variance tests depend on the assumption that all populations under comparison are normally distributed, the Kruskal-Wallis test places no such restriction on the comparison. It is a logical extension of the Wilcoxon Mann-Whitney Test (see listing).

L

Leader: An individual who is recognized by others as a person they will follow.

Leadership: An essential part of a quality improvement effort. Organization leaders must establish a vision, communicate that vision to those in the organization and provide the tools and knowledge necessary to accomplish the vision.

Lean manufacturing: Initiative focused on eliminating all waste in manufacturing processes. Principles of lean include zero waiting time, zero inventory, scheduling (internal customer pull instead of push system), batch to flow (cut batch sizes), line balancing and cutting actual process times.

Life cycle stages: Design, manufacturing, assembly, installation, operation and shutdown of product.

Listening post: An individual who, by virtue of his or her potential for having contact with customers, is designated to collect, document and transmit pertinent feedback to a central collection authority within the organization.

Lost customer analysis: Analysis conducted to determine why a customer or a class of customers was lost.

Lot: A defined quantity of product accumulated under conditions considered uniform for sampling purposes.

Lot, batch: A definite quantity of some product manufactured under conditions of production that are considered uniform.

Lot quality: The value of percentage defective or of defects per hundred units in a lot.

Lot size (also referred to as N): The number of units in the lot.

Lot tolerance percentage defective (LTPD): Expressed in percentage defective, the poorest quality in an individual lot that should be accepted.

Note: LTPD is used as a basis for some inspection systems and is commonly associated with a small consumer's risk.

Lower control limit (LCL): Control limit for points below the central line in a control chart.

M

Maintainability: The probability that a given maintenance action for an item under given usage conditions can be performed within a stated time interval when the maintenance is performed under stated conditions using stated procedures and resources. Maintainability has two categories: serviceability (the ease of conducting scheduled inspections and servicing) and repairability (the ease of restoring service after a failure).

Malcolm Baldrige National Quality Award (MBNQA): An award established by the U.S. Congress in 1987 to raise awareness of quality management and recognize U.S. companies that have implemented successful quality management systems. Two awards may be given annually in each of five categories: manufacturing company, service company, small business, education and healthcare. The award is named after the late Secretary of Commerce Malcolm Baldrige, a proponent of quality management. The U.S. Commerce Department's National Institute of Standards and Technology manages the award, and ASQ administers it.

Management review: A periodic meeting of management at which it reviews the status and effectiveness of the organization's quality management system.

Manager: An individual charged with the responsibility for managing resources and processes.

Master Black Belt (MBB): Six Sigma or quality experts responsible for strategic implementations within the business. The Master Black Belt is qualified to teach other Six Sigma facilitators the methodologies, tools and applications in all functions and levels of the company and is a resource for utilizing statistical process control within processes.

Matrix: A planning tool for displaying the relationships among various data sets.

Mean: A measure of central tendency; the arithmetic average of all measurements in a data set.

Mean time between failures (MTBF): The average time interval between failures for repairable product for a defined unit of measure; for example, operating hours, cycles and miles.

Measure: The criteria, metric or means to which a comparison is made with output.

Measurement: The act or process of quantitatively comparing results with requirements.

Median: The middle number or center value of a set of data in which all the data are arranged in sequence.

Metric: A standard for measurement.

Metrology: The science of weights and measures or of measurement. A system of weights and measures.

MIL-Q-9858A: A military standard that describes quality program requirements.

MIL-STD-45662A: A military standard that describes the requirements for creating and maintaining a calibration system for measurement and test equipment.

MIL-STD-105E: A military standard that describes the sampling procedures and tables for inspection by attributes.

Mission: An organization's purpose.

Mode: The value occurring most frequently in a data set.

***Muda*:** Japanese for waste. Any activity that consumes resources but creates no value for the customer.

Multivariate control chart: A control chart for evaluating the stability of a process in terms of the levels of two or more variables or characteristics.

Myers-Briggs type indicator (MBTI): A methodology and an instrument for identifying an individual's personality type based on Carl Jung's theory of personality preferences.

N

n: The number of units in a sample.

N: The number of units in a population.

National Institute of Standards and Technology (NIST): An agency of the U.S. Department of Commerce that develops and promotes measurements, standards and technology. NIST manages the Malcolm Baldrige National Quality Award.

Natural team: A team of individuals drawn from a single work group; similar to a process improvement team except that it is not cross functional in composition and it is usually permanent.

Next operation as customer: The concept of internal customers in which every operation is both a receiver and a provider.

Nominal group technique: A technique, similar to brainstorming, used by teams to generate ideas on a particular subject. Team members are asked to silently come up with as many ideas as possible, writing them down. Each member is then asked to share one idea, which is recorded. After all the ideas are recorded, they are discussed and prioritized by the group.

Nonconformity: The nonfulfillment of a specified requirement (see also "blemish," "defect" and "imperfection").

Nondestructive testing and evaluation (NDT, NDE): Testing and evaluation methods that do not damage or destroy the product being tested.

Nonlinear parameter estimation: A methodology whereby the arduous, labor-intensive and distinctly frustrating task of multiparameter model calibration can be carried out automatically under the control of a computer.

Nonparametric tests: Nonparametric tests are often used in place of their parametric counterparts when certain assumptions about the underlying population are questionable. For example, when comparing two independent samples, the Wilcoxon Mann-Whitney test (see listing) does not assume the difference between the samples is normally distributed, whereas its parametric counterpart, the two-sample t-test, does. Nonparametric tests may be, and often are, more powerful in detecting population differences when certain assumptions are not satisfied. All tests involving ranked data (data that can be put in order) are nonparametric.

Nonvalue added: A term that describes a process step or function that is not required for the direct achievement of process output. This step or function is identified and examined for potential elimination.

Norm (behavioral): Expectations of how a person or persons will behave in a given situation based on established protocols, rules of conduct or accepted social practices.

Normal distribution (statistical): The charting of a data set in which most of the data points are concentrated around the average (mean), thus forming a bell shaped curve.

Number of affected units chart: A control chart for evaluating the stability of a process in terms of the total number of units in a sample in which an event of a given classification occurs.

O

Objective: A specific statement of a desired short-term condition or achievement; includes measurable end results to be accomplished by specific teams or individuals within time limits.

Operating characteristic curve (OC curve): A graph to determine the probability of accepting lots as a function of the lots' or processes' quality level when using various sampling plans. There are three types: type A curves, which give the probability of acceptance for an individual lot coming from finite production (will not continue in the future); type B curves, which give the probability of acceptance for lots coming from a continuous process; and type C curves, which (for a continuous sampling plan) give the long run percentage of product accepted during the sampling phase.

Original equipment manufacturer's (OEM): A company that uses product components from one or more other companies to build a product that it sells under its own company name and brand. Sometimes mistakenly used to refer to the company that supplies the components.

Ott, Ellis R. (deceased): An educator who devoted his career to providing U.S. industry with statistical quality control professionals. In 1946, Ott became the chairman of the mathematics department at Rutgers University's University College with one condition: that he could also consult on and teach quality control. His influence led the university to establish the Rutgers Statistics Center. Ott, an ASQ Honorary Member, developed the analysis of means procedure and published many papers.

Out-of-control process: A process in which the statistical measure being evaluated is not in a state of statistical control. In other words, the variations among the observed sampling results can be attributed to a constant system of chance causes (see also "in-control process").

Out of spec: A term that indicates a unit does not meet a given requirement.

Outputs: Products, materials, services or information provided to customers (internal or external), from a process.

P

Pareto chart: A graphical tool for ranking causes from most significant to least significant. It is based on the Pareto principle, which was first defined by J. M. Juran in 1950. The principle, named after 19th century economist Vilfredo Pareto, suggests most effects come from relatively few causes; that is, 80% of the effects come from 20% of the possible causes. The Pareto chart is one of the "seven tools of quality."

Partnership/alliance: Both a strategy and a formal relationship between a supplier and a customer that engenders cooperation for the benefit of both parties.

P chart: See "percent chart."

PDCA cycle: See "plan-do-check-act cycle."

Percent chart: A control chart for evaluating the stability of a process in terms of the percentage of the total number of units in a sample in which an event of a given classification occurs. The percent chart is also referred to as a proportion chart.

Performance standard: The metric against which a complete action is compared.

Plan-do-check-act (PDCA) cycle: A four-step process for quality improvement. In the first step (plan), a plan to effect improvement is developed. In the second step (do), the plan is carried out, preferably on a small scale. In the third step (check), the effects of the plan are observed. In the last step (act), the results are studied to determine what was learned and what can be predicted. The plan-do-check-act cycle is sometimes referred to as the Shewhart cycle, because Walter A. Shewhart discussed the concept in his book *Statistical Method From the Viewpoint of Quality Control,* and as the Deming cycle, because W. Edwards Deming introduced the concept in Japan. The Japanese subsequently called it the Deming cycle. Also called the plan-do-study-act (PDSA) cycle.

P95' P50' P10' P05' and so forth: The submitted quality in fraction defective for which the probability of acceptance is 0.95, 0.50, 0.10, 0.05, and so forth, for a given sampling plan. Note: The exact value of P95' P50' Pl0' P05' and so forth, depends on whether "submitted quality" relates to lot quality or process quality.

***Poka-yoke*:** Japanese term that means mistake-proofing. A *poka-yoke* device is one that prevents incorrect parts from being made or assembled or easily identifies a flaw or error.

Policy: An overarching plan (direction) for achieving an organization's goals.

Precision: The aspect of measurement that addresses repeatability or consistency when an identical item is measured several times.

Preventative action: Action taken to remove or improve a process to prevent potential future occurrences of a nonconformance.

Prevention cost: The cost incurred by actions taken to prevent a nonconformance from occurring.

Prevention vs. detection: A term used to contrast two types of quality activities. Prevention refers to activities designed to prevent nonconformances in products and services. Detection refers to activities designed to detect nonconformances already in products and services. Another phrase to describe this distinction is "designing in quality vs. inspecting in quality."

Probability (statistical): A term referring to the likelihood of occurrence of an event, action or item.

Probability of rejection: The probability that a lot will be rejected.

Problem solving: The act of defining a problem; determining the cause of the problem; identifying, prioritizing and selecting alternatives for a solution; and implementing a solution.

Procedure: The steps in a process and how these steps are to be performed for the process to fulfill customer's requirements.

Process: A set of interrelated work activities characterized by a set of specific inputs and value added tasks that make up a procedure for a set of specific outputs.

Process average quality: Expected or average value of process quality.

Process capability: A statistical measure of the inherent process variability for a given characteristic. The most widely accepted formula for process capability is six sigma.

Process capability index: The value of the tolerance specified for the characteristic divided by the process capability. The several types of process capability indexes include the widely used C_{pk} and C_p .

Process control: The methodology for keeping a process within boundaries; minimizing the variation of a process.

Process improvement: The application of the plan-do-study-act (PDSA) philosophy to processes to produce positive improvement and better meet the needs and expectations of customers (see "plan-do-check-act cycle").

Process improvement team: A structured environment often made up of cross functional members who work together to improve a process or processes.

Process *kaizen*: Improvements made at an individual process or in a specific area. Sometimes called "point *kaizen*."

Process management: The pertinent techniques and tools applied to a process to implement and improve process effectiveness, hold the gains and ensure process integrity in fulfilling customer requirements.

Process map: A type of flowchart depicting the steps in a process, with identification of responsibility for each step and the key measures.

Process owner: The person who coordinates the various functions and work activities at all levels of a process, has the authority or ability to make changes in the process as required and manages the entire process cycle to ensure performance effectiveness.

Process performance management (PPM): The overseeing of process instances to ensure their quality and timeliness. Can also include proactive and reactive actions to ensure a good result.

Process quality: The value of percentage defective or of defects per hundred units in product from a given process. Note: The symbols "p" and "c" are commonly used to represent the true process average in fraction defective or defects per unit; and "l00p" and "100c" the true process average in percentage defective or in defects per hundred units.

Process reengineering: A strategy directed toward major rethinking and restructuring of a process; often referred to as the "clean sheet of paper" approach.

Production part approval process (PPAP): A Big Three automotive process that defines the generic requirements for approval of production parts, including production and bulk materials. Its purpose is to determine during an actual production run at the quoted production rates whether all customer engineering design record and specification requirements are properly understood by the supplier and that the process has the potential to produce product consistently meeting these requirements.

Product or service liability: The obligation of a company to make restitution for loss related to personal injury, property damage or other harm caused by its product or service.

Product warranty: An organization's stated policy that it will replace, repair or reimburse a buyer for a product in the event a product defect occurrs under certain conditions and within a stated period of time.

Profound knowledge, system of: Defined by W. Edwards Deming, a system that consists of an appreciation for systems, knowledge of variation, theory of knowledge and understanding of psychology.

Project management: The application of knowledge, skills, tools and techniques to a broad range of activities to meet the requirements of the particular project. Project management knowledge and practices are best described in terms of their component processes. These processes can be placed

into five process groups (initiating, planning, executing, controlling and closing) and nine knowledge areas (project integration management, project scope management, project time management, project cost management, project quality management, project human resource management, project communications management, project risk management and project procurement management).

Project team: Manages the work of a project. The work typically involves balancing competing demands for project scope, time, cost, risk and quality, satisfying stakeholders with differing needs and expectations and meeting identified requirements.

Pull system: An alternative to scheduling individual processes, in which the customer process withdraws the items it needs from a supermarket, and the supplying process produces to replenish what was withdrawn. Used to avoid push. See also "*kanban*."

Q

QEDS Standards Group: The U.S. Standards Group on Quality, Environment, Dependability and Statistics consists of the members and leadership of organizations concerned with the development and effective use of generic and sector specific standards on quality control, assurance and management; environmental management systems and auditing, dependability and the application of statistical methods.

Q9000 series: Refers to ANSI/ISO/ASQ Q9000 series of standards, which is the verbatim American adoption of the 2000 edition of the ISO 9000 series standards.

QS-9000: A quality management standard developed by the Big Three Automakers for the automotive sector. Currently largely replaced by Technical Specification 16949 (ISO/TS 16949, see listing).

Quality: A subjective term for which each person has his or her own definition. In technical usage, quality can have two meanings: 1. the characteristics of a product or service that bear on its ability to satisfy stated or implied needs. 2. a product or service free of deficiencies.

Quality assurance/quality control (QA/QC): Two terms that have many interpretations because of the multiple definitions for the words "assurance" and "control." For example, "assurance" can mean the act of giving confidence, the state of being certain or the act of making certain; "control" can mean an evaluation to indicate needed corrective responses, the act of guiding or the state of a process in which the variability is attributable to a constant system of chance causes. (For a detailed discussion on the multiple definitions, see *ANSI/ISO/ASQ A3534-2, Statistics—Vocabulary and Symbols—Statistical Quality Control*.) One definition of quality assurance is: all the planned and systematic activities implemented within the quality system that can be demonstrated to provide confidence a product or service will fulfill requirements for quality. One definition for quality control is: the operational techniques and activities used to fulfill requirements for quality. Often, however, "quality assurance" and "quality control" are used interchangeably, referring to the actions performed to ensure the quality of a product, service or process.

Quality audit: A systematic, independent examination and review to determine whether quality activities and related results comply with planned arrangements and whether these arrangements are implemented effectively and are suitable to achieve the objectives.

Quality circles: Quality improvement or self-improvement study groups composed of a small number of employees (10 or fewer) and their supervisor. Quality circles originated in Japan, where they are called quality control circles.

Quality control: See "quality assurance/quality control."

Quality costs: See "cost of poor quality."

Quality engineering: The analysis of a manufacturing system at all stages to maximize the quality of the process itself and the products it produces.

Quality Excellence for Suppliers of Telecommunications (QuEST) Forum: A partnership of telecommunications suppliers and service providers with more than 130 members. The QuEst Forum developed TL 9000 (see listing).

Quality function deployment (QFD): A structured method in which customer requirements are translated into appropriate technical requirements for each stage of product development and production. The QFD process is often referred to as listening to the voice of the customer.

Quality loss function: A parabolic approximation of the quality loss that occurs when a quality characteristic deviates from its target value. The quality loss function is expressed in monetary units: the cost of deviating from the target increases quadratically the further the quality characteristic moves from the target. The formula used to compute the quality loss function depends on the type of quality characteristic being used. The quality loss function was first introduced in this form by Genichi Taguchi.

Quality management (QM): The application of a quality management system in managing a process to achieve maximum customer satisfaction at the lowest overall cost to the organization while continuing to improve the process.

Quality management system (QMS): A formalized system that documents the structure, responsibilities and procedures required to achieve effective quality management.

Quality plan: A document or set of documents that describe the standards, quality practices, resources and processes pertinent to a specific product, service or project.

Quality policy: An organization's general statement of its beliefs about quality, how quality will come about and what is expected to result.

Quality score chart: A control chart for evaluating the stability of a process. The quality score is the weighted sum of the count of events of various classifications in which each classification is assigned a weight.

Quality tool: An instrument or technique to support and improve the activities of process quality management and improvement.

Quality trilogy: A three-pronged approach to managing for quality. The three legs are quality planning (developing the products and processes required to meet customer needs), quality control (meeting product and process goals) and quality improvement (achieving unprecedented levels of performance).

Quincunx: A tool that creates frequency distributions. Beads tumble over numerous horizontal rows of pins, which force the beads to the right or left. After a random journey, the beads are dropped into vertical slots. After many beads are dropped, a frequency distribution results. In the classroom, quincunxes are often used to simulate a manufacturing process. The quincunx was invented by English scientist Francis Galton in the 1890s.

R

RAM: Reliability / availability / maintainability (see individual entries).

Random cause: A cause of variation due to chance and not assignable to any factor.

Random sampling: A commonly used sampling technique in which sample units are selected so that all combinations of n units under consideration have an equal chance of being selected as the sample.

Range (statistical): The measure of dispersion in a data set (the difference between the highest and lowest values).

Range chart (R chart): A control chart in which the subgroup range, R, is used to evaluate the stability of the variability within a process.

Red bead experiment: An experiment developed by W. Edwards Deming to illustrate it is impossible to put employees in rank order of performance for the coming year based on their performance during the past year because performance differences must be attributed to the system, not to employees. Four thousand red and white beads in a jar, 20% red, and six people are needed for the experiment. The participants' goal is to produce white beads because the customer will not accept red beads. One person begins by stirring the beads and then, blindfolded, selects a sample of 50 beads. That person hands the jar to the next person, who repeats the process and so on. When everyone has his or her sample, the number of red beads for each is counted. The limits of variation between employees that can be attributed to the system are calculated. Everyone will fall within the calculated limits of variation that could arise from the system. The calculations will show that there is no evidence one person will be a better performer than another in the future. The experiment shows that it would be a waste of management's time to try to find out why, say, John produced four red beads and Jane produced 15; instead, management should improve the system, making it possible for everyone to produce more white beads.

Reengineering: A breakthrough approach involving the restructuring of an entire organization and its processes.

Registrar Accreditation Board (RAB): A board that evaluates the competency and reliability of registrars (organizations that assess and register companies to the appropriate ISO 9000 series standards and to the ISO 14000 environmental management standard). RAB provides ISO course provider accreditation. Formed in 1989, RAB is governed by a board of directors from industry, academia and quality management consulting firms and by a joint oversight board for those programs operated with the American National Standards Institute (see listing).

Registration: The act of including an organization, product, service or process in a compilation of those having the same or similar attributes.

Registration to standards: A process in which an accredited, independent third-party organization conducts an on-site audit of a company's operations against the requirements of the standard to which the company wants to be registered. Upon successful completion of the audit, the company receives a certificate indicating that it has met the standard requirements.

Regression analysis: A statistical technique for determining the best mathematical expression describing the functional relationship between one response and one or more independent variables.

Rejection number: The smallest number of defectives (or defects) in the sample or samples under consideration that will require the rejection of the lot.

Reliability: The probability of a product's performing its intended function under stated conditions without failure for a given period of time.

Requirements: The ability of an item to perform a required function under stated conditions for a stated period of time.

Results: The effects that relate to what is obtained by an organization at the conclusion of a time period.

Right the first time: A term used to convey the concept that it is beneficial and more cost effective to take the necessary steps up front to ensure a product or service meets its requirements than to provide a product or service that will

Quirky Quality Dictionary

You're not likely to find these terms in any dictionary or quality handbook, but the *Quality Progress* staff thought you might have fun with the following:

Qubit: Measurement of all of quality's dimensions.

Qubicle: A place where many quality people work.

Qudos: High praise for quality work.

Quriosity: The desire to learn everything you can about quality.

Quisine: Really good food.

Qult: A group of people promoting quality.

Qultured: Enlightened about quality.

Quort: A place where the level of quality of a product is judged.

Quortesy: Quality behavior.

Qupid: The Roman god of quality.

Qure: A quality remedy.

Quru: A thought leader in the quality field.

Summa qum laude: Graduating top in your class with a degree in quality (also qum laude, magna qum laude).

Do you have other suggestions? Send them to editor@asq.org.

need rework or not meet customer needs. In other words, an organization should engage in defect prevention rather than defect detection.

Robustness: The condition of a product or process design that remains relatively stable, with a minimum of variation, even though factors that influence operations or usage, such as environment and wear, are constantly changing.

Romig, Harry G. (deceased): An Honorary Member and founder of ASQ who was most widely known for his contributions in sampling. At AT&T Bell Laboratories, Romig and Harold F. Dodge developed the Dodge-Romig sampling tables, operating characteristics for sampling plans and other fundamentals. Romig alone developed the first sampling plans using variables data and the concept of average outgoing quality limit. Later in his life, Romig was a consultant and taught quality related courses at several universities.

Root cause: A factor that caused a nonconformance and should be permanently eliminated through process improvement.

Run chart: A chart showing a line connecting numerous data points collected from a process running over a period of time.

S

Sample: In acceptance sampling, one or more units of product (or a quantity of material) drawn from a lot for purposes of inspection to reach a decision regarding acceptance of the lot.

Sample size: [n] The number of units in a sample.

Sample standard deviation chart (S chart): A control chart in which the subgroup standard deviation, s, is used to evaluate the stability of the variability within a process.

Sampling at random: As commonly used in acceptance sampling theory, the process of selecting sample units so all units under consideration have the same probability of being selected. Note: Actually, equal probabilities are not necessary for random sampling—what is necessary is that the probability of selection be ascertainable. However, the stated properties of published sampling tables are based on the assumption of random sampling with equal probabilities. An acceptable method of random selection with equal probabilities is the use of a table of random numbers in a standard manner.

Sampling, double: Sampling inspection in which the inspection of the first sample leads to a decision to accept a lot, reject it or take a second sample; the inspection of a second sample, when required, then leads to a decision to accept or to reject the lot.

Sampling, multiple: Sampling inspection in which, after each sample is inspected, the decision is made to accept a lot, reject it or to take another sample; but there is a prescribed maximum number of samples, after which a decision to accept or reject the lot must be reached. Note: Multiple sampling as defined here has sometimes been called "sequential n sampling" or "truncated sequential e sampling." The term "multiple sampling" is recommended by this standard.

Sampling, single: Sampling inspection in which the decision to accept or to reject a lot is based on the inspection of a single sample.

Sampling, unit: Sequential sampling inspection in which, after each unit is inspected, the decision is made to accept a lot, reject it or to inspect another unit.

Satisfier: A term used to describe the quality level received by a customer when a product or service meets expectations.

Scatter diagram: A graphical technique to analyze the relationship between two variables. Two sets of data are plotted on a graph, with the y-axis being used for the variable to be predicted and the x-axis being used for the variable to make the prediction. The graph will show possible relationships (although two variables might appear to be related, they might not be: those who know most about the variables must make that evaluation). The scatter diagram is one of the "seven tools of quality."

Scientific management/approach: A term referring to the intent to find and use the best way to perform tasks to improve quality, productivity and efficiency.

Scorecard: A scorecard is an evaluation device, usually in the form of a questionnaire, that specifies the criteria customers will use to rate your business's performance in satisfying their requirements.

Self-directed work team (SDWT): A type of team structure in which much of the decision making regarding how to handle the team's activities is controlled by the team members themselves.

Service level agreement: A formal agreement between an internal provider and an internal receiver (customer).

Seven tools of quality: Tools that help organizations understand their processes to improve them. The tools are the cause and effect diagram, check sheet, control chart, flowchart, histogram, Pareto chart and scatter diagram (see individual entries).

Shanin, Dorian (deceased): An Honorary Member of ASQ, Shanin developed a discipline called statistical engineering. He was in charge of quality control at a larger division of United Technologies Corp. and later did consulting for more than 900 organizations. Shanin also was on the faculty of the University of Chicago and wrote more than 100 articles and several books.

Shewhart cycle: See "plan-do-check-act cycle."

Shewhart, Walter A. (deceased): Referred to as the father of statistical quality control because he brought together the disciplines of statistics, engineering and economics. He described the basic principles of this new discipline in his book *Economic Control of Quality of Manufactured Product*. Shewhart, ASQ's first Honorary Member, was best known for creating the control chart. Shewhart worked for Western Electric and AT&T Bell Telephone Laboratories, in addition to lecturing and consulting on quality control.

Signal to noise ratio (S/N ratio): A mathematical equation that indicates the magnitude of an experimental effect above the effect of experimental error due to chance fluctuations.

Six Sigma: A methodology that provides businesses with the tools to improve the capability of their business processes. This increase in performance and decrease in process variation lead to defect reduction and improvement in profits, employee morale and quality of product.

Six Sigma quality: A term generally used to indicate a process is well controlled, (±6 sigma from the centerline in a control chart). The term is usually associated with Motorola, which named one of its key operational initiatives "Six Sigma quality."

Software quality assurance (SQA): A planned and sys-

tematic approach to the evaluation of the quality of and adherence to software product standards, processes and procedures. SQA includes the process of assuring that standards and procedures are established and are followed throughout the software acquisition life cycle.

Special causes: Causes of variation that arise because of special circumstances. They are not an inherent part of a process. Special causes are also referred to as assignable causes (see also "common causes").

Specification: A document that states the requirements to which a given product or service must conform.

Sponsor: The person who supports a team's plans, activities and outcomes; the team's "backer."

Stages of team growth: Four stages that teams move through as they develop maturity over time: forming, storming, norming and performing.

Stakeholder: Any individual, group or organization that will have a significant impact on or will be significantly impacted by the quality of the product or service an organization provides.

Standard: The metric, specification, gage, statement, category, segment, grouping, behavior, event or physical product sample against which the outputs of a process are compared and declared acceptable or unacceptable.

Standard deviation (statistical): A computed measure of variability indicating the spread of the data set around the mean.

Standard work: A precise description of each work activity specifying cycle time, takt time (see listing), the work sequence of specific tasks and the minimum inventory of parts on hand needed to conduct the activity.

Statistical process control (SPC): The application of statistical techniques to control a process. The term "statistical quality control" is often used interchangeably with "statistical process control."

Statistical quality control (SQC): The application of statistical techniques to control quality. The term "statistical process control" is often used interchangeably with "statistical quality control," although statistical quality control includes acceptance sampling as well as statistical process control.

Statistics: A field that involves the tabulating, depicting and describing of data sets; a formalized body of techniques characteristically involving attempts to infer the properties of a large collection of data from inspection of a sample of the collection.

Strategic planning: The process by which an organization envisions its future and develops strategies, goals, objectives and action plans to achieve that future.

Stretch goals: A set of goals designed to position the organization to meet future requirements.

Structural variation: Variation caused by regular, systematic changes in output, such as seasonal patterns and long-term trends.

Supplier: A source of materials, service or information input provided to a process.

Supplier quality assurance: Confidence a supplier's product or service will fulfill its customers' needs. This confidence is achieved by creating a relationship between the customer and supplier that ensures the product will be fit for use with minimal corrective action and inspection. According to J. M. Juran, there are nine primary activities needed: 1. define product and program quality requirements, 2. evaluate alternative suppliers, 3. select suppliers, 4. conduct joint quality planning, 5. cooperate with the supplier during the execution of the contract, 6. obtain proof of conformance to requirements, 7. certify qualified suppliers, 8. conduct quality improvement programs as required and 9. create and use supplier quality ratings.

Supply chain: The series of suppliers relating to a given process.

Surveillance: The continual monitoring of a process; a type of periodic assessment or audit conducted to determine whether a process continues to perform to a predetermined standard.

Survey: The act of examining a process or of questioning a selected sample of individuals to obtain data about a process, product or service.

Symptom: An observable phenomenon arising from and accompanying a defect.

System: A group of interdependent processes and people that together perform a common mission.

System *kaizen*: Improvement aimed at an entire value stream.

T

Taguchi, Genichi: Executive director of the American Supplier Institute, the director of the Japan Industrial Technology Institute and an honorary professor at Nanjing Institute of Technology in China. Taguchi is well-known for developing a methodology to improve quality and reduce costs, which, in the United States, is referred to as the Taguchi Methods. He also developed the quality loss function. He is an Honorary Member of ASQ.

Taguchi Methods: The American Supplier Institute's trademarked term for the quality engineering methodology developed by Genichi Taguchi. In this engineering approach to quality control, Taguchi calls for off-line quality control, on-line quality control and a system of experimental design to improve quality and reduce costs.

Takt time: The rate of customer demand. Takt is the heartbeat of a lean system. Takt time is calculated by dividing production time by the quantity the customer requires in that time.

Tampering: Action taken to compensate for variation within the control limits of a stable system. Tampering increases rather than decreases variation, as evidenced in the funnel experiment.

Task: A specific, definable activity to perform an assigned piece of work, often finished within a certain time.

Team: A group of individuals organized to work together to accomplish a specific objective.

Theory of constraints (TOC): Also called constraints management, it is a set of tools that examines the entire system for continuous improvement. The current reality tree, conflict resolution diagram, future reality tree, prerequisite tree and transition tree are the five tools used in its ongoing improvement process.

TL 9000: A quality management standard for the telecommunications industry built on ISO 9000. Its purpose is to define the requirements for the design, development, production, delivery, installation and maintenance of products and

services. Included are cost and performance based measurements that measure reliability and quality performance of the products and services.

Tolerance: The maximum and minimum limit values a product may have and still meet customer requirements.

Tooling and Equipment (TE) Supplement: An interpretation of QS-9000 (see listing) developed by the Big Three automakers for tooling and equipment suppliers.

Top-management commitment: Participation of the highest level officials in their organization's quality improvement efforts. Their participation includes establishing and serving on a quality committee, establishing quality policies and goals, deploying those goals to lower levels of the organization, providing the resources and training lower levels need to achieve the goals, participating in quality improvement teams, reviewing progress organizationwide, recognizing those who have performed well and revising the current reward system to reflect the importance of achieving the quality goals.

Total productive maintenance (TPM): A series of methods, originally pioneered by Nippondenso (a member of the Toyota group), to ensure every machine in a production process is always able to perform its required tasks so that production is never interrupted.

Total quality: A strategic integrated system for achieving customer satisfaction that involves all managers and employees and uses quantitative methods to continuously improve an organization's processes.

Total quality control (TQC): A system that integrates quality development, maintenance and improvement of the parts of an organization. It helps a company economically manufacture its product and deliver its services.

Total quality management (TQM): A term initially coined by the Naval Air Systems Command to describe its Japanese style management approach to quality improvement. Since then, TQM has taken on many meanings. Simply put, it is a management approach to long-term success through customer satisfaction. TQM is based on the participation of all members of an organization in improving processes, products, services and the culture in which they work. The methods for implementing this approach are found in the teachings of such quality leaders as Philip B. Crosby, W. Edwards Deming, Armand V. Feigenbaum, Kaoru Ishikawa and Joseph M. Juran.

Transaction data: The finite data pertaining to a given event occurring in a process. Examples are the data obtained from an individual checking out groceries (the grocery shopping process) and the data obtained from testing a machined component (the final product inspection step of the production process).

Tree diagram: A management tool that depicts the hierarchy of tasks and subtasks needed to complete an objective. The finished diagram bears a resemblance to a tree.

Trend: The graphical representation of a variable's tendency, over time, to increase, decrease or remain unchanged.

Trend control chart: A control chart in which the deviation of the subgroup average, X-bar, from an expected trend in the process level is used to evaluate the stability of a process.

t-test: Assesses whether the means of two groups are statistically different from each other. Use this analysis if you want to compare the means of two groups.

Type I error: An incorrect decision to reject something (such as a statistical hypothesis or a lot of products) when it is acceptable.

Type II error: An incorrect decision to accept something when it is unacceptable.

U

U chart: Count per unit chart.

Unit: An object on which a measurement or observation can be made. Note: Commonly used in the sense of a "unit of product,"the entity of product inspected in order to determine whether it is defective or nondefective.

Upper control limit (UCL): Control limit for points above the central line in a control chart.

V

Validation: The act of confirming a product or service meets the requirements for which it was intended.

Validity: The ability of a feedback instrument to measure what it was intended to measure; also, the degree to which inferences derived from measurements are meaningful.

Value added: The parts of the process that add worth from the perspective of the external customer.

Value adding process: Activities that transform input into a customer usable output. The customer can be internal or external to the organization.

Values: The fundamental beliefs that drive organizational behavior and decision making.

Value stream: All activities, both value added and nonvalue added, required to bring a product from raw material state into the hands of the customer, bring a customer requirement from order to delivery and bring a design from concept to launch.

Value stream loops: Segments of a value stream with boundaries broken into loops are a way to divide future state implementation into manageable pieces.

Value stream manager: Person responsible for creating a future state map and leading door-to-door implementation of the future state for a particular product family. Makes change happen across departmental and functional boundaries.

Value stream mapping: A pencil and paper tool used in two stages: 1. Follow a product's production path from beginning to end and draw a visual representation of every process in the material and information flows. 2. Then draw a future state map of how value should flow. The most important map is the future state map.

Variable data: Measurement information. Control charts based on variable data include average (X-bar) chart, range (R) chart, and sample standard deviation (s) chart.

Variation: A change in data, characteristic or function caused by one of four factors: special causes, common causes, tampering or structural variation (see individual entries).

Verification: The act of determining whether products and services conform to specific requirements.

Virtual team: Remotely situated individuals affiliated with a common organization, purpose or project who conduct their joint effort via electronic communication.

Vision: An overarching statement of the way an organization wants to be; an ideal state of being at a future point.

Vital few, useful many: A term used by Joseph M. Juran to describe his use of the Pareto principle, which he first defined in 1950. (The principal was used much earlier in economics and inventory control methodologies.) The principle suggests most effects come from relatively few causes; that is, 80% of the effects come from 20% of the possible causes. The 20% of the possible causes are referred to as the "vital few"; the remaining causes are referred to as the "useful many." When Juran first defined this principle, he referred to the remaining causes as the "trivial many," but realizing that no problems are trivial in quality assurance, he changed it to "useful many."

Voice of the customer: The expressed requirements and expectations of customers relative to products or services, as documented and disseminated to the members of the providing organization.

W

Waste: Any activity that consumes resources and produces no added value to the product or service a customer receives.

Weighed voting: A way to prioritize a list of issues, ideas or attributes by assigning points to each item based on its relative importance.

Wescott, Mason E.: ASQ founder and Honorary Member. A professor emeritus at the Rochester Institute of Technology (RIT), Wescott has been teaching mathematics and statistics since 1925. He has taught at Northwestern University, Rutgers University and RIT, where the Wescott Statistics Laboratory was dedicated in his honor in 1984. Wescott succeeded Martin A. Brumbaugh as the editor of Industrial Quality Control in 1947, a position he held until 1961.

Whisker: From box plot, displays minimum and maximum observations within 1.5 IQR (75th to 25th percentile span) from either 25th or 75th percentile. Outlier are those that fall outside of the 1.5 range.

Wilcoxon Mann-Whitney test: Used to test the null hypothesis that two populations have identical distribution functions against the alternative hypothesis that the two distribution functions differ only with respect to location (median), if at all. It does not require the assumption that the differences between the two samples are normally distributed. In many applications, it is used in place of the two sample t-test when the normality assumption is questionable. This test can also be applied when the observations in a sample of data are ranks, that is, ordinal data rather than direct measurements.

Work team: A team comprising members from one work unit. Also called a "natural team."

World-class quality: A term used to indicate a standard of excellence: best of the best.

X

X-bar chart: Average chart.

Z

Zero defects: A performance standard and methodology developed by Philip B. Crosby that states if people commit themselves to watching details and avoiding errors, they can move closer to the goal of zero.

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