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# Quality Control of Documents

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## ABSTRACT

WRITINGS ON THE TOTAL QUALITY MANAGEMENT (TQM) concept as applied to the organization as a whole are reviewed. This approach is then compared to quality measures used for the selection and indexing of documents for inclusion in a database, methods of maintaining currency and relevancy in existing databases, and techniques used by information professionals in the selection of material from databases in response to user needs. Various methods of quality filtering of input, throughput, and output are assessed. Conclusions suggest that a total quality approach merits greater application by all parties involved.

## INTRODUCTION

An information system may be used,...but not be useful; it may also be useful, but not used. It may even be neither useful nor used. It is ideal if it is *both* used and useful—Manfred Kochen (1976, p. 150)

Martha Williams (1990), in her opening address to the eleventh annual national online meeting, documented the continuing growth in the database industry. She cited the increase in the number of databases, database producers, vendors, revenue, searchers, and the like. The most striking statistic was the growth in the number of database records in the worldwide set of publicly available databases. According to Williams (p. 2), this rose from 52 million in 1975 to nearly 5 billion in 1989. One effect of this dramatic increase has been a substantial growth in the number of problems. A strong

concern for quality might lead one to speculate about the proportion of these records that are inaccurate, obsolete, duplicates, or trivial. If a percentage as low as 10 percent were estimated for inaccurate records, another 10 percent for obsolete materials, and still another 10 percent for duplicates or inconsequential entries, it suggests that some 150 million records in publicly available databases are problematic. If we revise our estimate downward substantially to a tenth, or a hundredth, or a thousandth of that amount, it would still mean anywhere from 100,000 to 15 million bad records. Yet a guarantee of accurate, current, nonduplicated consequential records at the 90, 99 or 99.9 percent level sounds like a high degree of reliability. In actual practice, it may be much lower and our requirement may be much higher.

An estimate of the proportion of these 5 billion records that are actually retrieved and used moves us to the other end of the spectrum. A number of studies of library circulation over the past twenty years have shown that only a fraction of the total collection accounts for the majority of its use. The 80/20 ratio found for collection use (80 percent of the use is from 20 percent of the collection) reflects similar findings from a wide number of fields. Statisticians use the term "concentration effect" to describe the phenomenon that, in any population which contributes to a common effect, a relative few of the contributors account for the bulk of the effect. Juran (1992), one of the leaders of the "Total Quality Management (TQM)" movement, terms instances of unequal distribution the Pareto principle after Pareto's mathematical models for the unequal distribution of wealth. He employs the phrase "the 'vital few and trivial many'" as a useful way to focus attention on the more important elements of a population (pp. 68-71). An order of magnitude change in the base number of records from which to find "the vital few" makes the retrieval problem extraordinarily difficult and, all too often, results in retrieval of large amounts of the "trivial many." Says Prabha (1990): "The sheer number of bibliographic references retrieved degrades the quality of retrieval output when the number exceeds users' tolerance" (p. 339). The filtering techniques most commonly used to select "the vital few" references often seem more like blunt instruments than delicate extractive tools.

Rapid information obsolescence is a third effect of the gargantuan increases in the recorded knowledge base. This, combined with the speed with which yesterday's knowledge decays and is replaced by today's findings, creates another problem. In addition to coping with information obsolescence, discoveries of fraudulent or falsified data surface with alarming frequency. The National Library of Medicine (NLM), as part of a quality assurance effort, has added the heading

"retracted publication" to its controlled vocabulary list to indicate an article that has been retracted by the original published journal (Kotzin & Schuyler, 1989). In one case, however, where the physician was indicted on criminal charges of falsifying research, NLM could not index a retraction, because the physician, his laboratory, nor the journal editors published a retraction of the falsified research (pp. 338-39). This anecdote suggests that quality control of documents encompasses a very large system that includes the author and the journal publishers as well as the database producers and those who retrieve from the databases.

A slightly different problem concerns the scope and coverage of databases. Whitney (1991) notes: "It has become popular to analyze databases to determine author's publishing habits, national productivity in research, and other bibliographic attributes of a given literature" on the assumption that the databases "accurately reflect the literature they purport to cover" (p. 533). Whitney demonstrates that organizational variables (e.g., database editing and staff practices) may be an artifactual cause of various trends attributed to the growth and change of a literature.

Pao (1989b) documents the impact of database quality on retrieval performance in her analysis of 8,184 records randomly selected for a study of research productivity in one particular field. In her sample, sixty-six duplicate records were identified, publication years were not consistently entered, and numerous errors and misspellings were discovered in the author field. Pao found that the percentage of author errors distorted author productivity distribution to such an extent that it no longer conformed to Lotka's Law.

Thus, from the three perspectives of controlling input error, enhancing retrieval, and correcting the existing database, there seems to be a growing need for better techniques of quality filtering. Interest in the topic is timely because there is an emerging consensus that information professionals must take greater responsibility for the quality of the product or service delivered to the client. As Keiser (1991) puts it: "Being a good manager means taking responsibility for that which your department produces; in our case, it's information" (p. 194). It is also timely because "quality" is the byword of the 1990s. In order to remain competitive in a global marketplace, every organization and every individual within those organizations are asked to pay greater attention to quality improvement. Customers and end-users of database searching have become aware of issues relating to quality and they are demanding greater reliability and precision commensurate with the dollar and/or time cost they incur in use.

Parallel to the demand for higher quality is a yearning for a more trust-based compact between customers and their suppliers. The downward spiral of seeking the lowest cost solution and quick profits that characterizes much of American society today has created a demoralizing atmosphere of suspicion and distrust. This, too, will have to be redressed before a more receptive climate for fresh approaches to quality can be created.

To assess the feasibility and desirability of quality control of documents, the writings on quality issues as applied to the organization as a whole will be reviewed. Lessons gleaned from this material will be applied first to quality issues dealing with the selection and indexing of documents for inclusion in a database (that is, what determines quality in the development of a product or service on the input side). The second aspect of quality control of documents focuses on throughput, that is, what determines quality in maintaining currency and relevancy within the collection or database. A third assessment of quality relates to the selection of material from a collection or database in response to a user need, that is, what determines quality on the output side in the delivery of a product or service.

## TOTAL QUALITY MANAGEMENT (TQM)

*It is quality rather than quantity that matters—Seneca (1985)*

The quality movement by whatever name—quality management, continuous improvement, quality leadership, integrated process management, or total quality management—refers to a philosophy, a strategy, and a methodology of management that, according to one of the earliest formulations (Shewhart, 1931), uses information feedback from work processes and from customers to improve services and products continuously. It began in Bell Laboratories (then Bell Institute) over sixty years ago when William Shewhart and W. Edwards Deming collaborated to apply statistical controls to understand processes. The history of the quality movement can be traced, in part, by following Deming's career, as his name has become virtually synonymous with it.

Although Deming's doctorate was in physics, he became interested in statistics through his collaborative work with Shewhart. The two men theorized that the limits of variation for any process could be defined. Deming further believed that workers with knowledge of acceptable variance could monitor their own tasks. His first experiments with clerical workers supported his belief. During the second world war, statistical process controls were applied by

Deming in work for the Navy. Afterward, there was little continuing interest in the approach in the United States, but a group of Japanese scientists (who later became the Japan Union of Scientists and Engineers) approached Deming and invited him to help solve the problem of the poor quality of Japanese products. Deming's work is credited with a complete turnaround in the quality of these goods, the rapidity of which caught the attention of the media. In 1980, a documentary about Deming's work, "If Japan Can, Why Can't We?", appeared on national television and galvanized a renewed interest in issues of quality in the United States.

Deming's fourteen points of management describe the transformation he believes is necessary to reorient an organization for high quality (Deming, 1986; also Walton, 1986, 1990). "Create constancy of purpose..." (Deming, 1986, p. 23), the first point, means that improvement of products and services requires a long-term commitment; TQM is not a quick fix. Some of Deming's other points include:

"Cease dependence on inspection to achieve quality" (p. 23). Each individual should be equipped to track his or her own performance and to take a more pro-active approach to correcting problems.

"Institute training on the job....Institute a vigorous program of education and self-improvement" (pp. 23-24). Deming means first teaching each worker where his or her particular job fits into the total organization and then teaching specific statistical and analytical techniques to provide a baseline for accountability and to determine variance and causes of error, to perceive patterns of occurrence, and to monitor the whole process. Training, he believes, should also be directed to team-building skills because the work team must be the focus of improvement efforts. Training takes place at all levels, at all times (Mackey & Mackey, 1992, p. 61). Retraining established employees is also essential to develop new skills, to "keep abreast of technological changes, or be prepared for changes in the job. In the Deming world," say Mackey and Mackey (1992), "retraining is a way of rewarding good employees, preparing employees for advancement, and preventing burnout" (p. 610).

"Drive out fear" (Deming, 1986, p. 23). Workers should be rewarded, not punished, for pointing out problems, even problems in their own performance. "Break down barriers between departments" (p. 24). This suggests a horizontal view of the organization and use of cross-functional teams. Other points include: "Eliminate work standards (quotas)....Eliminate management by objective. Eliminate...numerical goals" (p. 24). Use standards to measure the *process* by which ends are achieved but not the end results. "Remove

barriers that rob people...of their right to pride of workmanship....Eliminate slogans, exhortations and targets....Institute leadership....Put everybody in the company to work to accomplish the transformation" (pp. 23, 24).

The quality movement in the United States follows a long period in which marketing has been the principal focus of attention. It has meant the rediscovery of the importance of the details of production and service delivery and the realization that management has to become more knowledgeable about these operations. The U.S. approach to quality management, during the period up to the 1980s, was primarily confined to the production line in manufacturing companies. Inspection of all items produced or a sample of them was the accepted way to control quality; a typical goal of 1 percent defects was considered satisfactory.

Early indicators that this approach was not satisfactory led to several changes. One of the first was a greater emphasis on prevention rather than correction of problems. Feigenbaum (1983) argued that significant expenses could be avoided by getting the product or service right the first time, thus introducing the "cost of quality" concept. The saying, "You don't inspect quality into a product, you have to build it in!" emphasized this shift in emphasis from inspection to prevention (Kivenko, 1984, p. 9). Investing in prevention can be economic, as Crosby (1979) demonstrates in a classic book with the compelling title, *Quality is Free*. The quality control department changed its name to quality assurance to reflect its new attitude that quality begins with the prevention of errors; "zero defects" (that is, a product or service that meets the specification set for it every time) became the new goal. To establish "zero defects" meant that the product or service had to be defined more precisely and the methods by which it was produced or provided also had to be more carefully designated.

This new direction meant a stronger emphasis on standards, systems, rules, and procedures. Companies began to develop quality auditing methods to ensure that proper procedures were followed (see, for example, Arter, 1989). Standards were first developed by a separate class of controllers, but the division of responsibility between the doers and the controllers resulted in much tension between workers and supervisors. The stage was set for more top management involvement.

The reluctance of management to face its responsibility for producing quality products and services is characterized by Deming (1986) in typical pithy fashion, as the "failure of top management to manage" (p. ix). To achieve top management commitment to quality, Juran (1992) suggests that the language of things and

techniques used at the operational level must be translated to the better understood language of money for managers (i.e., better quality reduces costs and increases productivity). Many of Deming's and Juran's techniques focus on ways to achieve technical perfection, but they both stress that it is from customers—their requirements and needs—that targets for improvement and criteria for standards must come. One of the Japanese experts on quality control writes: "To practice quality control is to develop, design, produce and service a quality product which is most economical, most useful, and always satisfactory to the consumer... We must emphasize *consumer orientation*" (Ishikawa, 1985, p. 44). Perhaps one of the reasons why *In Search of Excellence*, published in 1982 (Peters & Waterman), was such a highly popular book was because its authors suggest that some American companies also have lessons about quality to offer—lessons that relate to quality as the customer defines it.

The focus on customers advocated by Peters and Waterman, the Japanese, and current writers on quality control is a broad one. Customers are the ones who should determine the output standards—that is, the criteria of excellence. The question of who is the customer is answered by enumerating the many kinds of customers—both external and internal—that are conceivable. Externally, customers include those who purchase, the ultimate users (often different from the purchasers), the regulators who have mandated requirements, the vendors or suppliers, and the general public. All of these customers must be studied to determine output standards for products and services. Extending the concept of customers even further, Juran suggests two internal categories of customer-supplier relationships. The first group includes supervisors and subordinates. The supervisor is considered a customer of the subordinate's work because the quality of that work affects whether or not the supervisor can meet his or her responsibilities; conversely, the subordinate is also a customer of the supervisor from whom he/she receives training, information, orders, advice, decisions, and resources needed for the work. The quality of the supervisor's instructions affects whether the worker can perform well. A second group of internal customers, according to Juran (1988), are all the internal units who must depend on output of another internal unit to achieve their goals and who must satisfy other units with their own output (pp. 24-27). The concept of a chain of supplier-customer relationships in which each receiver/customer sets standards of quality for each individual or unit supplying the service or product is a powerful way of breaking down barriers between departments and creating a partnership relationship with external clients.

Serving the customer well is profitable and has other benefits. Most employees want to feel they satisfy the customers. One survey of 3,300 employees in fourteen companies showed that the most important factor connected to an employee remaining in a company and having high morale was whether he or she thought the organization provided good service to its customers (Whiteley, 1991, p. 16). Whiteley makes a distinction between processing customers and pleasing them, closely akin to the distinction Peters and Austin (1985) make between satisfying customers and delighting them.

In 1987, a federal law created the Malcolm Baldrige National Quality Award as a recognition incentive for profit-making companies. Two awards may be given each year in each of three categories: large manufacturing companies, large service companies, and small companies with fewer than 500 employees in either manufacturing or service. Criteria for the awards are spelled out in seven categories, each assigned a different weighting. The categories are: (1) leadership, (2) information and analysis, (3) strategic quality planning, (4) human resources utilization, (5) quality assurance of products and services, (6) quality results, and (7) customer satisfaction. The first three items may receive anywhere from 60 to 90-points each; the next three are weighted more heavily and may earn 150 points each. The last one—the effectiveness of the company's systems to determine customer requirements and its demonstrated success in meeting these requirements—may earn 300 points (National Institute of Standards and Technology, 1991). To date, no service agency has received an award. Service agencies fail in two categories: (1) human resource utilization, because employee turnover is too high, and (2) quality assurance, because service companies lack good ways of measuring quality (*Commitment-Plus*, July 1990, p. 2). In an example of one award-winning company's attitude to its workers, Charles Cawley, the president of MBNA, when accepting the Baldrige award for his company, commented that MBNA no longer uses the word "employee" because they feel: "It reduces people to a category and carries with it undertones of ownership"; in its place they employ "people" who are treated as customers (Whiteley, 1991, p. 91).

Quality management concepts begin with three necessary, but insufficient, ingredients: (1) top management commitment, (2) employee involvement and empowerment, and (3) a strong customer orientation. These set the stage for the application of a wide array of analytical tools and techniques. Statistical tools, graphic modeling, and systems analysis techniques are essential components of analysis. The design of an appropriate measuring system is critical. Appropriate measures arise from customer needs—i.e., product and service characteristics that are important to customers and identified

according to their relative value and the level of performance that will meet the needs.

The statistical tool of first importance is concentration or Pareto analysis. It helps to identify the critical components of the process, particularly the few items that may account for the majority of problems. A Pareto diagram shows the relative influence of a small number of factors that affect the quality of a product or service. The purpose of the diagram, of course, is to establish the first target—that factor where the impact of improvement will be the greatest.

Cause and effect diagrams, sometimes called Ishikawa diagrams after their designer, or fishbone diagrams after their appearance, graphically identify and display possible causes of problems or the factors needed for a success of some effort. Time plots or run charts are used to determine data for trends on patterns that occur over times and form the basis for making a control chart that uses measures of variability to depict average performance and upper and lower control limits to show the variability within which performance normally fluctuates. Control charts are used for machine or human self-regulation to monitor a process to assess if it is within acceptable limits. Dot plots and histograms show what values occur and how often. Stratification helps pinpoint a problem by exposing patterns of occurrence—when and where. Scatter diagrams display the relationship between two process characteristics. Flow charts; work flow diagrams; and deployment flowcharts lay out tasks; decision points; the movement of materials, people, or information; and identify who has responsibility for which steps in a process. All of these techniques are applied to the study of processes at the micro and macro levels to determine first where improvement efforts should be directed and then to acquire an understanding of the process that will reveal how improvements can be made.

Process analysis methods are sometimes referred to as the TQC cycle, the Deming Wheel, or PDCA cycle (for Plan-Do-Check-Adopt) (Shores, 1988). A simplified list of the steps follows:

- *Understand*—who the customers are, what products or services are offered, how the products or services are performed, and whether or not they meet expectations.
- *Select*—from a list of prioritized problems the one that promises the biggest improvement if it is solved.
- *Analyze*—how the process really works, what the current level of performance is, and what are potential and actual causes of problems.

- *PDCA*—*Plan* a solution; *do* an experiment with the approach; *check* to see if it works as expected; *adopt* the solution permanently.

The notion of a cycle suggests, of course, that the process of improvement making is never ending, hence, the frequently used synonymous term for TQM—continuous improvement.

### APPLICATION OF TQM TO QUALITY CONTROL OF DOCUMENTS

Quality is free. It's not a gift, but it is free—Crosby (1979, p. 1)

The process of document retrieval can be understood as a chain of producer/suppliers and customer/receivers, some of them internal to a particular organization and some of them external. Tenopir (1992) describes “A Day in the Life of a Database Producer,” a composite of her experience in visiting and observing all steps of creation and distribution at three large database producing companies. The first customer-supplier relationship is between those who determine what titles will be included in the database and those who must acquire them. The next customer-supplier relationship exists between the acquisition department and the jobbers or publishers, followed by a parallel one between the jobbers and the receiving department. The customers of the receiving department are the indexers and abstractors. The indexers are clients of the editors and catalogers who provide lists of subject headings and name authority files. As Tenopir describes the process, a great deal of checking and verifying goes on. The verifiers, whether human or machine, are the customers or receivers of the indexing output. Tenopir (1992) identifies a group of quality control specialists who “oversee the general quality of the products and authority files” and correct errors (p. 20). These form the final group of internal customers before the product is made available to the outside.

The quality control process for these database producers seems to rely to a very high degree on inspection. Some checking is automated—for example, controlled term fields, format and typing errors, subject heading references, “near-miss” checking for close match terms, duplication checking, etc.—but much checking is performed by humans as well. Following a checklist, reviewers verify the accuracy of bibliographic information and indexing. Quality control specialists are responsible for editorial policy and for correcting errors introduced by users of the files. Thus, processes are in place to monitor the quality of the data input and to correct

errors on an ongoing basis, even if these processes are not always those favored by current thinking about quality improvement.

One of the companies visited by Tenopir (1992) stated that, although there were many errors in the data created in the 1970s and 1980s, "data produced in the last five years is extremely clean" (p. 20). Much credit for the relative purity of today's data can be attributed to researchers working to develop automated data validation and cost-effective methods of detecting spelling and typographic errors. Automated authority control systems and duplication detection by record matching algorithms have also advanced substantially. O'Neill and Vizin-Goetz (1988), in reviewing the research in this area, sum it up by stating, "while there has been a great deal of important work, database quality control remains a collection of isolated methodologies....the methodology for error detection and correction is quite advanced..." (p. 146). Perhaps it is because the methodologies are isolated and not considered systematically that spelling and other input errors continue to occur. Mintz (1990) points out that, although all input errors are technically equal to the information producers, to the customer "all misspellings are *not* equal and some are more serious than others" (p. 16). Typos of unique terms that often occur in unindexed full-text files pose more difficult problems, she notes, than do typos of commonly used words.

There is no evidence of commitment to total quality management on the part of the database producers. The EUSIDIC Code of Practice for Databases and Databanks eschews any such grand ideals and contents itself with encouraging "best practice," here summarized to mean indexing policy, arrangements with vendors and implementation procedures clearly stated, and public announcement of changes in any of these elements. This code, published in 1983, seems disappointingly vague and easy to achieve without demonstrating any real improvement in what Director of INSPEC Aitchison (1988) identifies as the five desirable but lacking qualities for database production: "Absolute accuracy. Complete reliability. Unvarying consistency. Total comprehensiveness [limited by intention], [and] Maximum timeliness" (p. 51).

The most common approach to quality assurance by the database producers is to use error correction software and automated control systems combined with an inspection process. Grooms (1988) describes such a process of "rigorous Quality Assurance" (p. 161) in the practices of the U.S. Patent and Trademark Office (PTO). The PTO selects a 6 percent sample of the full text of the database and rejects errors in excess of 15 per 100,000 characters. It used Military Standard 105-D, originally written for production of military spare parts, in

establishing its statistical sampling frame and in setting acceptable quality levels. A quality index of 99.92 percent on the attributes of completeness, accuracy, and consistency was statistically calculated for the database.

Arnold (1992) predicts that information manufacturing, his term for building a database, will enter a stage of reconstruction in the next five years, rebuilding successful databases that cannot be changed quickly enough to meet the needs of the customer. He cites some of the reasons why database producers are unwilling or unable to make product-related changes:

- Programming cost is beyond the organization's resources
- Priority of the change is too low to warrant investment
- Technically impossible in the present manufacturing "plant"
- Return on investment does not meet organization's target
- Copyright or other legal issues block the change. (p. 36)

He believes the reconstruction stage will be fueled by informed customers no longer willing to accept the "reign of error" (Bulkeley, 1982, p. B6); competitors will enter the field with enhancements and create customized information products for niche markets.

Database producers have informed customers in the information specialists who use their products. Aitchison (1988) notes that of the two different external customers—end-users and information professionals—"end-users have a higher opinion of the performance of abstracting and indexing services than information workers have or the services deserve. Obviously, this is because they do not know any better." On the other hand, information professionals display a "weary acceptance" of the imperfections in the databases and Aitchison asks why they are so easygoing and muted in their "rumblings of discontent" (p. 52).

An examination of some of the fine critical articles reviewing or comparing individual databases does not suggest that the professionals are so easygoing. At this point, it appears the information professionals are the best prods for improvement the producers have. In fact, Mintz (1990), after a careful analysis of the main sources of error in current databases, proposes a stronger involvement for the customers in the improvement effort. She calls for a tripartite commission to develop industrywide standards of database publishing to resolve some of the problems she discusses.

Thus it appears database producers fall far short of attaining total quality management although some measures of improvement are in place. It also suggests that customers may need to be even more aggressive in their demands for quality.

## APPLICATION OF TQM TO QUALITY CONTROL OF DOCUMENT RETRIEVAL

The assurance of continuous quality service depends on performance evaluation—Miranda Pao (1989a, p. 215)

On the output end, the information professionals can point with some pride to a long history of concern for improvement of services. Marchand (1990) identifies eight dimensions of information quality as a framework for analysis:

1. The *actual value* an information product or service may have for the information user. Some attributes of value will be relative to the information; others will be “user-specific and unique criteria.”
2. The *features* of the information product or service. “Characteristics...such as the accuracy or comprehensiveness” are included here.
3. “The reliability of the information product or service.”
4. The *meaning* of the information *over time*. Information has a life cycle and its meaning varies widely with changing circumstances.
5. The *relevance* of the information. Relevance refers to the degree to which information conforms to the user’s criteria or standards....For an information systems designer, relevance may be associated with conformity to specifications”; for the user it may be relative to a point in time.
6. The *validity* of the information. Validity may be associated with how the information is collected or analyzed, who delivers it, and/or how the results are presented.
7. The *aesthetics* of the information. This includes a set of “highly subjective attributes associated with the way information is presented, delivered, and packaged.”
8. The *perceived value* of the information. Indirect measures of comparison are used to compensate for lack of information on other dimensions. Thus, “the reputation of an information product or service may legitimise the reliance that an information user places on its use.” (p. 12)

These dimensions are similar to those suggested by Taylor (1986) who uses a value-based approach to suggest that the use of information is balanced against competing criteria of information value, only one dimension of which is information quality; others are ease of use, noise reduction, adaptability, time saving, and cost saving.

Olaisen (1990) distinguishes between cognitive authority quality factors (dependent on how information is perceived by the user) and

technical user friendliness quality factors (dependent on what the user is offered) in considering the philosophical aspects of information quality versus the service quality aspects of management theory. The former includes the familiar list of such things as credibility, trustworthiness, reliability, relevance, meaning over time, validity, and perceived value. The latter refers to form, actual value or novelty, accessibility, timeliness, desired speed, flexibility, completeness, intrinsic plausibility, selectivity, browsability, and other added features (p. 96). Following an empirical test of these factors, Olaisen's model of information quality consists of four determinants: (1) cognitive quality, (2) design quality, (3) product quality, and (4) delivery quality; together they make up process quality.

In the last decade, greater attention has been directed to standards and measures of performance in all venues of library and information service provision. Measurements or standards are a small but important part of a quality management program. Standard setting involves structure criteria (the resources necessary to complete the task successfully), process criteria (the actions to be taken to achieve the desired results), and outcome criteria (the desired effect or results stated in measurable ways). Porter (1990) describes one interlibrary loan standard-setting exercise, the problems encountered, and the advantages of the exercise. One unanticipated outcome was that the library's reputation was considerably enhanced by the effort.

Schwuchow (1990) proposes a procedure for making the quality of an information system more objective. In his method, a representative group of users is asked to develop criterion functions in an iterative process and then to judge performance based on them. Mapping these judgments on the criterion functions produces a variability chart that can be used as a standard against which to measure individual judgments over time. It can also provide upper and lower control limits as targets for reduction of variability in the continuous improvement process.

Although they are not the only ones, the health sciences field can claim the greatest demonstrated applications of the TQM concept within the service sector. Marshall (1990) says that health care organizations have developed the most elaborate systems to analyze quality management practices and, as a result, health science libraries have been the first to apply these principles to provision of library services. The quality assurance (QA) concept—more or less a synonymous term for TQM—is seen as an elaboration of existing standards to include “quality of care” and other customer oriented dimensions.

Fredenburg (1988) describes a quality assurance program developed in response to an organization-wide quality assurance program. Eight standard activities were selected to monitor and two to five standards of measurement or "Problem Indicators" were devised for each activity (p. 278). These measures were stimulated by the question: "How would he [my administrator] know if I am succeeding in that library activity" (p. 278)? Any staff person may identify, solve, or defuse a potential library problem in Fredenburg's library. The QA program is based on a partnership with administrators, the support staff, committees, departments, and library clientele. Library objectives and potential problems are discussed with these groups and a performance plan in the form of "a mutually agreeable written contract" is generated (p. 280). "[Y]early and interim appraisals stress *improvement* over finding fault" (p. 282). Fredenburg's practical suggestions on how to establish a QA program in other libraries stress the need to be adaptable and flexible.

Humphries and Naisawald (1991), at another health sciences library, describe a quality assurance program specifically for online services. It is designed to evaluate these services against five specific criteria identified in research studies as important to customer satisfaction. Their goal of measurable standards for quality services "proved more challenging and complex than originally anticipated" (p. 265). The list of quality determinants they developed went far beyond issues of technical proficiency and included reliability, responsiveness, approachability, courtesy, security, and some tangible physical factors. One of the improvements resulting from this program consists of a regular sampling period for online search monitoring whereby, during twice-yearly periods, searchers print out all searches and review them according to a checklist of quality search criteria. Reviews may result in recommendations for formal coursework and presentations for in-house review sessions as a means to improve competency. A customer complaint policy is advertised on all search request forms. A search log was instituted to record date and time the request was received and completed and the customer notified. A standard two-day turnaround policy for all searches for primary clientele and a same-day turnaround for urgent patient care searches was established and advertised. Interview guidelines were standardized as was a letter to send with every search describing databases searched, years covered, and search method used with concerns or possible alternative strategies discussed and an opportunity for customer feedback. Confidentiality was addressed through use of individual professional workstations with private conference space and attractive packaging for completed searches. Humphries and Naisawald attribute the achievement of a more professional customer-oriented

program to their QA efforts. They believe the program provides a mechanism to establish high standards, to monitor all service practices, and to generate pride, teamwork, and collegiality.

Wilson (1990) cautions that if we think of QA as simply a technique rather than as an attitude of mind, its disappearance into "the sediment of management techniques" is almost guaranteed (p. 49). The notion of service delivery as an exploratory or experimental process similar to action research seems to Wilson an appropriate stance for the practitioner relative to the incorporation of QA into the librarian's management philosophy. Wilson offers some policy guidance techniques for data collection that will help the librarian "find out what works and what doesn't [and how] to improve services" (pp. 50-51).

The earlier examples show that total quality management can be adapted to the provision of general library and document retrieval services. The approach requires a willingness to believe that error will occur. "The environment has to be one that is error-friendly. Quality is error driven," says General Motors President F. J. MacDonald (Humphries & Naisawald, 1991, p. 265). Further, the approach requires an acceptance that quality improvement is ongoing and not of finite duration. It requires the development of measures arising from the customer's level of desired quality, Pareto analysis as a guideline for where remedial action should be focused, and the involvement of all staff in the process.

## CONCLUSION

Quality means doing the right thing, doing it the right way, doing it right the first time and doing it on time—Townsend (p. 167, 1986)

The arguments in this article direct the reader to a process of gradual evolution. More radical proposals for quality control of documents have also been proposed and are not without merit. Jewitt (1986), for example, believes that information technology will find a solution to the problem of information control. He urges a reconsideration of target audience classification, asserting that this idea has received little support due to indexer and publisher vested interests. Jewitt's proposed system would remove their influence and let usage act as the primary quality filter. When a newly submitted paper is placed on deposit in Jewitt's information system of the future, it would have no readership classification and be labeled "unrefereed." Only after the paper was accessed by at least one reader would it become a candidate for an organized refereeing system. Arguing that too much information is the largest single problem facing our society, Jewitt further challenges information professionals to evaluate the intellectual content of the documents they handle and to give up the posture of indexing neutrality.

Concern over the quality and trustworthiness of information is growing not only among online searchers and information professionals but also among the general public. Berkman (1990) says: "In a world where speed and instant gratification is a priority, information, too, has now been relegated to the fast fix" (p. 49). He urges information specialists to assist clients in understanding the limitations of data sources, to be suspicious of the data, to cultivate critical thinking, and to evaluate the accuracy and reliability of the information gathered. Although this is useful advice, it may be time for the information professionals to demand higher quality and more trustworthiness from the database producers and vendors and to urge on them the merits of a total quality approach while adopting it themselves.

Quality improvement is clearly an important topic for the information industry and the information professionals who use its products for their customers. Three major conferences on the theme of information quality have taken place in the last three years (Brockman, 1991; Williams, 1990; Wormell, 1990). Researchers are developing greater sophistication in the use of automatic checking and error correction and the database producers are adopting these techniques. There appears some willingness to use the concepts and tools of TQM by information professionals if not yet by database producers. Two motivations for pursuit of quality improvement programs can be discerned—one stems from being a unit in a larger organization that has made a commitment to this approach and the other emerges as a voluntary action on the part of programs that already have a high degree of excellence and are attracted to the idea of continuous improvement.

Documentation exists to show that the cost of doing quality work is not great when the cost of lost customers, redoing work, and correcting errors is added to the equation. Still, many organizations are reluctant to change and want justification that the time involved in analysis, evaluation, and the continuing search for better methods will pay off in substantial and ongoing improvements in the balance sheet. If such results are not rapidly forthcoming, they are ready to abandon the initial foray. For example, one recent study raises doubt about the effectiveness of some of the practices included in the TQM concept ("TQM Doesn't Always Deliver ...," 1992, p. 2) claiming that worker teams have not always produced the continuing performance improvement anticipated by management. "The [Ernst & Young] study concludes that work teams can help in lower-performing companies at the beginning of TQM efforts but over the long term, teams lose their value, as corporate performance improves" (p. 4). Another area of TQM singled out by the study

as not uniformly efficacious was benchmarking, a fairly recent addition to the TQM armamentarium. Benchmarking refers to the practice of setting goals based on what has already been achieved by competitors (Camp, 1989). The notion is that if a standard of excellence has once been reached by someone, it is attainable by others as well. The study found that benchmarking is more effective in high-performing companies that know how to apply the information they gather but less so in others.

The problems identified in this study may result from dissatisfactions expressed by companies accustomed to a "management by objectives" philosophy that emphasizes results over process. Deming's philosophy reverses this and urges long-term commitment toward continual improvement of products and services. In his view, quality is not a step function; it is a process of incremental change. Its intent is not to become ever more efficient in current processes but rather to test continually the way things are done in order to find a better means of meeting customer needs. TQM is an attitude, a culture of continuous improvement. Deming's constancy of purpose means that even when the TQM approach stops producing the dramatic results often possible with its initial implementation, it will still be seen as a more effective way of doing business from the viewpoint of the customers, the workers, and the society as a whole. The long-term benefits of a quality approach are trust, durability, loyal customers and staff, and a trouble-free operation.

The adoption of a TQM orientation to quality demands emphasis on customer-defined standards, where "customer" is interpreted to mean whoever is the receiver of a product or service, whether internal or external. Quality must be judged by the customer. The quality management approach focuses on finding and reducing the causes of variation that occur in the systems used to produce the results. Improved document delivery is everyone's business. We must form partnerships with all other participants in the chain of database producer to end-consumer and plan a total system commitment to continuous quality improvement.

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