Dr. W. Edwards Deming (born October 14, 1900) was elected to the National Academy of Engineering in 1983, inducted into the Science and Engineering Hall of Fame in 1986, awarded the National Medal of Technology in 1987, and in 1988 received the award "Distinguished Career in Science from the National Academy of Sciences." (photo courtesy of W. E. Deming)

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TOTAL QUALITY MANAGEMENT AND ORGANIZATIONAL BEHAVIOR MANAGEMENT: AN INTEGRATION FOR CONTINUAL IMPROVEMENT

THOMAS C. MAWHINNEY
UNIVERSITY OF DETROIT MERCY

Organizational behavior management (OBM) applies Skinnerian ideas to organizational analyses and problems (Skinner, 1953, 1981). Total quality management (TQM) applies principles and theories based on the work of W. Edwards Deming (1982, 1986) to improving quality of organizational performance and work life. Each of these areas of knowledge has important implications for behavior analysts who seek to describe, understand, and develop solutions to social problems associated with organizations. Demand for higher quality products and services is being forced on many organizations by their competitive environments. Some competitive environments are now global. In addition, higher quality is important to the modern organization and critical for ultimate survival within demanding consumer markets.

Goals

This paper integrates behavior analysis, specifically OBM, with components of the recent quality movement. Specifically, the goals of this paper are to (a) describe the problem of poor-quality outputs and the origins of the problem among U.S. goods and services providers, (b) characterize Deming's approach to the quality problem with statistical reasoning from the TQM vantage point, (c) describe OBM as an operant-based approach to performance management, (d) discuss areas of agreement and disagreement between OBM and Deming's views of TQM, and (e) explain how OBM can contribute to the TQM movement.

The Quality Problem

A quality crisis in the U.S. was clearly announced and changes recommended by the cultural anthropologist Marvin Harris (1981) in his book *America Now*. Another analysis was presented by Deming (1986) in his book *Out of the Crisis*. Harris examined a web of possible relationships among variables as diverse as declining quality of goods and services, the rise of large corporate structures, changes in family life, inflation, and welfare programs. To solve the quality problem, he recommended decentralization of production of goods and services and delivery systems (e.g., smaller entrepreneurial business and service structures).

Who is Deming? An Icon of the Total Quality Movement

Deming is recognized as a major contributor to the stellar rise of product and service quality in Japan. His 1986 book is aimed specifically at describing the quality problem in America. His work is the touchstone of every other notable approach to quality management, including statistical process control (SPC), total quality management (TQM), total quality control (TQC), and company-wide quality control (Redmon, 1992). Deming's views are detailed below.

Origins of the Quality Problem

Unlike Harris (1981), Deming does not question the legitimacy of large corporate structures. The quality problem, according to Deming (1986), has more to do with the American management style than with size or any other factor associated

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Address correspondence and reprint requests to Thomas C. Mawhinney, College of Business, University of Detroit Mercy, 4001 W. McNichols Road, Detroit, Michigan 48221.

with American organizations. American managers are slow to recognize that a new economic era has dawned. In this new era, competition is increasingly global. The achievement of product (service) quality and attention to customer service before, during, and after the moment of a sale will distinguish among survivors and casualties in this increasingly competitive environment. The collapse of the U.S. Steel Corporation in the 1960s and the loss of nearly 30% of the domestic auto market to foreign competitors during the past 25 years illustrate the seriousness of the quality problem.

Deming (1986) contends that traditional American management practices arose during a time when organizations prospered by getting large numbers of products into the market. The competitive conditions present when that strategy was viable are gone, but the style of management that worked in those times continues. (I have conducted a theoretical behavior analysis of why these practices linger in organizational cultures; Mawhinney, in press-a.) Therefore, Deming contends that only a fundamental change in the American style of management will solve the quality problem. He provides evidence that focusing on output quantity instead of quality drives costs up, without necessarily improving quality. Focusing on continual improvement of quality, on the other hand, has the effect of reducing costs while increasing market shares. According to Deming, achieving quality objectives has as much to do with the "motivation" of workers and managers as it does with the use of statistical process control (SPC) methods or other technologies. To understand this idea, top-level managers must understand several other things. Therefore, Deming's solution involves the reeducation and motivation of management (at all organizational levels) and workers, not one or the other group alone. Investments in exotic machinery will not necessarily solve these behavioral problems. Management and workers are, together with many other factors, part of a larger "system." To achieve necessary improvements in quality, therefore, the larger system must be changed; however, management controls most of the variables that can make this happen.

What Managers Must Understand About TQM

Top-level managers must understand the connections among sources of variation in outputs of a production or service process in which workers and lower level managers work. Without this knowledge, they cannot understand how motivation fits into the quality equation. They must have some understanding of statistical theories of variation. They must be able to envision production and service operations as processes with outputs influenced by a *system* of variables, including (a) people, (b) methods, (c) materials, (d) equipment, and (e) environmental factors (Scherkenbach, 1988). Variations in all of these variables are unavoidable and enter the process, causing variation in its outputs. Control of output variation is an essential requirement for the control of quality. Thus, control of quality requires control over the effects of these variables on variations in process outputs. How they are to be controlled depends on how they cause variation in process outputs. Managers must, therefore, gain knowledge about causal relations among system variables and process output variations. Deming recommends that scientific methods of developing knowledge be adopted. According to Geller's editorial in this issue, Deming now recognizes that knowledge provided by psychology is another type of knowledge required of managers intent on improving quality with TQM. To summarize, Deming believes that managers must know or learn something about (a) statistical theories of variation, (b) causal relations among a system of variables responsible for process output variation, (c) scientific methods for isolating cause–effect relationships among system variables and process output variation, and (d) psychological variables that relate people to the work processes responsible for quality outputs.

The Quality Cycle in TQM

Elaborating on Shewhart's (1939) work, Deming (1986) distinguished between the "old way" of organizing production processes and the relation of the process to consumers and the "new way" of organizing this process. The old way involved the following three relatively unrelated steps in a linear process: (a) design the product, (b) make the product, and (c) try to sell it. Absent from the process was any feedback from the customer to the people in the design and production process. The new way adds steps to form a quality cycle or feedback loop: (a) design the product, (b) make it and test it in the production line and in the laboratory, (c) put it on the market, (d) test it in service, find out what the user thinks of it and why the *nonuser has not bought it,* (e) revise product design in response to customer feedback or new opportunities to improve it, and (f) initiate another production and test cycle (Deming, 1986).

Implementing the new way requires valid and reliable measurement of customer satisfaction with and preferences for product/service characteristics. Statistical sampling and analytic techniques together with computer processing of data now make it economically feasible to obtain such information. Once measured, the current status of production/service system outputs must be compared to the ultimate customer criteria. The comparison permits one to decide whether the process is capable of providing what the customer wants (Brethower, 1982; Deming, 1986). Whether measured or not, increasing gaps between consumer preferences for output characteristics and characteristics of outputs put into the market increase the organization's risk that competitors will better identify and satisfy consumers' preferences. Lost market share is an early warning that viability of the organization could be in jeopardy due to noncompetitive quality.

When Deming's (1986) approach to TQM is employed, the process of responding to consumer feedback adapts production/service system performance specifications to consumer preferences. If adopted and effectively maintained, a process of adaptation and quality enhancement ensues. Development of this process is what is meant by the term continual quality improvement (CQI).

Quality and costs are related in a chain of events described by Deming (1986). This chain of events can be characterized in terms of what behavior analysts now call a *metacontingency*. Elsewhere I have adopted Glenn's (1991) terminology for characterizing contingencies that exist between cultural practices in organizations, such as those supporting Deming's statistical approach to CQI, and their consequences (e.g., price/quality relations that permit the organization to take market share rather than lose it). Glenn called these relationships metacontingencies. Applying the concept to processes responsible for an organization's survival or decline and death, I have called these contingencies *organizational survival-related metacontingencies* (Mawhinney, in press-a).

Deming's (1986) 14 points (Table 1) delineate a set of cultural practices or style of management that upper level American management must adopt to initiate and maintain organizational cultures that support CQI. If adopted, the following five-phase chain reaction occurs: (a) Costs decrease because rework and mistakes decrease and there are fewer delays and snags; better use of machine/facilities time and materials is achieved. (b) Productivity improves because costs relative to outputs fall. (c) Market share is captured with better quality and lower prices when costs savings are shared with consumers. (d) The organizational culture survives and prospers. (e) More jobs are created, more faculty appointments are won in universities, more grants are won by researchers and human services providers, and more consumers are more satisfied with goods and services. Survival-related metacontingencies exist for both for-profit (Redmon & Agnew, 1991) and not-for-profit (Redmon & Wilk, 1991) organizations. Thus, what Deming has to say about the quality problem is applicable to both organizational types.

Defining Quality Specifications

What is quality? Quality is in the eye of the beholder, and Deming (1986) identifies quality as seen through the eyes of workers, managers, and consumers:

> In the mind of the production worker, he produces quality if he can take pride in his work. Poor quality, to him, means loss of business, and perhaps of his job. Good quality, he thinks, will keep the company in busi-

Deming's 14 Points for Continual Improvement of Organizational Performance

1. Create constancy of purpose toward improvement of product and service, with aim to become competitive, to stay in business, and to provide jobs.
2. Adopt the new philosophy. We are in a new economic age. Western management must awaken to the challenge, must learn their responsibilities, and take on leadership for change.
3. Cease dependence on inspection to achieve quality. Eliminate need for inspection on a mass basis by building quality into the product in the first place.
4. End the practice of awarding business on the basis of price tag. Instead, minimize total cost. Move toward a single supplier for any one item, on a long-term relationship of loyalty and trust.
5. Improve constantly and forever the system of production and service, to improve quality and productivity, and thus constantly decrease costs.
6. Institute training on the job.
7. Institute leadership. The aim of supervision should be to help people and machines and gadgets to do a better job. Supervision of management is in need of overhaul, as well as supervision of production workers.
8. Drive out fear, so that everyone may work effectively for the company.
9. Break down barriers between departments. People in research, design, sales, and production must work as a team, to foresee problems of production and in use that may be encountered with the product or service.
10. Eliminate slogans, exhortations, and targets for the work force asking for zero defects and new levels of productivity. Such exhortations only create adversarial relationships, because the bulk of the causes of low quality and low productivity belong to the system and thus lie beyond the power of the work force [to alter on its own].

11a. Eliminate work standards (quotas) on the factory floor. Substitute leadership.

11b. Eliminate management by objectives. Eliminate management by numbers, numerical goals. Substitute leadership.

12a. Remove barriers that stand between the hourly worker and his right to pride of workmanship. The responsibility of supervisors must be changed from sheer numbers to quality.

12b. Remove barriers that rob people in management and in engineering of their right to take pride of workmanship. This means, inter alia, abolishment of the annual or merit rating and of management by objectives.

13. Institute a vigorous program of education and self-improvement.
14. Put everybody in the company to work to accomplish the transformation. The transformation is everybody's job.

Source: Deming (1986, pp. 23–24).

ness. . . . Quality to the plant manager means to get the numbers out and to meet specifications. His job is also, whether he knows it or not, continual improvement of processes and continual improvement of leadership. (p. 168)

Deming (1986) paraphrases Shewhart (1931) to characterize quality in the eyes of the customer:

> The difficulty with defining quality is to translate future needs of the user into measurable characteristics, so that a product can be designed and turned out to give satisfaction at a price that the user will pay. This is not easy, and as soon as one feels fairly successful in the endeavor, he finds that the needs of the consumer have changed, competitors have moved in, there are new materials to work with, some better than the old ones, some worse; some cheaper than the old ones, some dearer . . . . (p. 169)

Thus, quality is a dynamic process. The process relies on customer preference studies to identify what quality characteristics make a difference in the consumer's ultimate choice among alternative goods and services. For example, contrary to popular opinion, the Japanese did not have to surpass their U.S. competitors by a wide margin of superior quality to increase consumer preference for their products (Reddy & Berger, 1983). They focused on those particular product differences that made a difference to potential consumers. The critical quality characteristics, once identified, must be translated into specifications for the various parts of a processing system. They may relate to any of the following: (a) contact with sales people at the point of purchase, (b) length of warranties, (c) useful life of the product, (d) appearances, such as fit and finish in autos, and (e) intuitive appeal or face validity in behavioral intervention programs (Geller, 1991b). Deming (1986) refers to Bross (1953) to characterize the basic nature of the specification development and revision cycles: "The purpose of studies in consumer preferences is to adjust the product [specifications] to the public, rather than, as in advertising, to adjust the public to the product" (p. 95).

Once the customer criteria have been identified and built into the process, the challenge is to keep the outputs within acceptable limits set by those criteria. This requires a precise set of measurements, rules for evaluating variation in process outputs, and internal feedback procedures that relate workers to process technologies, workers in separate parts of the process to one another and to any other individuals or groups whose work can influence the process (e.g., design engineers, purchasing managers, and so on).

In TQM the methods of SPC are used to control variation in process outputs so that, ideally, all outputs from a processing system are within limits that satisfy customer preferences. Such control requires consumer preferences to be translated into operational definitions and measures of system outputs of importance to consumers. Control of the variation in these measured values of outputs is obtained using SPC and scientific methods.

Classifying Output Variations and Their Causes

Just as behavior analysts recognize that no two instances of behavior are identical, experts in SPC begin their work by recognizing the axiom that "no two things are alike; they will always vary" (Wheeler & Chambers, 1986, p. 1). One of Shewhart's important contributions to SPC theory was to conceptualize the elements of a processing system (e.g., people, materials, equipment, and so on) as a *cause system.* Normally occurring variations in the processing system's component variables (cause system) can produce variations in central tendency (mean) or variance (spread) of outputs from the process. Occasionally, effects that are normally small change more than usual, or effects of a variable outside the identified cause system enter it. In either case, the changed nature of the process cause system can be detected in a changed mean and/or variance among process outputs. Detecting changes and controlling output variations from either source require that the cause system governing process output variation be as well identified as possible. Just as Skinner (1966) sought to learn all the variables of which behavior was a function, the quality controller using SPC seeks to learn all the variables of which variation in process outputs is a function. Deming (1986) partitioned variation in process outputs into two categories based on the type of variable responsible for the variation. Wheeler and Chambers (1986) describe Deming's classifications of process output variation:

> *Common causes* of variation in a production process are causes of variation that exist because of the manufacturing system, or the way that [the cause] system [people, materials, methods, equipment, environment] is managed. They arise out of the process, or out of the way the process is organized and operated. Because they are part of the [organizational performance] system, they are the responsibility of those who control the [organizational performance] system: the managers, and specifically, the top level of management. Common causes of variation can only be removed through action by management. . . . *Special causes* of variation are causes that are localized in nature. They are not part of the overall [organizational performance] system, and should be considered as abnormalities. Often they will be specific to a certain operator, a certain machine, or a certain batch of material. (pp. 9–10)

Identifying and Controlling Output Variation with SPC Methods

Statistical rules and empirical observations of outputs from a processing system are employed to judge whether processing system output variation is controlled. The following steps are required: (a) The aspect of the process outputs to be controlled must be operationally defined and a means of measuring it decided upon. (b) A plan for collecting observations of outputs through time must be designed (i.e., a sampling plan). (c) When enough observations have been taken from processing system outputs, a time series of them is plotted, the mean, variance, and standard deviation of the observations are computed, and the mean or center line (CL) is drawn onto a mean control chart (upper panel of Figure 1). Similar data are plotted on a range control chart (lower panel of Figure 1). (d) Upper control limits (UCL) and lower control limits (LCL) are calculated as +3 sigmas and −3 sigmas and drawn onto the control chart. (e) The plotted observations are examined to determine whether they are all within the UCL and LCL; one or more observations outside the control limits indicate the process is not in control. Observations 17 and 19 in the control chart depicted in Figure 1 signal presence of a special cause.

Because of variation in process outputs, some output units will exceed and some will fall below the desired range of customers' preferences for the outputs *unless the process variation is controlled within certain limits.* Customer satisfaction with system outcomes can be met in two ways. First, inspect and accept or reject output units that do not satisfy customer specifications, rework rejected outputs if possible, and scrap rejected output that cannot be reworked. This approach increases rather than decreases the cost portion of the metacontingency discussed above. Second, control output variation with respect to customer specifications so that unacceptable outputs are minimized, that is, virtually all production outputs or services delivered meet or exceed measured specifications required to satisfy customers. Even when no unacceptable outputs are produced by a processing system, however, some variation among outputs will occur.

Specifications of acceptable variation in a system's outputs are typically set with respect to a mean and limits on variation of outputs above and below the mean. These limits are called the upper specification limit (USL) and lower specification limit (LSL), respectively. Statistical process control methods are used to control variation of outputs so that, in the ideal case, *all outputs,* when measured for some specified characteristic, will be within the USL and LSL established for the process. Specification limits are set to satisfy customer requirements for processing system outputs.

It is important to recognize the difference between control limits based on the *empirical data* and customer-based specification limits; the latter are set *without reference to the actual outputs* of the process. The empirical control limits (UCL and LCL) are used to determine whether the variation from the process is controlled (i.e., controlled variation occurs from Observations 2 to 16 in Figure 1). The upper and lower specification limits are those requirements of processing system outputs set by the customer or by design and process engineers. It is entirely possible for a processing system's variation to be controlled while its variation is so great that much of its output will be outside specification limits. If the USL and LSL were located between the UCL and LCL just above and just below the CL in Figure 1, the empirical process would be considered stable but incapable of consistently making acceptable outputs. That is, the processing system would consistently and predictably produce outputs, some of which would require reworking or scrapping. Work on the system should take place to narrow the spread of variation about the mean in order to achieve controlled variation within the specification limits. In the case of Figure 1, high process capability would occur when the USL and LSL were an appreciable distance above and below the UCL and the LCL, respectively.

Efforts to change a processing system's capability involves interventions aimed at changing common cause variation that is a function of the production processing or service system, as opposed to changing special causes. In fact, effects of some special causes must be identified and removed or controlled before process variation can be considered under control. Importantly, attempts to change the mean, variance, and capability of a process when its variation is not controlled (i.e., Observations 15 to 19 of Figure 1) often lead to greater variation and even chaotic behavior of the process and its outputs. Thus, control over processing system output variation is the sine qua non of efforts to analyze and change the system's capability to produce consistently outputs that meet or, whenever economically possible, exceed specifications.

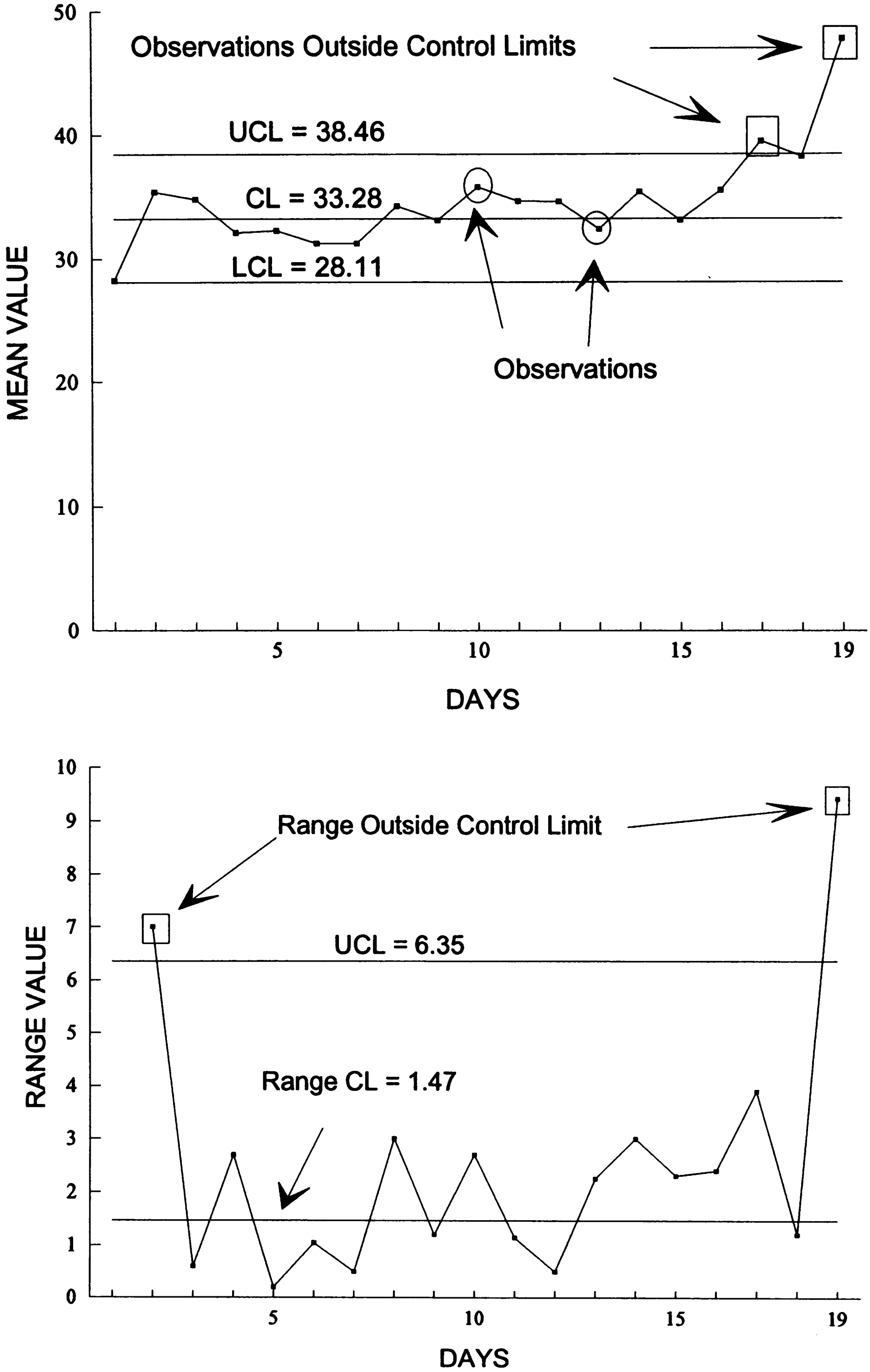

Figure 1. An example of a mean control chart (upper panel) and range control chart (lower panel). Disregarding the range chart, the outputs in the mean chart from Observations 1 to 16 exhibit controlled variations, or common causes, and Observation 17 signals the onset or entry of a special cause into the process cause system.

A Practical Example of Common and Special Cause Variation

The *cause system* is composed of all variables of a processing system that contribute to variation in outputs. Suppose three people performed three different operations on some material using different tools, and their work was measured after the final step in the process. They would exhibit controlled variation if the variation among their outputs were steady and within certain limits. Then suppose a machine tool used by one person malfunctioned and, instead of the usual random variation around a mean value of outputs, the measured aspect of output rose and began to occur above the UCL. The shift in the output suggests that the process is no longer in control and a special cause not typically part of the processing system has entered the process (e.g., the broken machine tool). Using SPC methods, the workers themselves could discover this special cause, fix it or get a new tool, and thereby return the process to a state in which it produced controlled variation. The critical issues for production and service system designers, managers, supervisors, workers, or anyone concerned with managing systems' variations to achieve continual quality improvement are:

1. Whether the variability is controlled.
2. Whether the variation indicates presence of special causes.
3. Whether special causes, if identified, can be controlled.
4. If special causes are controllable, on what, where, and by whom in a system must action be taken to control them?
5. Whether the mean is in the desired location, and if not,
6. Whether the cause of its location is controllable.
7. If the mean is controllable, on what, where, and by whom in a system must action be taken to control the cause of mean location?

Deming's 14 Points on Managerial Style

Deming's (1986) 14 points (see Table 1) provide an agenda to guide management efforts aimed at creating conditions, or organizational cultures, in which members at every level are empowered by management to work in the best interests of themselves, their organization, their customers, and, ultimately, the nation. However, only higher levels of managerial personnel have the authority and power to alter system-level variables responsible for common cause variation in process outputs. Deming's 14 points direct management attention to practices that should continue or be eliminated. When reading these points one should remember that, according to Deming's analysis, most variation (85% or more) in process outputs is common cause variation due to system-level variables beyond control of shop floor (or sales floor) workers and their supervisors.

OBM: Operant Behavior and Performance Management

Organizational behavior management (OBM) is an extension of the experimental analysis of behavior and applied behavior analysis into the world of organizations. Its scientific roots are in operant behavior analysis. Its technological roots are in applied behavior analysis. It has close relations with other fields, such as organizational behavior and industrial/organizational (I/O) psychology. It differs from both root disciplines in that it is more likely to address applied problems in which accomplishments serve as dependent variables as opposed to behavior per se (Frederiksen, 1982; O'Brien & Dickinson, 1982). Accomplishments are what remain when the behavior has passed into history (Gilbert, 1978; Gilbert & Gilbert, 1992). In practice, the terms *accomplishment* and *performance* are often interchangeable. Organizational behavior management includes research focused on behavior per se (e.g., server–customer interactions) and whether the behavior has direct or indirect effects on organizational accomplishments (e.g., sales and repeat purchases; Luthans, Paul, & Taylor, 1985). Accomplishments may be ancillary to the primary economic activities of an organization (e.g., concern for the safety and welfare of people at work; Fellner & Sulzer-Azaroff, 1985; Geller, 1989, 1990). Although the balance has varied through the years, research has been conducted in both private- and public-sector organizations (Balcazar, Shupert, Daniels, Mawhinney, & Hopkins, 1989; Merwin, Thomason, & Sanford, 1989). Although the typical intervention is still narrow in scope, work on larger scale comprehensive organizational problems is anticipated (Smith & Chase, 1990).

Organizational behavior management is explicitly theoretical in the inductive tradition of B. F. Skinner (1969, 1981). Quantitative representations of the law of effect (Baum, 1973; Herrnstein, 1970; Rachlin, 1989) as aids to theoretical analyses are appreciated (Mawhinney & Gowen, 1990; Redmon & Lockwood, 1986). Organizational behavior management is concerned with translations among paradigms in which behavior-analytic theories serve as touchstones. Thus, references can be found to the matching law (Herrnstein, 1970), the Premack principle (Bernstein & Ebbesen, 1978; Welsh, Bernstein, & Luthans, in press), and to culture and cultural materialism (Eubanks & Lloyd, in press; Glenn, 1991; Harris, 1981). In time, other theoretical analyses rooted in behavior-analytic traditions may prove useful to OBM researchers (Branch & Galbicka, 1992). With respect to controversies such as those inspired by mentalistic attacks on behavioral constructs and methods, OBM researchers appear to follow Komaki's (1981) advice: "The time spent on academic arguments could be more profitably spent improving the work place" (p. 111).

An early statement of Skinner's (1931) behavior theory is comprehensive enough to include all the individual subject variables of interest to OBM researchers as they extend the experimental analysis of behavior and applied behavior analysis into the world of work organizations; the variables in the theory are essentially a behavioral version of Shewhart's and Deming's conceptions of a cause system. The theory relates behavior to environmental antecedents, consequences, and reinforcement history, or "third variables" as in the following equation:

$$R \text{ (or } B) = f(S, A),$$

where R is a response and S is the situational stimulus. The relationship between R (or B) and S is conditional on a third variable, A (Skinner, 1931). In studies of operant behavior, A is a history of deprivation and satiation. In its most general interpretation, A functions to provide an orderly account of B (or R) in terms of the situational stimulus, S. In other words, A is any important element of a history of reinforcement or other person-specific factor that differentially influences effects of current situational stimuli, S, on a behavior, B, or outputs of a behavioral system to be predicted or controlled.

A common OBM intervention model involves the following sequence of steps: specification, observation, and administration of consequences (S-O-C) contingent on occurrences of specified features of a behavior or accomplishment (Brethower, 1982). *Specification* is also called *pinpointing* the behavior to be changed (Daniels, 1989). A series of questions concerning behavior, accomplishment, and the local work environment is asked and answered to decide whether a problem is due to environmental constraints or is under the control of operant contingencies of reinforcement that can be changed by changing contingencies of reinforcement (Mager & Pipe, 1970). *Observation* concerns how the pinpointed behavior or accomplishment will be measured and its reliability determined (for a practical example see Goltz, Citera, Jensen, Favero, & Komaki, 1989). *Consequence* refers to the identification of possible reinforcers that can be arranged to follow desired behaviors contingently. Practical significance and reliability of data are often established with methods similar to those that characterize research in the tradition of applied behavior analysis.

The ideal OBM intervention includes social validation from the vantage point of the people whose behavior is targeted for change (Fellner & Sulzer-Azaroff, 1985; Geller, 1991a; Mawhinney, 1984). The validity of the studies from the vantage point of the organizational system representative who approves an OBM study is determined by whether the specified behaviors or accomplishments are changed in desired ways. Validity is also measured by the economic impact of interventions, as captured by a cost–benefit ratio (Mawhinney, 1975). Finally, the ideal intervention maintains behavior or accomplishment changes for as long as desired by the organization in which it was implemented (Balcazar et al., 1989; Merwin et al., 1989).

Organizational behavior management is now poised to move on to larger scale interventions that concern organizational culture changes (what is called organizational development in other literatures; Eubanks & Lloyd, in press; Mawhinney, in press-b). For this reason, some changes in method may be required. Statistical process control methods may prove useful as OBM broadens the scope of its organizational interventions, just as Fawcett (1991) suggests that applied behavior analysis can broaden the scope of its applications and methods in the community.

Points of Agreement and Disagreement Between OBM and TQM

The TQM and OBM movements share some important assumptions and related practices. Both are data based. Both place high reliance on operationally defined specifications, standards, or criteria for evaluating measured observations of process outputs. This point of agreement concerns the S and O of the S-O-C sequence in OBM. A major point of departure between OBM and TQM concerns the role of consequences, C, in the control of behavior in the work setting and in the executive suite. A comparison of OBM and TQM approaches to performance management by Redmon and Dickinson (1987) revealed that whereas OBM attends carefully to three-term contingencies relating antecedents, behaviors, and consequences, Deming's 14 points are exclusively devoted to antecedents. Their conclusion was probably conditioned by two characteristics of Deming's 14 points. First, the points that concern consequences tend to focus on internal variables such as "pride of workmanship" as a source of work "motivation." These motivational issues are focused primarily on organizational members from the shop floor to somewhere below the executive level. Second, defective behaviors at the executive, board, and governmental levels are described.

Deming does not analyze the contingencies that maintain behaviors in terms of reinforcement. With respect to what is wrong with behavior in many American corporations, Deming (1986) provides clear insights. With respect to the contingencies that maintain these behaviors, Deming's analysis is incomplete. There is no reason to believe that action will be taken to correct the problems identified until contingencies of reinforcement are changed to make powerful reinforcers depend on addressing the problems. Interventions aimed at implementing TQM should be much improved when effective and reliable contingencies of reinforcement support them. Deming's 14 points are examined below in terms of the degree to which they correspond with what the OBM literature reveals about their probable validity, applicability, and utility.

Deming's (1986) first point, to "create constancy of purpose toward improvement of product and service, with aim to become competitive and to stay in business, and to provide jobs" (p. 23), can be considered a slogan or exhortation aimed at top-level managers. An OBM approach suggests that the contingencies responsible for inattention to product and service improvement require analysis. Then, powerful contingencies would have to be arranged to prevent top-level executives from receiving significant remuneration (reinforcement) even as their organizations fail. For example, some executives have received huge retirement benefits upon departure from corporations that were cutting jobs because market shares had been lost during the administration of the retiring executive! Actions such as these cannot occur without approval of a board of directors in public corporations. Thus, the contingencies that govern executive behavior are not simple in origin or in what is required to change them. Nothing short of a change in the mechanisms of corporate governance and representation on boards of directors will cure problems at the top.

To the extent that boards of directors represent investors who demand short-term profits at the possible expense of long-term survival, asking executives to take the longer view is like asking a worker to take action on a process that is under control of system-level variables. What must change is the even larger system that determines how executives come to be executives and the contingencies that govern their behavior once they arrive "at the top." This line of reasoning is equally applicable to Deming's exhortation that executives "adopt the new philosophy" (1986, p. 23). Simply put, an OBM analysis suggests that executive behavior will change when the larger system-level contingencies of reinforcement that control their behaviors are changed. The Lincoln Electric Company provides one model of what is possible when the executive's contingencies, including a long and strong cultural history that maintains a quality orientation, support appropriate executive behavior (Handlin, 1992).

Deming's Point 3 suggests that process output variation be controlled and system-level variables be manipulated so that all output meets customer satisfaction criteria. His fifth point relates to the third and simply notes that quality is a dynamic relationship among the following: (a) consumer preferences, (b) behavior of competitors, (c) behavior of materials suppliers and inventors, and (d) behavior of people in the organization who attempt to control its quality and satisfy its customers. A competitor may engage in continual quality improvement too; therefore, the best insurance for the long run and in the best interest of both organization members and consumers is continual improvement among all organizations. There is nothing whatever wrong with these ideas. The nearly 30% market share the domestic auto companies lost to foreign competitors and the related displacement of working people in this country might have been avoided had the domestic producers been engaged in TQM following World War II. They were not.

Reduced costs are supposed to accrue to achievement of these two objectives (control of quality and continual improvement), and they probably do (Handlin, 1992). The combination of lower costs and higher quality is also supposed to result in increased market share. This is a less certain outcome that depends on executives' and board members' behaviors. Whether prices are reduced to achieve more market shares or allocated to higher returns to investors again depends on the organizational system of governance and the values and objectives of people in charge of the culture. Similarly, whether lower level organizational members share in quality cost savings and the mechanism that governs sharing can determine whether their behavior supports programs aimed at improving quality. Unless "pride of workmanship" is very powerful and is a consequence of quality improvement, working people may not support quality improvement efforts. For example, if 85% of the variance in process outputs is determined by management action on the system, workers within the system may not "see" (be reinforced by) a connection between what they do and the quality achieved. A more micro OBM approach is required to analyze this question. If "pride of workmanship" is not salient, OBM interventions can bring reinforcing consequences within close physical and temporal proximity to the management and worker behaviors required to produce quality outputs (Bourdon, 1977).

Deming's (1986) Point 4, about awarding business on the basis of minimum total costs and single supply sources in long-term relations based on trust, makes sense from a quality improvement standpoint. In this instance, Deming accurately identifies higher level systems of reinforcement contingencies governing executive action. Government regulations in some industries associate a financial risk for corporations that make such arrangements; the relationships may be broken up and penalties assessed that later take away any gains from making the arrangements in the first place. Just as system-level variables can prevent workers from achieving higher quality, legislative structures in the form of restrictive rules and regulations can stand between management and its ability to support maximal quality improvement.

An OBM approach bypasses the structural impediments and addresses the behavioral interface between purchasers and suppliers. That is, the purchasing organization must construct an S-O-C contingency for its suppliers to make them more like an extension of the producer. This is what accrues to a long-term relation based on trust. However, the empirical facts that Deming mustered to support his position on this point are unequivocal. The larger the number of suppliers, the more difficult is control of quality. Thus, OBM interventions aimed at improving interorganizational relations present challenging research opportunities and can improve quality.

Deming's (1986) Point 6 is to institute training on the job. Training on the job is a double-edged practice I have discussed indirectly in the context of corporate cultural practices (Mawhinney, in press-a). A long internship with movement among departments and operations or training on the job within a corporate culture certainly has the advantage that the student learns about the complexities of production (or service) operations. The disadvantage is that unless the culture is already one in which Points 1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, and 14 are norms of the culture, what the trainee may learn is how to "beat the system" or "how to play the quality game." Thus, although it makes sense to train on the job in quality-oriented cultures such as the top Japanese companies and the Lincoln Electric Company, it may not be the best approach in organizations attempting to introduce quality orientation as a cultural alternative to the status quo. This is a fertile area for research in organizational development as it evolves within the OBM movement (Eubanks & Lloyd, in press).

Deming's (1986) Point 7 calls for institution of leadership. Deming's idea of leadership distinguishes it from supervision and management by objectives (MBO). Leadership, according to Deming, involves helping people achieve "pride of workmanship" by removing common cause–related obstacles in the workplace that prevent them from producing quality or improving quality outputs. Supervision and MBO, on the other hand, are directed at the elements of the S-O-C sequence of OBM (i.e., specifying [often participatively], observing/measuring, and providing consequences for accomplishing specified objectives). Supervisors are supplemental to the motivational system in work settings; as Skinner (1987) noted, wage and salary systems motivate performance with avoidance contingencies. Workers often do only what is required to avoid loss of wages and a certain standard of living. According to Skinner, the power of social reinforcement by managers or supervisors over their followers derives from the "leader's" ability to terminate employment. This contingency precipitates countercontrol against the system and the manager or supervisor.

One reason for countercontrol against supervision may be the punitive supervision that arises when supervisors are not trained in SPC concepts. Notz, Boschman, and Tax (1987) documented supervisors' and trainers' propensities to administer rewards and punishers to trainees (followers) that were based on individual observations of followers' performances; these supervisors ignored the fact that individual variations occurred randomly about a stable mean baseline or CL. Worse, in the absence of specific training, there is a propensity to formulate and employ a general rule that "punishers are more effective than rewards." This rule is formulated when supervisors notice that performance tends to rise after administration of punishers and to fall after administration of rewards. When the behavior is stable, of course, these observations result from what is called a regression to the mean (i.e., individual performance far above or far below the mean performance is more likely to be followed by performance closer to the mean).

Almost every description of the OBM approach to solving a behavior ("motivational") problem provides a series of steps that, when properly followed, lead the analyst to distinguish between what Deming (1986) calls a system problem due to common cause variation and an individual worker problem due to a localized special cause. The most extensive decision guide in this area is probably one by Mager and Pipe (1970). Thus, simply thoroughly educating and training supervisors and managers in the OBM approach of behavior and accomplishment analysis and problem-solving techniques should help promote the quality movement. Training in OBM and performance management (Daniels, 1989) should reduce the probability that supervisors blame and punish workers for common cause variation in their work process or the random variations about their own mean performance level. When workers are not seen as the locus of all performance problems, attention can shift to the system per se.

Unions are formalized systems of countercontrol that have equalized the balance of organizational power over individual workers by joining larger numbers of workers together. Today supervisors have less power than they once had because of the rise of formal countercontrol (Jermier, 1988). For this and other reasons (Mawhinney & Ford, 1977), supervisors must correlate rewarding consequences with followers' performance-related behaviors. Even in relatively simple situations this can be challenging (Rao & Mawhinney, 1991).

By applying the S-O-C approach to leadership, it is possible to shape managers' and supervisors' behavior to specified behavioral criteria, unless the process evokes countercontrol (Miller, 1991). For example, in an early OBM study the negative commentary of a supervisor about his followers was reduced while the performance of his followers was increased (Chandler, 1977). The OBM paradigm should be flexible enough to address a wide variety of behavior-change problems that arise within the context of implementing TQM.

Deming's (1986) Point 8 calls for driving fear out of the workplace. A reasonable question is whether fear exists in the workplace. Skinner's (1987) answer is "yes." For example, some workers fear displacement by technological advancements and the improved efficiency associated with quality improvement. Deming's corrective action is more antecedent control of the following type: "Top management should publish a resolution that no one will lose his job for contribution to quality and productivity" (p. 26). (This could be a hollow promise—see Mawhinney, in press-a.) He also contends that annual merit reviews and numerical quotas are fear inducing. Deming is opposed to pay-for-performance contingencies as well; they reduce intrinsic task interest or take away "pride of workmanship."

Pay-for-performance systems, such as the one used by Lincoln Electric Company, permit managers' and workers' bonus pay to rise and fall with product outputs they create through their cooperative efforts. Lincoln Electric Company provides a lifetime employment guarantee to all employees after they pass a probationary period. Because labor and administration costs fall during recessionary times and the hours worked by many organizational members are reduced during these times, the company neither lays off nor terminates employment of members during recessions. Organizations that do not have the cost flexibility provided by such organization-wide bonus plans and continuous employment policies typically reduce costs with worker layoffs and terminations during recessions. This common practice no doubt maintains some ambient level of fear in the workplace. Thus, when critically analyzed, the pay practices that Deming recommends are probably not congruent with driving fear out of the workplace.

Japanese organizations that engage in TQM, it should be noted, provide employment security; a significant portion of employee pay is in the form of bonuses paid several times per year based on company-wide economic performance. It is entirely possible that effects of "pride of workmanship" on quality in Japan are confounded with these bonus payments, as it was in the Hawthorne studies (Parsons, 1992). This is not to say, however, that "pride of workmanship" has no role in motivation among people in the workforce. It is a worthy objective.

Deming's (1986) Point 9 concerns breaking down barriers between departments. Again, group- and organization-level contingencies of reinforcement must be analyzed and group-based contingencies put into place to achieve the required relationships. Analysis and redesign of intergroup contingencies can be accomplished by management fiat or by participative methods. The OBM approach to such problems of group alignment suggests that powerful reinforcers must be made contingent on accomplishment of the integration. The mere existence of the contingency is not enough. As Malott (in press) noted, consequences of complex contingencies may be too delayed to gain control over behavior. The OBM problem in this area is to analyze team-building programs, whether participatively administered or not, and identify ways to construct contingencies that foster and maintain cooperative intergroup relations. Unfortunately, in recommending better leadership in Point 7, Deming condemns MBO programs. If there is a fault in MBO programs, and there may well be, it is in the contingencies of reinforcement they generate. Individual MBO programs with numerical objectives can result in corruption of the MBO process by managers who work on making a "winning MBO career record" whether the quality system improves or not. It may be easier for the TQM movement to make progress in organizations with past commitments to MBO by simply shifting objective-setting processes from individuals to teams, by developing programs that might be called management by team objectives (MTO) or management by system's objectives (MSO). This approach shifts the S in S-O-C to cooperative intergroup behaviors. Redmon (1992) develops these ideas and reviews some literature on team concepts in his commentary.

Deming's (1986) Point 10 calls for an end to slogans and targets. This is essentially a call for an end of attempts to change behavior with antecedents and specifications of performances that are not controlled by the workers (i.e., they cannot alter common cause variations without management assistance). An important caveat is in order. Recent work on contingency-specifying stimuli (statements) or effects of verbal descriptions of reinforcement contingencies (Agnew & Redmon, in press) suggests a role for antecedent-only interventions under particular conditions. Deming helps identify the conditions in which antecedent-only interventions do and do not make sense. When the desired behavior or performance sought is not constrained by other factors, antecedent-only interventions can be effective. Kello, Geller, Rice, and Bryant (1988) achieved a three-fold increase in safety belt use among industrial employees by merely increasing "awareness" of using vehicle safety belts. If contextual factors exist to support quality-related behavior once the behavior occurs, then, like safety belt use, evoking and maintaining the behavior might be as simple as effectively describing the contingencies. Mawhinney and Ford (1977) also discussed this idea in the context of leadership and supervision.

Deming's (1986) Points 11 and 12 call for elimination of quotas on the factory floor, avoidance of incentive pay, and a shift from emphasis on numbers alone to emphasis on quality. If the prevailing reinforcement contingencies in a work setting are avoidance contingencies (as described in regard to Point 7), an OBM analysis supports this point. The problem with quotas is not that they fail to get the level of output they are supposed to get; it is that *quota is all they get*! An operant analysis suggests that once quota is made, in an avoidance contingency there is no reinforcement value for going beyond quota. A piece-rate pay system with no quota might seem attractive if rate of output is the sole objective. Deming condemns this practice as well. High rates of output with many defects do not contribute to "pride of workmanship." The defect problem can be addressed by docking the worker some amount for each defective piece. This, however, could be a penalty for a defect caused by common cause variation that is beyond the worker's control (e.g., poor machinery or poor materials). Most of Deming's positions on pay depend on the validity of the assumption that most working people are reinforced by a feeling of pride of workmanship. How widespread is pride of workmanship among working people? Does TQM really provide the catalyst for unleashing its behavioral manifestations? What are its behavioral manifestations? These questions provide an agenda for joining OBM, TQM, organizational behavior, and I/O research traditions in cooperative research efforts.

Deming noted that incentive piece-rate pay systems are not used in Japan. There are important differences between the Japanese and U.S. manufacturers, and here I do not mean cultural context factors. Corporate cultures evolve and are shaped by experiences in a process analogous to shaping individual behaviors (i.e., selection by consequences; Mawhinney, in press-a). In Japan, SPC and related methods were introduced early in the histories of what are now considered TQM cultures. Deming and Juran provided guidance in the early days. As early as 1951, Juran (Juran, Seder, & Gryna, 1962) developed a coherent analysis of the psychological "forces" and cultural practices associated with maintenance of status quo organizational cultures. He also identified the behaviors, objectives, and methods required to change the status quo. Thus, the Japanese organizations that evolved into the exemplars of the TQM movement were very young when the TQM innovation was introduced, compared to the older U.S. organizations that are the targets of the movement today.

The essence of TQM appeared in Shewhart's (1931, 1939) work; the organizational and psychological guidelines for implementation are presented by Juran et al. (1962). Deming's (1986) 14 points, on the other hand, are an attempt to codify the evolutionary history of the Japanese experience. Equally important, the 14 points reflect Deming's experience with the quality issue in this country. Lincoln Electric Company and Japanese cultures have prospered through continual quality improvement; ***the relation of quality, cost, price, and competitiveness is not a phenomenon restricted to Japan.*** Japanese TQM companies and Lincoln Electric Company each adopted TQM practices early in their cultural histories (Handlin, 1992). The uniqueness of an organizational culture's evolution and the timing of innovation relative to the age of the culture are important factors in determining whether TQM is resisted or adopted. A comparative analysis of U.S. and Japanese reactions to quality issues by Harris (1981) supports this position. However, behavior-analytic interventions to alter countercontrol of quality innovations could prove to be one of the most constructive OBM research topics in the future (Gowen & Jennings, 1990).

The Lincoln Electric Company culture includes motivational practices diametrically opposed to those prescribed by Deming (e.g., individual merit and bonus pay for performance apply to all members of the Lincoln Electric Company culture). Close supervision and incentive pay systems during the early days of Deming's career in industry arose from the indifference theory of worker motivation (i.e., its first premise was that workers are indifferent with respect to work quality and require strong extrinsic monetary rewards and close supervision to produce quality work). Deming's (1986) condemnation of quotas and incentive pay schemes almost certainly arises from the craftsmanship theory, which states that "industrial workers, like their ancestors, contain an internal drive for accomplishing things, and derive satisfaction from producing workmanlike results" (Juran et al., 1962, p. 10). From this assumption about worker motivation numerous deductions follow: There should be (a) less emphasis on pay for performance and more on supervisory leadership, (b) more reliance on workers to control tool use, (c) limited formal inspection, (d) consultations with workers for ideas about improvement of the system, and more.

In view of these models, the Lincoln Electric Company culture is clearly a hybrid. Labor–management relations are governed by assumptions of the craftsmanship theory. The individual merit-based incentive profit-sharing plan was initiated in response to suggestions from a worker–management advisory board. Yet, the pay plan resembles a pay method associated with the indifference theory. However, the Lincoln Electric Company culture was actually predicated on the Golden Rule (treat others as you would be treated, as an employee, manager, customer, and/or owner). But the Lincoln Electric Company culture was also conceived as a competitive team, playing in an economic field of consumer markets; all other competitors represent opposing teams on the playing field. Ultimately, the incentive pay system functions to maintain equity among the members of the organizational team by correlating work contributions with monetary returns. Thus, the Lincoln Electric Company culture should not be viewed as a contradiction of Deming's views or TQM. It does serve to remind us that in the matter of organizing for TQM, there may be ***no*** "one best culture" for behavior analysts to shape.

Deming's (1986) Point 13 calls for a program of education and self-improvement. In reference to this point, Deming makes the following observation: "In respect to self-improvement, it is wise for anyone to bear in mind that there is no shortage of good people. Shortage exists at high levels of knowledge, and this is true in every field" (p. 86). Although Deming then contends that people should have more than monetary interests in their careers, the quote above could be viewed as advice within a veiled threat; a reinterpretation could mean, "if you don't improve yourself your talents will be valued lower—you may not be employed." A more generous interpretation would be that it never hurts to keep up-to-date in one's field of expertise; fields of knowledge typically change.

Finally, Point 14 calls for putting everyone to work on accomplishing the transformation. Given what Deming (1986) has said up to this point, it is more critical for some organizational members than for others to get to work on the transformation. Those with greater power in the organization have a better chance of moving the culture toward TQM. But they cannot do it alone. They cannot simply issue orders and expect something to happen. Deming provides a detailed elaboration on the development of a team orientation at multiple levels and across organizational functions. The linking of OBM with team building and TQM processes could provide synergistic effects and benefits for both movements (Redmon, 1992).

Conclusion

Interventions that combine OBM, SPC, and the Deming philosophy may be superior to either one alone. This is more an empirical question to be answered with data than a pronouncement of a probable phenomenon. But, suffice it to say the most effective OBM interventions can be accomplished, and if the organization is not competitive in its markets where quality is the basis of competition, effective small-scale OBM interventions will be of little solace to organizational members, whether workers or managers. Organizations with highly effective but piecemeal OBM programs that do not include support of continual quality improvement can die in spite of their effective OBM programs. Therefore, OBM people should be working on quality problems. I suggested areas of research as early as 1986 (Mawhinney, 1986). The organization-wide scope of OBM was fleshed out by Malott and Garcia (1987) in a special issue of the *Journal of Organizational Behavior Management* that focused on SPC, Deming, and OBM (Mawhinney, 1987). Some progress has been made (Henry & Redmon, 1990; Krigsman & O'Brien, 1987; Notz et al., 1987; Shaw & Sulzer-Azaroff, in press; Sulzer-Azaroff, Pollack, & Fleming, in press; Whittkopp, Rowan, & Poling, 1990). The issue of compatibility of pay for performance and pride of workmanship is well developed in our literature (Cameron, Epling, & Pierce, 1992; Dickinson, 1989; Hopkins & Mawhinney, 1992; Mawhinney, 1979; Mawhinney, Dickinson, & Taylor, 1989; Skaggs, Dickinson, & O'Connor, 1992). The technologies for observing leadership in the field have been developed (Komaki, 1986; Komaki, Zlotnick, & Jensen, 1986; Luthans, Rosenkrantz, & Hennessey, 1985). The connection between teamwork and pay has been broached (Latham & Huber, 1992), and other dimensions of pay have been examined (Oah & Dickinson, 1992). The concepts of feedback, training, and program evaluation have received some attention (Balcazar, Hopkins, & Suarez, 1985; Bruwelheide & Duncan, 1985; Clark et al., 1985; Duncan & Bruwelheide, 1985). A behavior analysis in the S-O-C tradition successfully improved employee participation in an organization-wide suggestion system (Smith, Kaminski, & Wylie, 1990). More work on integration of OBM, SPC, applied behavior analysis, and Deming's ideas about TQM is required and anticipated.

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