



---

A Theory of Quality Management Underlying the Deming Management Method

Author(s): John C. Anderson, Manus Rungtusanatham and Roger G. Schroeder

Source: *The Academy of Management Review*, Vol. 19, No. 3, Special Issue: "Total Quality" (Jul., 1994), pp. 472-509

Published by: [Academy of Management](#)

Stable URL: <http://www.jstor.org/stable/258936>

Accessed: 10/09/2013 20:38

---

Your use of the JSTOR archive indicates your acceptance of the Terms & Conditions of Use, available at <http://www.jstor.org/page/info/about/policies/terms.jsp>

JSTOR is a not-for-profit service that helps scholars, researchers, and students discover, use, and build upon a wide range of content in a trusted digital archive. We use information technology and tools to increase productivity and facilitate new forms of scholarship. For more information about JSTOR, please contact support@jstor.org.



*Academy of Management* is collaborating with JSTOR to digitize, preserve and extend access to *The Academy of Management Review*.

<http://www.jstor.org>

# A THEORY OF QUALITY MANAGEMENT UNDERLYING THE DEMING MANAGEMENT METHOD

JOHN C. ANDERSON  
MANUS RUNGTUSANATHAM  
ROGER G. SCHROEDER  
University of Minnesota

In its current form, the Deming management method contains a prescriptive set of 14 points that serve as guidelines for appropriate organizational behavior and practice regarding quality management. Despite the apparent effect of these 14 points on both the industrial world and the practice of management theory around the world, there is little evidence of the role of the Deming management method in the formalization and advancement of management theory. Although its impact on management practice is clear, neither its theoretical contribution nor its theoretical base has yet to be articulated. Yes, there is a theory of quality management underlying the Deming management method, but at present, this theory is presented in the prescriptive form of these 14 points. We propose and articulate a theory of quality management to describe and explain the effects of adopting the Deming management method. This theory is based on the conceptual synthesis of Deming's writings, literature on the Deming management method, observations of practice, and, more specifically, the results of a Delphi study involving a panel of experts on the Deming management method. We trace the development of this method, position it within the context of theory, describe our theory formulation process, propose and explain an underlying theory of quality management, and offer implications for practice and further research.

Increasingly, organizations are recognizing the strategic importance of quality and quality management. Many organizations have arrived at the conclusion that effective quality management can enhance their competitive abilities and provide strategic advantages in the marketplace. This belief has led to "a flurry of activity" (*Business Week*, 1992) on the part of many organizations, both large and small, manufacturing and service, profit and nonprofit, to shape and evolve their approach(es) to quality management, often with the help of industrial and academic leaders in the field of quality management.

One of the strongest proponents of quality management was W. Edwards Deming, a member of the select few credited with contributing to the rapid revitalization of the Japanese economy after World War II (Deming, 1986; Walton, 1986; Yoshida, 1989). The Deming management method

is currently embraced by many firms in the United States and around the world (Hodgson, 1987); its widespread popularity appears to stem from numerous case studies attributing organizational turnaround to the influence of the Deming management method (e.g., Baker & Artinian, 1985; Hodgson, 1987; Scherkenbach, 1986b; Walton, 1986: 121–238).

Despite the apparent effect that the Deming management method has had on the practice of management around the world, there is little empirical research support for its effectiveness beyond anecdotal evidence. This is in part because no theory describing, explaining, and predicting the impact of the Deming management method has been presented to guide the progress of the empirical researcher; neither its theoretical contribution nor its theoretical base has yet to be articulated. Academic attention on the Deming management method has, in fact, been surprisingly sparse (Gartner & Naughton, 1988); the role that this method has played in the formalization and advancement of management theory remains a relatively unexplored issue.

Deming's energies related to implementation of the 14 points, likewise, have not been expended to espouse or to verify theories. The purpose of the Deming management method has been and continues to be the transformation and improvement of the practice of management, more specifically, the practice of quality management (Deming, 1986: 18). This purpose has served to propel practice ahead of formalized theory. We believe that the formalization of the theoretical context of the effectiveness of the Deming management method is essential for improved implementation of these 14 points and, more generally, to the advancement of the field of quality management.

The primary objective of our article is to propose and articulate a theory of quality management underlying the Deming management method, leaving verification of the proposed theory for later. The proposed theory is based upon conceptual synthesis of Deming's writings, available literature on the Deming management method, observations of practice, and, more specifically, on the results of a Delphi study on the Deming management method. As will be presented, our analysis leads to the conclusion that the theoretical essence of the Deming management method concerns the creation of an organizational system that fosters cooperation and learning for facilitating the implementation of process management practices, which, in turn, leads to continuous improvement of processes, products, and services, and to employee fulfillment, both of which are critical to customer satisfaction, and, ultimately, to firm survival. Implicit in this theoretical statement is the crucial role that organizational leadership plays in ensuring the success of quality management, because it is the leaders' responsibilities to create and communicate a vision to move the firm toward continuous improvement and to provide formal and informal support to enable the creation and sustenance of an organizational system that is receptive to process management practices.

## THE DEMING MANAGEMENT METHOD

The Deming management method is a set of 14 imperative statements, published together for the first time in Deming (1981/1982) and subsequently in Deming (1982) and Walton (1986). The development of the 14 points in the Deming management method was a gradual process spanning four decades, during which generalizations drawn from Deming's consulting experience with firms in Japan and in the United States have been molded into the 14 points (Walton, 1986: 33–34; Yoshida, 1989). Duncan and Van Matre (1990) have provided some interesting insights into the development of the 14 points. The 1986 (Deming, 1986: 23–24) version of the 14 points is shown in Table 1. Each of the 14 points begins with a verb and is expressed in the "imperative mood" (Fowler, 1986: 192–193), taking the language structure of a "command."

Deming has unfailingly used anecdotes, stories, and examples containing morals for everyone in the organization to convey the meanings of the 14 points. Although Deming's intended audience was everyone within an organization, the overall message, embodied in the 14 points, has significantly greater implications for top-management behavior (Baillie, 1986). They are "obligations" expected of top management (Deming, 1981/1982), for it is clearly top management's responsibility to create and communicate a vision for quality management (Point 1), to authorize and institute ongoing training (Point 6), and to develop a plan of action for adopting the 14 points (Point 14). These 14 points are "principles of transformation" to be embraced by top management in its efforts to continually change and enhance an organization's ability to survive (Deming, 1986: 23). These principles of transformation hint at several theoretical concepts to characterize the "transformed" organization. Whereas Point 9 alludes to the concept of cooperation, Point 7 calls for leadership to replace supervision.

As principles of transformation, the 14 points are based on a set of assumptions about "how work is accomplished and how the outcomes of work should be evaluated" (Gartner, 1993: 147), assumptions premised on the notion that variability is inherent to all phenomena (Gartner & Naughton, 1988: 139). The 14 points represent Deming's beliefs regarding how to manage this variability; therefore, they prescribe a number of practices in the name of quality management (Anderson, Dooley, & Misterek, 1992). The elements in this set of practices traverse beyond the boundary of a single discipline to include such traditionally different functional domains in management (Baillie, 1986; Gartner & Naughton, 1988) as human resources (Point 6), strategic management (Point 1), purchasing (Point 4), and process control (Point 5). The intent of these practices is to facilitate management of the extended process (Gitlow, Gitlow, Oppenheim, & Oppenheim, 1989: 2–4), stretching the legal boundaries of the organization to include and affect suppliers upstream (Point 4) and customers downstream (Point 9).

**TABLE 1**  
**The Deming Management Method<sup>a</sup>**

---

Point 1.	Create constancy of purpose toward improvement of product and service with the aim to become competitive and to stay in business, and to provide jobs.
Point 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 of change.
Point 3.	Cease dependance on mass inspection to improve quality. Eliminate the need for inspection on a mass basis by building quality into the product in the first place.
Point 4.	End the practice of awarding business on the basis of price tag alone. Instead, minimize total cost. Move toward a single supplier for any one item, on a long-term relationship of loyalty and trust.
Point 5.	Improve constantly and forever the system of production and service, to improve quality and productivity, and thus constantly decrease costs.
Point 6.	Institute training on the job.
Point 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.
Point 8.	Drive out fear, so that everyone may work effectively for the company.
Point 9.	Break down barriers between departments. People in research, design, sales, and production must work as a team, to foresee problems of production and use that may be encountered with the product or service.
Point 10.	Eliminate slogans, exhortations, and targets for the workforce asking for zero defects and new levels of productivity. Such exhortations only create adversarial relationships, as the bulk of the causes of low quality and low productivity belong to the system and thus lie beyond the power of the workforce.
Point 11.	<ul style="list-style-type: none"> <li>a. Eliminate work standards (quotas) on the factory floor. Substitute leadership.</li> <li>b. Eliminate management by objective. Eliminate management by numbers, numeric goals. Substitute leadership.</li> </ul>
Point 12.	<ul style="list-style-type: none"> <li>a. Remove barriers that rob the hourly worker of his [or her] right to pride of workmanship. The responsibility of supervisors must be changed from sheer numbers to quality.</li> <li>b. Remove barriers that rob people in management and in engineering of their right to pride of workmanship. This means, inter alia, abolishment of the annual or merit rating and of management by objective.</li> </ul>
Point 13.	Institute a vigorous program of education and self-improvement.
Point 14.	Put everybody in the company to work to accomplish the transformation. The transformation is everybody's job.

---

<sup>a</sup> From *Out of Crisis: 23-24* by W. E. Deming, 1986, Cambridge: Massachusetts Institute of Technology, Center for Advanced Engineering Study. Copyright 1986 by Massachusetts Institute of Technology, Center for Advanced Engineering Study. Reprinted by permission.

Some of the 14 points recommend behavioral practices aimed at changing the organization's infrastructure and cultural system. If organizational members practice Points 8 and 9, for instance, they will foster an open, trusting, and cooperative culture in which all employees from top managers to blue-collar workers perform to achieve the common goal of

firm survival. Other points (e.g., Points 3, 4, and 5) implicitly advocate methodological practices, including the use of specific tools and statistical methods in the design, management, and improvement of processes, products, and services. Although behavioral and methodological practices can provide distinctly separate opportunities for organizational improvement, it is important to realize that "both [types of practices] are integral to improving quality . . . [for] it is the synergistic implementation of all the points that will improve quality in a never-ending fashion" (Gitlow et al., 1989: 15).

The nature of the Deming management method is further complicated by the interrelationships among the 14 statements. In both Points 6 and 13, for example, Deming argues for continual development of the abilities of the individual, these being on-the-job skills and personal intellectual enrichment. Less obvious is the relationship between Points 4 and 8, which are fundamentally linked by the need to understand variation (Anderson et al., 1992). These interrelationships among the 14 points are better revealed from a careful analysis of the text accompanying each point (Deming, 1986). Given such interdependencies, Gartner and Naughton (1988) restated the warning by Gitlow and colleagues (1989) against interpreting or embracing each point independent of the remaining points. Deming (1981/1982) asserted, "failure of top management to act on any of the fourteen points . . . will impair efforts on the other thirteen."

### **The Deming Management Method: Is It Theory?**

Some scholars have positioned the Deming management method as a new management theory in and of itself. Gartner and Naughton (1988: 138), for instance, titled their review of several books on the Deming management method as "The Deming Theory of Management," describing the 14 points as offering an "entirely new paradigm of profound challenges to present-day managerial thinking and behavior." Others, in advancing the view of the 14 points as an expansion of statistical process control into an organizationwide systematic change process, gave the label *Theory D* to the Deming management method (Gruska, 1981; Luthans & Thompson, 1987).

We disagree, however, with labeling the 14 points as theory; the 14 points are, as Deming claimed, *principles of transformation* for improving the practice of management. They represent a complex, prescriptive set of interrelated rules of inter- and intraorganizational behavior, codified and communicated in the linguistic form of commands. Although they certainly do suggest and advocate a number of concepts, they, themselves, are not concepts, the building blocks of theory (Chafetz, 1978: 45). To be sure, there is a theory of quality management underlying the Deming management method, but at this point, this theory is presented in the prescriptive totality of the 14 points. This method, therefore, is more an artifact of a theory of quality management, which has yet to be articulated, rather than a theory per se. The challenge is to engage in

*systematic research* to discover, and if need be invent, this underlying theory of quality management; such a theory to describe, explain, and predict the effects of adopting the Deming management method is imperative for generating scientific knowledge on the 14 points, guiding researchers on the subject matter, and propagating useful practice related to the Deming management method.

## ARTICULATING A THEORY OF QUALITY MANAGEMENT UNDERLYING THE DEMING MANAGEMENT METHOD

Intuitively, one can argue that because Deming is the originator of the 14 points, a theory of quality management to describe and explain the effectiveness of the Deming management method should have been elicited from him. We, however, deliberately chose not to do so for two reasons. First, there are a number of other experts on the Deming management method who can offer rich insights to share and build upon, and, second, we believe that objectivity in theory development is best gained by multiple observations, as proposed by Mitroff, Betz, Pondy, and Sagasti (1974) in their work related to scientific schema.

To achieve our objective, we began the theory-formulation process (e.g., Blalock, 1969: 28; Van de Ven, 1989) with an in-depth examination of the phenomenon of interest: what the Deming management method is and how and why the effective adoption of the Deming management method would lead to the achievement of strategic results and firm survival. Our early research efforts were focused on acquiring a comprehensive and "intimate" understanding of what the 14 points are, how they originated, and why they exist. If a researcher reads widely and critically on the subject matter, the probability of creative insights from which a theory can be developed increases (Chafetz, 1978: 8). At the same time, the information derived from such readings provides a basis for judging whether or not the theory to be proposed is being communicated for the first time (Reynolds, 1971: 152).

Using our improved understanding of the Deming management method and the 1986 version of the 14 points as a base for subsequent theory development, we employed the Delphi method to aid in the preliminary identification and definition of concepts suggested in the 14 points. These concepts provide the "Whats" or building blocks of a theory (Whetten, 1989). To establish the "How?" of a theory, we subsequently applied the relations diagram, also known as the interrelationship digraph (King, 1989; Mizuno, 1988), in order to specify the relational linkages among the conceptual building blocks; these relational linkages must be articulated to provide the "raison d'être for . . ." a theory (Chafetz, 1978: 75). Also, to justify the "Why?" of the theory, that is, "Why is this particular theory credible?" we juxtaposed the proposed theory of quality management with the existing knowledge in the literature.



## The Delphi Method: Generating a Preliminary Set of Concepts

The Delphi method is a technique, developed at the RAND Corporation in the early 1950s, intended for systematically soliciting, organizing, and structuring judgments and opinions on a particularly complex subject matter from a panel of experts until a consensus on the topic is reached (Helmer & Rescher, 1959), or until it becomes evident that further convergence is not possible. Any application of the Delphi method is typified by anonymity, feedback, and summary of responses. Responses during each iteration are summarized verbally or statistically, and the summary of results is provided to the Delphi panel in the subsequent round as feedback on the previous iteration.

The first step in the execution of the Delphi method is the selection of expert panel members for the study. This initial step is crucial because this panel lends content validity to the task (Best, 1974; Jolson & Rossow, 1971; Tersine & Riggs, 1976). In the Delphi study, seven expert panel members, from both academe and industry, were invited to participate. These seven participants had been involved professionally, and, in some cases, personally with Deming. Some had attended Deming's seminars several times; many were also professionally involved in the implementation of the 14 points in organizations. Several of the panel members had actively conducted scholarly research and writing related to quality management.

The panel members were then introduced, verbally and in writing, to the nature and purpose of the task. For round one, a consistent form was prepared for each of the 14 points, which was based on Deming's 14 points as stated in 1986. The members of the Delphi panel were asked to identify on a response form what they thought were the underlying concepts for each of the 14 points and to define or operationalize each of their concepts. After three iterations, these members identified and defined 37 concepts, which they believed were suggested by the 14 points. Members of the panel consistently agreed to the meaning of the 37 concepts. Average "agreement" scores for each concept's nominal definition ranged from 1.0 (*strongly agree*) to 2.3 (*agree*), with the largest standard deviation being 1.3 and the smallest being 0.0 (i.e., perfect agreement among members). The 37 concepts and their nominal definitions, which emerged from the Delphi study, are available from us on request.

Although insightful, the 37 concepts from the Delphi study do not suit the purpose of theory building. A theory developed from 37 concepts would be too complex. Moreover, we believe that the 37 concepts can be combined through further abstraction. To this end, we heuristically performed a cluster analysis of the 37 concepts. Each of the members of the research team individually and independently evaluated all 37 concepts and their nominal definitions and identified clusters of concepts, each grouping signifying a potentially more abstract concept. When they were compared, the clustering outcomes among the research team members



indicated a high degree of interrater correlation of similarity; in fact, cluster membership for two research team members was identical. Where differences existed, a consensual approach was adopted to reconcile distinct perspectives until agreement was reached. The results of this abstraction effort are seven more abstract concepts that serve as the "Whats" or building blocks of our proposed theory of quality management. These seven concepts—visionary leadership, internal and external cooperation, learning, process management, continuous improvement, employee fulfillment, and customer satisfaction—and their nominal definitions are shown in Table 2. Each of the seven proposed concepts has as its membership one or more of the 37 concepts.

### The Relations Diagram: Developing the Conceptual Relationships

Having generated the "What?" of a theory, we proceeded next to specify the relational linkages among the set of seven concepts. For this purpose, the relations diagram (alternatively called an interrelationship digraph) was employed. The relations diagram is rooted in Warfield's (1960) works on digraphs and on relational representations as suggested by Senge (1990). Mizuno (1988: 87) described the relations diagram as a tool that "clarifies intertwined causal relationships in complex problems or situations in order to find appropriate solutions." The relations diagram, therefore, provides a visual means of mapping out the causal and/or associated relationships in the development of a coherent theory.

Like executing the Delphi Method, using the relations diagram is a creative and often judgmental process, one that consciously attempts to make logical patterns become more apparent among complex factors (King, 1989: 4.6). These logical patterns are identified through a diagram in which unidirectional arrows indicate cause-and-effect or objective-means relationships (Mizuno, 1988: 88) and bidirectional arrows represent correlations. Such a visual representation allows a theorist to clarify his or her conceptualization process in the face of highly complex relationships (Whetten, 1989).

By employing the relations diagram, we made the set of plausible relationships among the seven concepts more explicit. Thus, we drew unidirectional and/or bidirectional arrows to specify the nature of the theoretical relationships among the six concepts. These arrows resulted from a logical thought process, essentially asking the questions: "Is this concept a cause or an effect? If this concept is a cause, is there a preceding cause? If this is an effect, does it affect other concepts?" By repetitively applying this process of logic, each possible connection between pairs of concepts was examined and was either included or excluded from the relations diagram. The resulting relational statements, illustrated in Figure 1, lead to the following theoretical statement of quality management underlying the Deming Management Method.

*The effectiveness of the Deming management method  
arises from leadership efforts toward the simultaneous*

**TABLE 2**  
**Concepts Underlying the Deming Management Method<sup>a</sup>**

---

**Visionary Leadership**

The ability of management to establish, practice, and lead a long-term vision for the organization, driven by changing customer requirements, as opposed to an internal management control role. This is exemplified by *clarity of vision, long-range orientation, coaching management style, participative change, employee empowerment, and planning and implementing organizational change.*

**Internal and External Cooperation**

The propensity of the organization to engage in noncompetitive activities internally among employees and externally with respect to suppliers. This is exemplified by *firm-supplier partnership, single-supplier orientation, collaborative organization, teamwork, organizationwide involvement, systems view of the organization, trust, and elimination of fear.*

**Learning**

The organizational capability to recognize and nurture the development of its skills, abilities, and knowledge base. This is exemplified by *companywide training, foundational knowledge, process knowledge, educational development, continuous self-improvement, and managerial learning.*

**Process Management**

The set of methodological and behavioral practices emphasizing the management of process, or means of actions, rather than results. This is exemplified by *management of processes, prevention orientation, reduction of mass inspection, design quality, statistical process control, understanding of variation, elimination of numerical quotas, elimination of management by objectives, elimination of merit-rating reward systems, understanding motivation, total cost accounting, and stable employment.*

**Continuous Improvement**

The propensity of the organization to pursue incremental and innovative improvements of its processes, products, and services. This is exemplified by *continuous improvement.*

**Employee Fulfillment**

The degree to which employees of an organization feel that the organization continually satisfies their need. This is exemplified by *job satisfaction, job commitment, and pride of workmanship.*

**Customer Satisfaction**

The degree to which an organization's customers continually perceive that their needs are being met by the organization's products and services. This is exemplified by *customer-driven focus.*

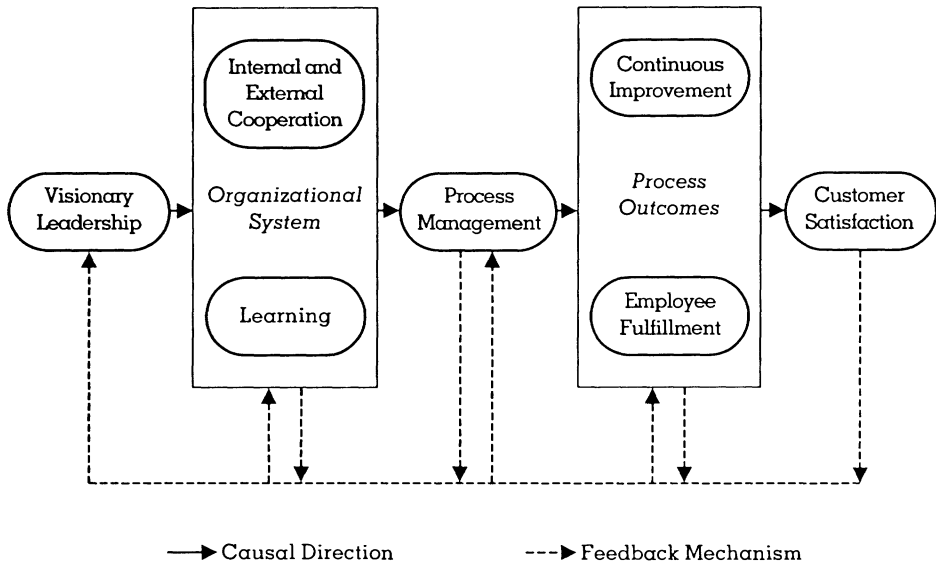
---

<sup>a</sup> Italicized words as identified by the Delphi panel.

*creation of a cooperative and learning organization to facilitate the implementation of process-management practices, which, when implemented, support customer satisfaction and organizational survival through sustained employee fulfillment and continuous improvement of processes, products, and services.*

The concepts in Table 2, along with the proposed theory illustrated in Figure 1, urge top managers to act as leaders to demonstrate responsibility for defining and communicating a purposeful vision of the desired

**FIGURE 1**  
**A Proposed Theory of Quality Management Underlying the Deming Management Method**



organizational system, one that is characterized by the pursuit of (a) internal and external cooperation and (b) learning. It is the organizational system that fosters cooperation and the willingness and ability of members to *learn*, which allows for the implementation of prescribed *process management* practices as statistical process control, design of experiments, total costing in purchasing, and so forth, and the rejection of certain popularized practices as management by objective and a merit-rating reward system. The suggested process management practices contribute in totality to the *continuous improvement* of processes, products, and services; they also help in attaining *employee fulfillment*, both of which are requisite for *customer satisfaction* and, ultimately, for the survival of the organization.

### Juxtaposing the Concepts and Conceptual Relationships in Existing Literature

To establish the "Why?" of the proposed theory, the proposed theory is juxtaposed onto existing relevant knowledge in the literature. Insights from this juxtaposition should help to explicate the reasoning process that governed the construction of this theory and should lend credibility to the proposed theoretical relationships. This juxtaposition is illustrative, not exhaustive; the purpose is to demonstrate supporting or conflicting viewpoints rather than to prove or disconfirm the relationships in the proposed

theory. We begin by defining the concepts in the proposed theory, using appropriate literature to lend credibility to the concept's nominal definitions. We then articulate and rationalize the four major propositions depicted in Figure 1.

## DEFINING CONCEPTS

### Visionary Leadership

*Visionary leadership* speaks of the role of top management in defining a long-range vision of an organization's development, communicating this vision, implementing a plan of action, and inspiring and motivating the entire organization toward the fulfillment of this vision—a definition that does not differ much from Barnard's (1938) identification of the three functions of top-management leadership. The defined and communicated vision "articulates a view of a realistic, credible, attractive future for the organization, a condition that is better in some important ways than what now exists" (Bennis & Nanus, 1985). This vision encourages the pursuit of change, which may be characterized by *convergence* and *reorientation*, terms coined by Tushman and Romanelli (1985: 209–215) to mean organizational stability and organizational change, respectively. Points 1 and 2 in the Deming management method, for example, suggest a vision of managed convergence and reorientation when they urge top management to create and adopt a vision of continuous improvement. Constancy of purpose, as articulated by Deming's Point 1, does not imply some end objective such as profitability or absolute quality level, but it calls for constancy in terms of efforts at continuous improvement of processes, products, and services.

By demanding that top management lead in the quest for continuous improvement, *visionary leadership* is akin to transformational leadership and opposed to transactional leadership (e.g., Avolio & Bass, 1986; Bass, 1985; Burns, 1978; Kuhnert & Lewis, 1987). Visionary leadership, therefore, concerns the enactment of a vision "which exists within the mind of an individual . . . into a social reality at the corporate or organizational level" (Sooklal, 1991). To enact this vision, visionary leadership has little congruence with trait-based theories of leadership that argue for a universal set of physical, mental, and personality traits to characterize and distinguish leaders from followers (e.g., Bird, 1940; Kelly, 1974), except perhaps the trait of knowledge of the business as noted in Bennis and Nanus (1985). To Deming, knowledge of the business and continual learning were essential prerequisites to effective leadership (Deming, 1986, 1993; W. E. Deming, personal discussion with Lou Schultz, June 1993).

Because top management leads by defining, communicating, and motivating continuous improvement, visionary leadership, as a conceptual building block, is more consistent with certain leadership styles. Likert's (1967) System 3 (consultative) and System 4 (democratic) styles of management, for example, are compatible to the employee empowerment

and leadership for participative change elements of visionary leadership. For such styles to be effective, though, employees must believe in their personal sense of effectiveness, the very definition of *employee empowerment* offered by Conger (1989).

### Internal and External Cooperation

The organizational system envisioned in the proposed theory embraces two fundamental characteristics: *internal and external cooperation* and *learning*. *Cooperation*, in this context, is synonymous with collaboration among different individuals, groups, or organizations, where all entities are engaging in noncompetitive, mutually beneficial, win-win activities. That organizations are cooperative systems has been advanced in Barnard's (1938: 73) definition of the *formal organization* as "a system of consciously coordinated activities or forces of two or more persons." The definition, itself, can be premised upon fundamental tenets of systems theory applied to complex organizations (e.g., Boulding, 1956), upon Ackoff's (1971) structural framework of systems theory, and upon Kast and Rosenzweig's (1969) general system theory.

Internal cooperation can be viewed in the context of social interdependency theory. Deutsch (1949) was the first to articulate a theory of cooperation and competition. Subsequently, Johnson and Johnson (1979) noted three forms of social interaction: cooperation, competition, and independence. In cooperative environments, persons *A* and *B* work together to achieve mutually beneficial goals; by cooperating, both individuals can achieve more than each could through independent or competitive actions. Shaw (1958) asserted that internal cooperation among employees enables higher individual performance by creating mutually beneficial situations among organizational members and between organizational members and the organization as a whole. The extensive literature review by Johnson and Johnson (1989) suggests that cooperative behavior results in superior achievement under most circumstances, including different tasks and contexts.

According to the alternative competitive perspective, a nondisruptive level of conflict can enhance individual and group performance because individuals would then develop and create necessary conditions to win (Michaels, 1977). In a competitive social relationship, person *A* can achieve his or her goals only at the expense of person *B*. This perspective of internal competition among individuals is in disagreement with Deming's writings. Deming (1993a: 85) argued against competitive behavior when he said: "Harm comes from internal competition and conflict, and from the fear that is thereby generated." Not all competition, however, has a negative effect on achievement. Tjosvold and Deemer (1980) have explored the role of competitive controversy within a cooperative environment; controversy, in this instance, can lead to greater openness, knowledge, and understanding, and, perhaps, performance.

External cooperation, manifesting itself as cooperation between a

firm and its suppliers, has merits in the just-in-time purchasing systems (e.g., Ansari & Modarress, 1990; Hall, 1983). A number of studies in this category have demonstrated the benefits of working collaboratively and on a long-term basis with a chosen supplier (e.g., Frey & Schlosser, 1993; Hahn, Kim, & Kim, 1986; Lascelles & Dale, 1989). Support for external cooperation among organizations is also evident in the organizational ecology paradigm, in which survival of multiple organizations is seen as being achieved through collaboration (e.g., Benson, 1975; Morgan, 1986).

Resource dependence theory (Pfeffer & Salancik, 1978), in contrast, presents an alternative prescription for interorganizational relations. According to this theory, organizations are interdependent on one another; this interdependence is created by one organization's, say *C*'s, need for resources that are beyond its capabilities and that are held by another organization, *D*. In such a scenario, organization *C* would seek to control *D*, in order to minimize its dependency on resources under *D*'s control, thereby reducing *D*'s ability to monitor and influence its behavior. The resulting interorganizational relationship is competitive as opposed to cooperative, because either *C* or *D* stands to gain from this relationship. A more detailed narration contrasting cooperative interorganizational relationships between suppliers and customers and the propositions of resource dependence theory as they relate to the quality management phenomenon can be found in Dean and Evans (1994: 117–119).

Likewise, transaction cost theory urges organizations to choose suppliers to lower their transaction cost; organizations, therefore, would prefer to hold suppliers at an arm's length and, quite often, have short-term, adversarial, rather than long-term, cooperative relationships with them (Donaldson, 1990; Williamson, 1985). More recently, an attempt has been made to broaden transaction cost theory to include and explain relational, long-run contracts (see Ring & Van de Ven, 1994) and trust (see Bromiley & Cummings, 1989) between organizations.

Deming was clearly opposed to the traditional transaction cost perspective (see Point 4) and was very much supportive of external cooperation:

Efforts by competitors acting jointly or together, aimed at expanding the market and to meet needs not yet served, contribute to optimization for all of them. When the focus of cooperation between competitors is to provide better service to the customer. . . , everyone comes out ahead. (Deming, 1993: 57–58)

He (W. E. Deming, personal communication, June 1992) viewed competition as wasteful and destructive because "competition constrains knowledge, economic, technological and market growth."

### **Learning**

A second characteristic of the organizational system, viewed as equally critical to the implementation of process management practices,



is the ability and willingness of the organization to engage in *learning* or knowledge-seeking activities at the individual, group, and organizational levels. The recent popular and academic interest on organizational learning (e.g., Brown & Duguid, 1991) complements Deming's and the proposed theory's emphasis on creating a learning organizational system. Much of Deming's writings on learning and knowledge have been influenced by the work of C. I. Lewis (1929). Points 6 and 12 in the Deming management method, for example, deal with the subject of ongoing training and education. The notion of organizationwide, experiential learning that is theory based pervades Deming's lectures (e.g., W. E. Deming, Deming seminar, June 1989; W. E. Deming, Deming seminar, September 1992) and writings (e.g., Deming, 1986, 1993). Deming (1988) said that "experience can cause us to modify our theory, reject it, accept it. . . . Without theory we are just groping in chaos." Deming spoke often of the tragedy of workers not being trained properly to perform work, let alone improve it, and not understanding the implications of their work on others' work (Deming, 1986).

Organizational learning, according to Deming, generates and encompasses two types of knowledge. There is process task knowledge, akin to the "science of the process," complete with its understanding of technology, human, and task requirements as explicated with precise operational definitions that guide activity and the measurement of quality (Deming, 1986). Separate from process task knowledge is what he termed *profound knowledge*, a set of foundational knowledge, comprising systems theory, statistics, psychology, and theories of knowledge (Deming, 1990; W. E. Deming, Deming seminar, June 1993). Whereas the first type of knowledge enables researchers to understand the characteristics of the process that produces and delivers products and services, the latter type contributes the methodological knowledge necessary to conduct process (i.e., scientific) inquiry that allows an organization to learn. Together, process knowledge and knowledge generated from applying profound knowledge stimulate and foster continuous improvement in processes, products, and services. Organizational learning and the subsequent knowledge that is generated, therefore, take on the special form of shared process knowledge measured by the artifact of process, product, and service variation. To Deming, variation and knowledge (the result of learning) are inversely related; that is, large process, product, and service variation indicates less knowledge of special and common causes of variation. Reduction of variation, therefore, signifies learning; this learning necessarily encompasses the four constructs as described in Huber's (1991) article: knowledge acquisition, information interpretation, information distribution, and organizational memory. Process task knowledge and profound knowledge must first be acquired; profound knowledge generates new information about the process that must be interpreted, understood, and verified; this information must then be communicated



and applied appropriately; and last, this information and the results of application must be documented.

Argyris and Schön's (1974) theoretical work on organizational learning and, more specifically, on single- and double-loop learning corresponds well with improvement through reduction of special- and common-cause variation. First-order learning, as discussed by March (1981) and Lant and Mezias (1992), with its emphasis on routine, incremental, conservative processes that serve to maintain stable relations and sustain existing rules, has direct correspondence to Deming's emphasis on process stability. Second-order learning, as defined by Argyris and Schön (1978) and Pfeffer (1981), and the process of experimentation as described by March (1988), in the context of Deming's and the proposed theory, however, departs from the goal-driven, "aspiration levels" view of learning (as discussed by Cyert & March, 1963; Glynn, Lant, & Mezias, 1991; March & Simon, 1958). According to Deming, learning is a continual process for the purpose of expanded knowledge with its own merit, much like one would argue for the advancement of science. The quest for knowledge is, therefore, driven by the lack of what one knows (i.e., in Deming's parlance, the existence of unexplained variation), beckoning new understanding and revised and/or new theory.

The learning organization that is envisioned here is knowledge intensive but differs from the knowledge-intensive firms (KIFs) of Starbuck (1992). Starbuck (1992: 718) defined a KIF as "a firm in which such experts [people with formal education and experience equivalent to a doctoral degree] are at least one-third of the personnel," a firm in which "exceptional and valuable expertise dominates commonplace knowledge" (Starbuck, 1992: 716) and where learning occurs by "managing training and personnel turnover, and by creating physical capital, routines, organizational culture, and social capital" (Starbuck, 1992: 715). The learning organization advocated here departs fundamentally from a KIF in how the generated knowledge is managed and disseminated; people who are *learning* within the organizational system proposed in our theory purposely share knowledge and nurture its generation throughout the organization, as opposed to having knowledge and knowledge creation be in the domain of experts who then selectively disseminate and apply knowledge as needed.

### Process Management

*Process management*, in the context of the proposed theory, connotes a set of practices that combine methodological approaches with human resource management, and these are implemented in order to manage and improve processes that produce products and services. This definition is similar in purpose, if not in content, to the empirically derived definition in Flynn, Schroeder, and Sakakibara (1993). Recent findings that manufacturing practices and human resource management practices

are often managed in concert (Snell & Dean, 1992) suggest that managing the process involves managing both the technical aspects and the human aspects of a process.

The methodological practices of process management, those aimed at managing and improving the technical aspects of processes, including its inputs and outputs, have benefited from Walter Shewhart's (1925, 1931, 1939) theoretical contributions of statistical theories of process variation applied to process control. Over the years, the methodological aspects of process management have blossomed to include not only techniques aimed at better management and control of processes (e.g., seven new quality control tools [Mizuno, 1988]), but also those techniques for improving process, product, and service designs (e.g., Taguchi methods [Taguchi, 1979]; quality function deployment [Akao, 1990]). Users of process management make proactive use of these methodological approaches in the execution of the plan-do-study-act (PDSA) cycle (Shewhart, 1931) for the dual purpose of prevention and improvement; the PDSA cycle is essentially the scientific method applied to continuous improvement (Box, 1987). In this case, less emphasis is placed on the reactive practice of mass inspection, although inspection does have an important role to play (see Vardeman, 1986).

Complementing the methodological approaches in process management is the set of practices regarding individual workers and their involvement in the transformation process. Questions about how jobs should be designed to fit workers or the degree of participation that workers should have in decision making are crucial. Process management practices that affect workers and their jobs are in agreement with three of the four scientific management principles (Taylor, 1911: 36–37) (i.e., replacing rules of thumb with science, training and developing workers, and cooperating with workers), but, unlike Taylor, the proposed theory does not encourage the clear separation of planning from execution, which would make an implicit distinction between leaders who plan and followers who carry out the plans. Furthermore, proponents of process management encourage the adoption of those “implementing concepts” suggested by Hackman, Oldham, Janson, and Purdy (1975) as combining related tasks (as opposed to emphasizing division of labor and specialization), forming natural work units, establishing client relationships, loading vertical information, and opening feedback channels. These implementing concepts signify a practical application of the job characteristics theory (Hackman & Oldham, 1976, 1980). Process management overlaps with the application of the sociotechnical perspective to work systems analysis and malfunction diagnosis (as elaborated in Trist, 1971). In both cases, for example, researchers are concerned with understanding the totality of the work system—technical and social—specifying system boundaries, assessing key variances and their interrelations, ascertaining sources of these variances, and so on.

Noticeably missing in the proposed process management concept are

the traditional quantitative or financial goals of output, productivity, costs, and profits. Although the apparent deemphasis on numerical goals runs counter to the importance of goals in traditional management theory (e.g., Taylor's scientific management) and the goal-setting research of Locke and his colleagues (e.g., Locke & Latham, 1984), it is, nonetheless, consistent with Deming's opposition to numerical goals for either the front-line worker (Point 10) or the manager (Point 11). An attempt to integrate the results and suggestions from the goal-setting research with the Deming management method, however, suggests an opportunity for reconciling and reducing the sharp contrast between the two opposing schools of thought; Carson and Carson (1992: 147) found, for example, that the goal-setting research on groups supports "Deming's assertion that groups can perform interdependent tasks and accomplish their objectives at least as effectively as individuals."

### Continuous Improvement

The concept of *continuous improvement* is receiving increased attention in part due to the inherent character of global competition that thrives upon progress of product (Garvin, 1987), service (Parasuraman, Zeithaml, & Berry, 1985), and process (Misterek, Anderson, & Dooley, 1990) quality. Continuous improvement defines the purpose of the Deming management method. Point 5, for example, encourages organizations to "[i]mprove constantly and forever the system of production and service" (Deming, 1986: 49). Continuous improvement is also implied in Deming's (1986: 3) chain reaction, which links higher quality to lower costs and higher market share (implying more satisfied and loyal customers) and provides organizations with the rationale for engaging in continuous improvements in quality. Continuous improvement consistently means "better and better quality, less and less variation" (W. E. Deming, Deming seminar, December 1985), which results from process management practices that bring forth incremental improvements and innovations in processes, products, and services.

Incremental improvement is grounded in the literature on learning curves (e.g., Cochran, 1968; Dutton, Thomas, & Butler, 1984; Muth, 1986; Wright, 1936; Yelle, 1979). These authors have proposed that extended production experience provides the employee with an opportunity for learning that may lead to a predictable decrease in the manufacturing cost per unit over time. Much of this literature has been based on an exponential model relating cumulative units of production to cumulative or individual unit hours of production, yet some researchers have proposed more complex formulations (see Eppele, Argote, & Devadas, 1991). Imai's (1986) conceptualization of incremental improvement as *kaizen* draws upon the notion of evolutionary operations (Box, 1987) where incremental process changes are planned, tested, observed, and appropriately implemented in order to benefit a particular quality dimension. Though

kaizen embraces the notion of learning, it is more prescriptive and descriptive of the process of improvement.

Innovation is also integral to both the concept of continuous improvement and to Deming's notions, as demonstrated in his explanation of Point 1 (Deming, 1986); it is, however, not the view of innovation as spontaneous or breakthrough in nature, but rather the emerging view of innovation as a process of "reinvention, proliferation, reimplementation, discarding, and termination actions" (Van de Ven, Angle, & Poole, 1989: 11). Deming, for example, appears to be less enthused with innovations envisioned through paradigm shifts and much more encouraging of incremental innovations stemming from methodological measurement, observation, and testing of the tractability of, and with, existing organizational processes. The two—incremental innovation and continuous improvement—are, in this regard, similar; this similarity is even more vivid in the juxtaposition of Shewhart's (1931) PDSA cycle with Leonard-Barton's (1988) cycles of adaptation, Van de Ven and Roger's (1988) view of innovation as cycles in activities tracks, and Dornblaser, Lin, and Van de Ven's (1989) view of innovation processes as learning and action loops.

Incremental process innovation as characterized by Abernathy and Townsend (1975), in particular, is central to the purpose of the Deming management method and the proposed process management concept, but although Abernathy and Utterback (1975) suggested the appropriateness of incremental innovation for mature products and industries, Deming advocated incremental innovation over a wider span of the product life cycle.

### **Employee Fulfillment**

*Employee fulfillment*, a multidimensional concept defined as the degree to which employees of an organization believe that the organization continually satisfies their needs, arises fundamentally from employees' being able to derive pride of workmanship, satisfaction, and commitment from the work they do. This concept is closely related to needs satisfaction by way of the work that employees perform (Cranny, Smith, & Stone, 1992: 259–260). A logical extension would be that a fulfilled employee is potentially more satisfied with the job he or she does. Job satisfaction is, therefore, "a pleasurable or positive emotional state resulting from the appraisal of [a person's] job or job experience" (Locke, 1976: 1300), which enables the employee to view his or her work favorably (Wanous & Lawler, 1972).

A second element of employee fulfillment is job commitment, which was discussed by Porter, Steers, Mowday, and Boulian (1974) and typically is defined in terms of "one's loyalty, identification, and involvement with the organization" (Mitchell, 1979: 249). Job commitment represents the extent of agreement between the employee and the fundamental values and purpose of the organization. To the extent that agreement exists, an employee would be more motivated to expend energy on organization-

al tasks and to provide high process, product, and service quality to satisfy the organization's customers. Job commitment is separate from job satisfaction and may, indeed, occur in the absence of job satisfaction; an employee, for example, may be committed to work situations in which certain tasks are not enjoyed (Steers, 1977).

Pride of workmanship, the third definitional element of employee fulfillment, was strongly vocalized by Deming, and it merits an entire point that calls for the removal of "barriers to pride of workmanship" (Point 12). Yet, this concept of pride of workmanship has scarcely been attended to in either the industrial psychology or the organizational behavior literature, except as a work value (i.e., pride in work [Wollack, Goodale, Wijting, & Smith, 1971]) in the tradition of the Protestant work ethic (Weber, 1958). In the context of employee fulfillment, pride in work as defined by Wollack and colleagues (1971: 332) lacks the necessary specificity; pride of workmanship proposed here includes three interactive sources.

1. The pride of accomplishment or achievement of product and service quality, obtained from being able to deliver a quality product or service to the customer.
2. The pride of knowing that one has improved the process that is producing the quality product or service, derived from the satisfaction of having improved the quality of how the work task will be accomplished by oneself and others.
3. The pride of having personally and successfully engaged in learning, brought about by the realization that one has used and applied existing knowledge and experience to generate new knowledge and advance what one already knows.

As Gabor (1990: 27) said: "An employee deserves to take pride in his [or her] work. . . . Deming believe[d] that this pride, or 'joy' as he often refers to it, comes from self-improvement and that it is the company's job to offer opportunities for continuous education." Deming (1993: 111), himself, claimed that "people are born with a natural inclination to learn. Learning is a source of innovation. One inherits a right to enjoy his [or her] work. Good management helps us to nurture and preserve these positive innate attributes of people."

Embedded in the employee fulfillment concept are assumptions that people "like" to work, "enjoy" challenging work, and are willing to "take responsibility" for work outcomes, assumptions that are essentially compatible with the Theory Y perspective on human work behavior (McGregor, 1960). In a more recent discussion of the history of perspectives on work, Nord, Brief, Atieh, and Doherty (1990) suggested a 2 by 2 classification framework using the dimensions of secular versus nonsecular and intrinsic versus extrinsic. Under this framework, employee fulfillment and its underlying assumptions are best classified under the secular, intrinsic cell. Deming consistently advocated the intrinsic nature of work, and as a result, he opposed the use of extrinsic rewards (e.g., Points 10 and 11); Deming (1993: 124) noted the necessity of preserving "the power of

intrinsic motivation, dignity, cooperation, curiosity, [and] joy in learning that people are born with."

### Customer Satisfaction

The relevance of customer satisfaction in any theory of quality management is apparent because the very definition (see Table 2), and, consequently, the measurement of customer satisfaction often has been based on a customer's perception of the quality of products and services. Quality, Deming (1982: 228, 1986: 177) said, arises from the interaction of three corners of a triangle: (1) the product, (2) the provision of training to the customer, and (3) the customer and the way he or she uses the product. This definition of quality highlights the importance of the customer, a theme that recurs throughout Deming's writings and those of his followers. Scherkenbach (1986a: 9), for example, wrote, "Dr. Deming has said for decades that the customer is the most important part of the production line." Deming (1982, 1986) encouraged companies to understand what the consumer needs and wishes now and in the future so that products and services could be designed to satisfy these needs and wishes. Deming further asserted that dissatisfied customers are detrimental to business performance; therefore, when a company makes decisions related to hiring and training employees who have direct contact with customers, he warned them to place top priority on an employee's ability to satisfy customers. Customer satisfaction, as such, is an instrumental motivational force behind Deming's 14-point approach to quality management; it is, at once, implicit, yet mandatory, in the Deming management method. In fact, Deming claimed that a firm's satisfied customers remain loyal customers and contribute to the well-being of the organization (Deming, 1993: 8, 1982: 225, 1986: 174–175). This belief motivated Deming to teach the 14 points as an approach that would perpetuate a continuous quality-improvement effort aimed at ensuring satisfied and loyal customers.

Satisfaction levels have been theorized in the literature as a result of subtractive disconfirmation, subjective disconfirmation, expectation, and perceived performance of a particular attribute, or set of attributes, of a product or service (Tse & Wilton, 1988). Although this is a useful idea, a troublesome issue emerges—that much of the marketing literature has focused on quality in terms of a single attribute (Steenkamp, 1989) in a static environment (Boulding, Kalra, Staelin, & Zeithaml, 1992), when, in reality, customer perceptions of quality are based upon multiple attributes that evolve over time. Steenkamp (1989) further observed that much of the traditional economic literature, when not ignoring the concept of quality, considered cost as a surrogate measure of quality, or at the very least, assumed that quality and costs are positively related. This logic leads to the reasoning that quality improvements are inherently costly. Neither Deming's chain reaction (1986: 3), nor the theory of quality management proposed here, presumes this positive relationship between quality and cost, suggesting instead that improvements in process quality would



result in opportunities for improved product and service quality at reduced cost, thereby creating the potential for increased customer satisfaction.

### SPECIFYING RELATIONSHIPS AMONG CONCEPTS

*Proposition 1: Visionary leadership enables the simultaneous creation of a cooperative and learning organization.*

Deming has consistently vocalized his support of leadership that provides a cooperative and learning environment. It is the leader's responsibility to execute Point 9 (break down barriers between departments), allowing people within an organization to work together. For example, illustrations of Deming's vigilance to how leadership can stifle internal cooperation are found in his work (1993: 85) and that of Scherkenbach (1986a: 48–49). Deming (W. E. Deming, Deming seminar, September 1988), himself, said: "The new philosophy requires leadership, we need to think in terms of win-win. There was a time for rugged individualism. It was not wrong. Times have changed." Now the emphasis is on teamwork (Deming, 1986; Scherkenbach, 1986a), and the leader must "help his [or her] people to see themselves as components in a system, to work in cooperation with succeeding stages and with following stages toward optimization of the efforts of all stages" (Deming, 1993: 128).

Leaders of organizations are similarly asked to institute programs of ongoing training and education (Points 6 and 13), because through these programs, organizational members embrace a continuous process of learning about their work and learning for the purposes of self-actualization and intellectual growth. Only leaders can remove the fear of learning; their responsibility "must be to develop [their employees] so that they can continually improve" (Scherkenbach, 1986a: 77, 89). Leaders, themselves, must be "unceasing learners, . . . [providing], when possible and feasible, seminars and courses for advancement of learning" for themselves and those they lead (Deming, 1993a: 128).

That leadership can envision and create a cooperative and learning organizational system finds advocacy in the writings of Schein (1992), Gilbert and Roberts (1984), and Likert (1967). Schein (1992), for example, saw leaders as critical forces in developing, molding, and shaping the cultural system of organizations. Accordingly, Schein (1992: 392) explained the impact of organizational leadership on organizational learning as follows: "If the [organizational] leaders of today want to create organizational cultures that will themselves be more amenable to learning, they will have to set the example by becoming learners themselves and involving others in the learning process." Gilbert and Roberts (1984), in their contrast of the instrumental versus the navigational perspectives on managing organizational culture, also viewed organizational leaders as capable of actively contributing to the characteristics of the organizational system that they captain. Likert (1967) likewise proposed that the



adoption of System 3 and System 4 management styles results in more open, cooperative, and trusting organizations.

*Proposition 2: An organization that simultaneously fosters cooperation and learning facilitates the implementation of process management practices.*

Deming's advocacy of this proposition can be inferred from several of the 14 points. Point 8, for example, demands the elimination of fear, a deterrence to cooperation, so as to allow employees to work effectively for the company. Internal cooperation is so important to Deming that he has, time and again, called for the removal of policies and practices that are detrimental to internal cooperation (e.g., Point 9). The annual performance review and the use of slogans, numerical goals, and so on, are exemplary internal forces that impede the implementation of process management practices because they foster adversarial intraorganizational relationships; the annual performance review, for instance, "brings teamwork to near zero" (W. E. Deming, Deming seminar, December 1985). "Process management requires cooperation, not competition, with shared knowledge" (W. E. Deming, personal communication, June 1989). Deming's emphasis on cooperation as a requisite to process management (and, ultimately, continuous improvement) is exemplified in his desire "to leave a legacy of the importance of systems thinking and the idea of win-win in process improvement" (W. E. Deming, Deming seminar, personal discussion with Lou Schultz, June 1993). In the last few years of Deming's life, the word *competition* became so foreign to his vocabulary that even the notion of creating improved competitive position brought stern admonition from him and a call for sharing, breaking down barriers, and cooperative efforts in implementing process management practices.

The criticality of *learning to process management* is evidenced in Point 6 and Point 13 and in Deming's consideration and advocacy of "profound knowledge" as foundational to the conduct of process management (Anderson et al., 1992; W. E. Deming, Deming seminar, September 1992). Deming's encouragement to continually apply Shewhart's (1931) PDSA cycle to managing and improving processes (e.g., Deming, 1986: 88) provides additional evidence of how essential employees engaging in learning and knowledge generation is to process management. The closed loop in the execution of the PDSA cycle signifies a continual cycle whereby the generation of process knowledge allows the perpetuation of the PDSA cycle: Knowledge generation effects actions on the process, which leads to more learning, more actions, and so forth. In this respect, learning and process management are iterative, mutually reinforcing one another.

Partial support for this proposition can be found in the work of Bushe (1988), which identified three cultural barriers (i.e., values on learning versus performing, meaning of information, and holism versus segmentalism) to the successful implementation of statistical process control, a process management practice. That the effective implementation and

subsequent practice of statistical process control depends on the degree to which the organization values and encourages learning is implied in this article (Bushe, 1988) and explicitly stated in a subsequent book by Bushe and Shani (1991). Starbuck (1992) identified several mechanisms (e.g., the provision of training, the retention of knowledgeable personnel, and the creation of physical capital where knowledge resides) in his explanation of the learning process within a knowledge-intensive firm. These mechanisms facilitate the manifestation of Huber's (1991) four constructs of knowledge acquisition, information interpretation, information distribution, and organizational memory in process management practices involving the employment of statistical methodologies for data collection and interpretation and the subsequent documentation of generated knowledge.

*Proposition 3: Process management practices simultaneously result in continuous improvement of quality and employee fulfillment.*

Process management is appropriately a central concept within the proposed theory underlying the Deming management method, for it is clearly the hallmark of Deming the man, his writings, his speeches, and his 14 points. According to Deming (1986: 51), the implementation and performance of process management practices allow processes to be brought into what Shewhart (1931) coined as a state of statistical control (i.e., no special causes of variation); Deming's (1986: 11) description of an industrial experience is telling: "Without process control, the process was in unstable chaos, the noise of which would mask the effect of any attempt to bring improvement." Deming's (1993:) statement, "We need better and better quality with less and less variation," demonstrates his belief that continuous quality-improvement efforts depend on the engagement and conduct of process management practices aimed at managing and continually reducing variation. The reduction in process variation, in turn, leads to benefits such as increasing output uniformity, continual reduction of rework and mistakes, continual reduction of waste of staffing, machine time, and materials (Deming, 1982).

Deming (1986: 248) also believed that the implementation and performance of process management practices lead to more fulfilled employees because of the removal of barriers that disallow pride of workmanship. The attention to the development of employees within the organization, not through directives, but rather through the removal of barriers and the nurturing of self-development and learning, pervades Deming's writings, as well as those of others who expound on his 14 points (e.g., Scherkenbach, 1986a). Deming deemed that employee fulfillment (as described here) is an essential element of work life and that the "pride of workmanship" component of employee fulfillment is dependent not only upon the realization of the quality of one's work output, but also upon the intrinsic reward and the personal development of one's self and one's processes of work.

Support for this proposition can be traced back to the definition of process management as both methodological- and human resources-related practices. The methodological practices make available the tools to engage in the continuous improvement of processes, products, and services. Statistical process control and design of experiments, for example, when effectively implemented and practiced bring about process improvements, first by eliminating special causes of variation and, second, by reducing common causes of variation. There is ample anecdotal evidence, for instance, to support a relationship between statistical process control and quality improvements (e.g., Dondero, 1991; Oakland & Followell, 1990; Rucinski, 1991; Sower, 1990). In contrast, the equating of the "implementing concepts" as suggested by Hackman and colleagues (1975) to those human resources-related practices regarding employees provides the theoretical fabric to describe and explain how and why the implementation and performance of process management practices result in employees who are more intrinsically motivated and satisfied with their work. Wall, Jackson, and Davids (1992) would also argue that the process management practices reassign process control away from specialists (such as the quality inspector), bestowing such responsibility on front-line employees assigned to work on the process. In this regard, continuous quality improvement occurs not only because front-line operators are able to respond faster to correcting quality problems when they do arise (*quick-response explanation*) but also because they are motivated proactively to prevent quality problems from occurring (*anticipatory explanation*). At the same time, the increase in the level of autonomy and feedback of employees' jobs translates into higher internal work motivation and job satisfaction, as explained by the job characteristics model (Hackman & Oldham, 1976). Empirical support for improvement in job satisfaction when process control is placed in the hands of the front-line operators can be found in the work of Wall and colleagues (1990).

*Proposition 4: An organization's simultaneous efforts continuously to improve its quality and to fulfill its employees lead to higher customer satisfaction.*

That continuous improvement results in customer satisfaction appears to be intuitively obvious; it would be difficult, for instance, to give arguments contradicting why rational consumers should be opposed to higher quality products and services at equal or lower costs to them. Deming's (1951) emphasis on consumer research requires that firms engage in continuous improvement of their products and services in order to meet and satisfy changing customer requirements. This point has been reiterated in Scherkenbach (1986a: 34): "What leads or persuades people to brag about using your products and services? Identifying their needs and expectations and then consistently meeting them. How do you do that? . . . Through the process of continuous improvement."

Other writers, besides Deming, appear to agree with the importance

of continuous quality improvement to customer satisfaction. Johnston and Daniel (1991), for instance, urged firms to satisfy customers by delivering and improving quality. Imai (1986: 207) similarly characterized continuous improvement as an antecedent to customer satisfaction. Scientific evidence on this proposed relationship, however, appears to be scarce. What does exist is evidence of a positive relationship between customer perceptions of quality and customer satisfaction. Lascelles and Barrie (1990), for example, found that demanding customers were the primary motivator for organizational efforts to improve quality. Another study by the U.S. Government's General Accounting Office (1991) of the 20 highest scoring companies applying for the Malcolm Baldrige Award also substantiates a positive relationship between customer satisfaction and perceived quality. A study in Sweden (Anderson, Fornell, & Lehmann, 1993) revealed that quality has a positive impact on both customer satisfaction and profitability. The PIMS data have consistently demonstrated the linkage between sustained market share and relative quality (Buzzell & Gale, 1987).

The rationality of the linkage between the management and continuous improvement of process, product, and service quality and customer satisfaction is further characterized within the structure and evaluative criteria of national quality awards. The Malcolm Baldrige National Quality Award, a case in point, weighs 30 percent of its evaluation of applicants on customer satisfaction; for Japan's Deming Prize, "customer satisfaction is implicit within all of the Deming Prize guidelines" (Dooley, Bush, Anderson, & Rungtusanatham, 1990). Additionally, the recent methodology of quality function deployment (e.g., Akao, 1990; Hauser & Clausing, 1988) provides a practical template to rationalize the linkages among customer satisfaction, customer attributes, and the engineering characteristics of processes, products, and services.

Customer satisfaction in the proposed theory is affected not only by continuous improvement efforts but also by the employee fulfillment concept. Deming did not explicitly address this relationship; it is treated implicitly as a natural outcome of employees' attaining pride of workmanship, particularly pride of quality of one's work. The logic of this implied relationship between employee fulfillment and customer satisfaction rests fundamentally on the interaction of pride of quality of work and Deming's (1982: 228, 1986: 177) enunciation of the three "corners" of quality; pride of quality of work necessarily relies upon (a) understanding and satisfying changing customer requirements, (b) providing relevant product- or service-related information, and (c) anticipating customer usage. Some related literature sheds light on the potential of employees to affect customer satisfaction. Mohr (1991), for instance, constructed and tested a simple theoretical model of the positive impact of perceived employee effort on customer satisfaction. Tornow and Wiley (1991) found that employees' perceptions and attitudes were positively related to customer satisfaction. Additional insights can be found in the literature on interpersonal contact between the customer and the employee in the context of

service quality (e.g., Parasuraman et al., 1985). The relationship proposed here is integral to any characterization of, let alone a proposed theory underlying, the Deming management method. It deserves more than implicit foundation and rationalization.

### **Examining the Proposed Theory as a Theory of Organizational Improvement**

In the foregoing we have described the individual concepts and the theorized relationships among them and have attempted to place both the concepts and their relationships in existing literature. What is missing is a theoretical discussion of the entirety of the proposed theory, either in a formative or evaluative manner. To do so, it is insightful to observe that the prescriptions in the proposed theory, though specific to the management and control of quality, can be interpreted in the context of organizational improvement at the macro level. As such, it may be instructive to compare and contrast the proposed theory to other existing theories of organizational improvement. Again, the discussion is meant to be illustrative rather than exhaustive and, we hope, will serve to further catalyze this type of theoretical discourse. For this purpose, the proposed theory will be juxtaposed against Taylor's principles of scientific management (Taylor, 1911) and Lawrence and Dyer's (1983) theory of readaptative organizations.

### **TAYLOR'S PRINCIPLES OF SCIENTIFIC MANAGEMENT**

At the onset, it appears that W. E. Deming and F. W. Taylor oppose one another in ideology. Deming, for example, spoke of visionary leadership, whereas Taylor spoke of management control. Deming believed in the intrinsic motivation to work that is ensured by process management; Taylor, however, appeared to advocate the extraction of performance through extrinsic motivation, merit review, and piece work. Deming wanted a cooperative organization, whereas Taylor, despite his case for cooperation, is often accused of developing an adversarial model of organizational management, one that is aligned with the interests of ownership and dehumanizes the worker in a mechanistic design of work and work improvement.

Despite these apparent differences, there are fundamental similarities between the two sets of management principles. Writings and careful examinations of Taylor's work (e.g., Wrege & Greenwood, 1991) raise the specter of a more humanistic Taylor—one who, like Deming, believed that industrial progress depends upon the entire organizational system of task design, technology, and people. It is also true that Taylor's principles of scientific management were a "synthesis of old and new techniques that acted as a catalyst on the late 19th century movement" (Nelson, 1975: 460), much like Deming's 14 points in the current time.

A more reflective contrast between the four principles of scientific

management and the theory proposed as underlying the effectiveness of the Deming management method reveals more interesting similarities and differences. Briefly stated, Taylor's four principles of scientific management are:

1. Develop a science for each element of a [person's] work, which replaces the old rule-of-thumb method.
2. Scientifically select and then train, teach, and develop the work[ers], whereas in the past [they] chose [their] own work and trained [themselves] as best [they] could.
3. Heartily cooperate with the [workers] so as to insure all of the work being done [is] in accordance with the principles of science which ha[ve] been developed.
4. There is an almost equal division of work and responsibility between the management and the worker. The management takes over all work [for] which they are better fitted than the work[ers], while in the past almost all of the work and the greater part of the responsibility were thrown upon the [employees]. (Taylor, 1911: 36–37)

The similarities between the principles of scientific management and the concepts and propositions in the proposed theory of quality management are quite evident. First, both place emphasis on a scientific approach to work and organizational improvement. Taylor said that the work that employees did must be scientifically constructed, where improvements to the work were outcomes of applying the scientific method to unearthing the optimal approach. The proposed concept of process management, which supports the use of the PDSA cycle (Shewhart, 1931), is representative of applying the scientific method of inquiry for the purpose of improvement (i.e., the elimination of special and common causes of variation). Deming's prescriptive study of process variation of the entire organizational system helps to overcome the "blind spot" (Drucker, 1979) of scientific management's more deterministic and linear view of improvement.

Advocates of both scientific management and the proposed theory recognize the influence and the potential for learning and knowledge in the conduct of organizational improvement. Taylor, however, would position management and staff as the keepers of organizational knowledge. Knowledge that would normally reside with the worker would be learned by management and staff and assimilated into management's revised design of the workers' task. Deming, in contrast (see discussion under the Learning concept), preferred the learning process to be an ongoing, organizationwide activity in which all organizational members engage.

Training is important to both theories, but the content of training differs. To Taylor, training is necessary for task execution, not for the conduct of further learning or self-improvement; training for scientific management has an implied end, assuming no fundamental changes in technology or task requirements. The concept of learning to Deming and in the context of the proposed theory, in contrast, concerns the provision of both process task knowledge and what Deming (1990, 1993) called "pro-



found knowledge"; more important, this learning is self-regulated, stimulated by a "natural inclination to learn" (Deming, 1993: 111).

Another similar point between scientific management and the proposed theory is the importance of cooperation. A difference, however, can be detected in the purpose and breadth of cooperation. Whereas cooperation under scientific management is needed to ensure that work is done properly, in a rigid and predetermined fashion set by management, cooperation in the proposed theory and as exemplified by Points 4 and 9 in the Deming management method is not only broader (encompassing an internal as well as an external orientation) but also less control oriented.

Taylor's notion of "soldiering" (whereby individuals purposely work below their capacity) offers yet another point of departure from the concept of employee fulfillment. To Deming, soldiering was not a behavioral strategy but a consequence of a lack of management and reduction of variation, and more generally, the lack of understanding of the true science of work and the barriers to progress. Taylor's emphasis on extrinsic motivation for purposes of work performance and organizational improvement also revealed a sharp contrast to the Deming management method's and the proposed theory's focus on removing barriers and enabling intrinsic motivation to work.

### **LAWRENCE AND DYER'S THEORY OF READAPTATIVE ORGANIZATIONS**

Lawrence and Dyer's (1983) theory of readaptative organizations is an empirically based prescription for the renewal of industry (i.e., organizational improvement), whose development was in part catalyzed by the progress within the Japanese economy. According to this theory, the environment provides both the opportunity and need for readaptation. Readaptation requires that (a) the organization obtains information from its environment to interpret and make sense out of external events and (b) the organization obtains resources from its environment in order to survive. An organization, therefore, progresses by placing dual priority on innovation and efficiency—the innovation comes from utilizing the information from the environment, and the efficiency comes from using scarce resources in the best manner. Lawrence and Dyer (1983: 9) further proposed that the ideal environment to foster organizational learning and readaptation is characterized by intermediate levels of both information complexity and resource scarcity.

Both Lawrence and Dyer's theory of readaptative organizations and the theory proposed here are founded on Barnard's notion of organizations as purposeful systems of coordinated action (Lawrence & Dyer, 1983: 294). Lawrence and Dyer (1983: 295) viewed organizations as "learning, production, and social systems that together with the environment in which they are embedded function as a larger system." Deming (1990), likewise, considered systems theory and learning, both integral to his notion of



profound knowledge, to be foundational elements for understanding the structure and purpose of organizational existence.

Another important similarity between the theory of readaptative organization and the proposed theory of quality management is the suggestion of an organizational evolutionary journey marked by a continual state of adaptation and improvement. Both theories place importance on the management and reduction of uncertainty. In the theory of readaptative organization, this is seen as finding and residing in environments with moderate information complexity and resource scarcity, as opposed to the management and reduction of process, product, and service variation in the proposed theory.

Users of both theories also express the critical role of organizational learning and knowledge in organizational improvement. A fundamental premise for sustaining the readaptative process, according to Lawrence and Dyer, is that organizational members need to learn in order to be innovative and need to strive in order to be efficient. Just as fundamental is the concept of learning within the proposed theory. Deming's juxtaposition of Shewhart's (1931) PDSA cycle and Lewis's (1992) treatise of learning and knowledge was basic to Deming's thoughts and development (Deming, 1989). The proposed theory, however, appears to part ways with Lawrence and Dyer's recognition of the need for organizational differentiation by employing knowledge specialists to manage the information complexity. Deming's emphasis on enabling wider organizational learning, shared understanding, the need for cooperation, and the risks of segregation seems to have drawn his attention away from the need for organizational differentiation with regard to information processing and knowledge generation. Deming took a much stronger position regarding the organizationwide process of learning and developing the skills and capabilities necessary to engage in personal learning and the development of knowledge.

Proponents of both theories espouse strong organizational leadership. Lawrence and Dyer's (1983: 10) readaptative process depends on the "organization's entire membership being made cognizant of the broad purpose, ethical standards, and operating principles," clearly a call for visionary leadership. Deming similarly emphasized leadership's role and responsibilities to instill a constancy of purpose within the organization (Point 1).

Human resource practices also present similarities and differences. The theory of readaptative organizations advocates high involvement of employees in the readaptative process (Lawrence & Dyer, 1983: 267) and a sense of organization membership that is in keeping with Deming's and the proposed theory. However, the proposed theory makes little use of the administrative bureaucratic control mechanisms suggested in the readaptative process (Lawrence & Dyer, 1983: 11), short of the structure and clarity that come from shared understanding of the operational definitions for process, product, and service requirements. In addition,

Lawrence and Dyer's (1983: 11) employment of "marketlike financial devices" and their view of moderate resource scarcity as motivational mechanisms emphasize extrinsic as opposed to the intrinsic orientation pervasive to Deming's work and the process management and employee fulfillment concepts. Lawrence and Dyer's (1983: 277) advocacy that "competition can partially substitute for external competition" toward overcoming complacency is clearly contrary to Deming's emphasis on cooperation.

## CONCLUSIONS AND FUTURE RESEARCH DIRECTIONS

In this article, we propose and articulate a theory of quality management to describe and explain the effectiveness of the Deming management method. The proposed theory is grounded in existing literature and observations of practice in industry, and it draws upon a Delphi study process involving experts on Deming and his 14 points. In particular, the concepts or building blocks in the proposed theory are derived from a conceptual synthesis of the Delphi study results with Deming's writings. The proposed theory serves and fulfills several purposes from the standpoint of both academic research and practice.

In terms of research, the proposed theory provides a basis for further conceptual and empirical work on the Deming management method and, more generally, for the discipline of quality management. Three streams of research are readily identifiable: the first being the necessity of subjecting the proposed theory to empirical examinations to see whether or not real-world data support the advocated relationships in the theory. One such attempt at verifying the proposed theory is currently being undertaken; however, other researchers are strongly urged to consider testing and extending the theory's boundaries of generalizability to various industries, to various countries, and to various time periods. Second, the 37 original concepts and their nominal definitions that have been generated by the Delphi panel can be made available to encourage alternative conceptualizations of causal linkages among these concepts. One possibility is to view the set of practices in process management as a change agent that alters the organizational system, as opposed to the current conceptualization. Third, opportunities exist for both theoretical and empirical researchers to examine, in greater depth, the various linkages in the articulated theory.

From a practical standpoint, the proposed theory increases understanding of the characteristics of the Deming management method. This understanding should lead to more efficient and more effective efforts at achieving the Deming management method's purpose of transforming and improving the practice of management. The importance of top-management's leadership in creating and communicating a vision for continual improvement in order to enhance the viability of the organization cannot be underestimated. With respect to the practice of management, what this means is that top- and functional-level management must

seriously engage in the formulation and implementation of respective strategies—strategies that are consistent with the goals of continuous improvement of product, service, and process quality. In time, from subjecting the proposed theory to questionnaire-based survey research, valid, reliable instruments to assess the effectiveness of quality management practices advocated in the Deming management method could be available for practitioners to use as a comprehensive, self-auditing tool.

As a final remark, it is important to emphasize that the theory articulated in this article is neither *the* theory of quality management nor the *only* theory of quality management underlying the Deming management method; it is simply a first attempt at defining and articulating a theory of quality management and has been presented for the purpose of discussion, dissection, and further development. Other researchers are encouraged to critically examine the Deming management method approach to quality management, as well as other approaches to quality management. Through such activity, more enriched and unified theories of quality management can be developed to further understanding of this phenomenon.

## REFERENCES

- Abernathy, W., & Townsend, P. 1975. Technology, productivity, and process change. *Technological Forecasting and Social Change*, 7: 379–396.
- Abernathy, W., & Utterback, J. 1975. A dynamic model of product and process innovation. *Omega*, 3: 639–657.
- Ackoff, L. 1971. Toward a system of systems concepts. *Management Science*, 17: 661–671.
- Akao, Y. (Ed.). 1990. *Quality function deployment*. Cambridge, MA: Productivity Press.
- Anderson, E., Fornell, C., & Lehmann, D. 1993. *Economic consequences of providing quality and customer satisfaction*. (Research Report No. 93-112). Cambridge, MA: Marketing Science Institute.
- Anderson, J. C., Dooley, K. J., & Misterek, S. A. 1992. The role of profound knowledge in the continual improvement of quality. *Human Systems Management*, 10: 243–259.
- Ansari, A., & Modarress, B. 1990. *Just-in-time purchasing*. New York: Free Press.
- Argyris, C., & Schön, D. 1974. *Theory in practice: Increasing professional effectiveness*. San Francisco: Jossey-Bass.
- Argyris, C., & Schön, D. 1978. *Organizational learning: A theory of action perspective*. Reading, MA: Addison-Wesley.
- Avolio, B., & Bass, B. 1986. *Transformational leadership, charisma, and beyond*. (Technical Report No. 85-90). Binghamton, NY: State University of New York School of Management.
- Baillie, A. S. 1986. The Deming approach: Being better than the best. *Advanced Management Journal*, Autumn: 15–23.
- Baker, E. M., & Artinian, H. L. 1985. The case of Windsor Export Supply. *Quality Progress*, June: 61–69.
- Barnard, C. 1938. *The functions of the executive*. Cambridge, MA: Harvard University Press.
- Bass, B. 1985. *Leadership and performance beyond expectations*. New York: Free Press.

- Bennis, W., & Nanus, B. 1985. *Leaders: The strategies for taking charge*. New York: Harper & Row.
- Benson, J. K. 1975. The interorganizational network as a political economy. *Administrative Science Quarterly*, 20: 229–249.
- Best, R. J. 1974. An experiment in Delphi estimation in marketing decision making. *Journal of Marketing Research*, 11: 448–452.
- Bird, C. 1940. *Social psychology*. New York: Apple-Century-Crofts.
- Blalock, H. H., Jr. 1969. *Theory construction: From verbal to mathematical formulations*. Englewood Cliffs, NJ: Prentice Hall.
- Boulding, K. E. 1956. General systems theory—The skeleton of science. *Management Science*, 2: 197–208.
- Boulding, W., Kalra, A., Staelin, R., & Zeithaml, V. 1992. A dynamic process model of service quality: From expectations to behavioral quality. *Journal of Marketing Research*, 30: 7–27.
- Box, G. 1987. *Quality improvement: An expanding domain for the application of the scientific method*. Working paper, Center for Quality and Productivity Improvement, University of Wisconsin, Madison.
- Bromiley, P., & Cummings, L. L. 1989. *Transaction costs in organizations with trust*. Working paper, Strategic Management Research Center, University of Minnesota, Minneapolis.
- Brown, J., & Duguid, P. 1991. Organizational learning and communities of practice: Toward a unified view of working, learning, and innovation. *Organizational Science*, 2: 40–57.
- Burns, J. 1978. *Leadership*. New York: Harper & Row.
- Bushe, G. R. 1988. Cultural contradictions of statistical process control in American manufacturing organizations. *Journal of Management*, 14: 19–31.
- Bushe, G. R., & Shani, A. B. 1991. *Parallel learning structures: Increasing innovation in bureaucracies*. Reading, MA: Addison-Wesley.
- Business Week*. 1992. The quality imperative: What it takes to win for the global economy. [Special issue]. October 25: 1–216.
- Buzzell, R. D., & Gale, B. T. 1987. *The PIMS principles—linking strategy to performance*. New York: Free Press.
- Carson, P. P., & Carson, K. D. 1992. Deming versus historical management theorists on the importance of goal-setting: Can both be right? *Academy of Management Best Paper Proceedings*: 144–148.
- Chafetz, J. S. 1978. *A primer on the construction and testing of theories in sociology*. Itasca, IL: Peacock.
- Cochran, E. 1968. *Planning production costs: Using the improvement curve*. San Francisco: Chandler.
- Conger, J. 1989. Leadership: The art of empowering others. *Academy of Management Executive*, 3(1): 17–24.
- Cranny, C. J., Smith, P. C., & Stone, E. F. 1992. *Job satisfaction: How people feel about their jobs and how it affects their performance*. New York: Lexington Books.
- Cyert, R., & March, J. 1963. *A behavioral theory of the firm*. Englewood Cliffs, NJ: Prentice Hall.
- Dean, J. W., Jr., & Evans, J. R. 1994. *Total quality: Management, organization, and strategy*. Minneapolis, MN: West.

- Deming, W. E. 1951. *Elementary principles of the statistical control of quality*. Nippon Kagaku Gijutsu Remmei: Japanese Union of Science and Engineering (JUSE).
- Deming, W. E. 1981/1982. Improvement of quality and productivity through action by management. *National Productivity Review*, 1(1): 12–22.
- Deming, W. E. 1982. *Quality, productivity, and competitive position*. Cambridge: Massachusetts Institute of Technology, Center for Advanced Engineering Study.
- Deming, W. E. 1986. *Out of the crisis*. Cambridge: Massachusetts Institute of Technology, Center for Advanced Engineering Study.
- Deming, W. E. 1990. A system of knowledge. *Actionline*, August: 20–24.
- Deming, W. E. 1993. *The new economics for industry, government, education*. Cambridge: Massachusetts Institute of Technology, Center for Advanced Engineering Study.
- Deutsch, M. 1949. A theory of co-operation and competition. *Human Relations*, 2(2): 129–152.
- Donaldson, L. 1990. The ethereal hand: Organizational economics and management theory. *Academy of Management Review*, 15: 369–381.
- Dondero, C. 1991. SPC hits the road. *Quality Progress*, 24(1): 43–44.
- Dooley, K. J., Bush, D., Anderson, J. C., & Rungtusanatham, M. 1990. The United States' Baldrige Award and Japan's Deming Prize: Two guidelines for total quality control. *Engineering Management Journal*, 8(2): 9–16.
- Dornblaser, B., Lin, T., & Van de Ven, A. H. 1989. Innovative outcomes, learning and action loops. In A. H. Van de Ven, H. Angle, & S. Poole (Eds.), *Research on the Management of Innovation*: 193–217. New York: Harper & Row.
- Drucker, P. 1979. *Adventures of a bystander*. New York: Harper & Row.
- Duncan, W. J., & Van Matre, J. G. (Guest Eds.). 1990. The Gospel according to Deming: Is it really new? *Business Horizons*, 33(4): 3–9.
- Dutton, J., Thomas, A., & Butler, J. 1984. The history of progress functions as a managerial technology. *Business History Review*, 58: 204–233.
- Epple, D., Argote, L., & Devadas, R. 1991. Organizational learning curves: A method for investigating intra-plant transfer of knowledge acquired through learning by doing. *Organization Science*, 2: 58–70.
- Flynn, B., Schroeder, R. G., & Sakakibara, S. 1993. *The impact of quality management practices on performance and competitive advantage*. Working paper 92-3, Operations and Management Science Department, University of Minnesota, Minneapolis.
- Fowler, H. R. 1986. *The Little, Brown handbook*. Boston: Little, Brown.
- Frey, S. C., Jr., & Schlosser, M. M. 1993. ABB and Ford: Creating value through cooperation. *Sloan Management Review*, 34(1): 65–72.
- Gabor, A. 1990. *The man who discovered quality: How W. Edwards Deming brought the quality revolution to America—the stories of Ford, Xerox, and GM*. New York: Times Books.
- Gartner, W. B. 1993. Dr. Deming comes to class. *Journal of Management Education*, 17: 143–158.
- Gartner, W. B., & Naughton, M. J. 1988. The Deming theory of management. *Academy of Management Review*, 13: 138–142.
- Garvin, D. A. 1987. Competing on the eight dimensions of quality. *Harvard Business Review*, 65(6): 101–109.
- General Accounting Office. 1991. *U.S. companies improve performance through quality efforts*. (NSIAD-91-190). Washington, DC: United States General Accounting Office.

- Gilbert, D. R., Jr., & Roberts, N. C. 1984. *The leader and organizational culture: Navigating the tricky currents*. Discussion paper #13, Strategic Management Research Center, University of Minnesota, Minneapolis.
- Gitlow, H., Gitlow, S., Oppenheim, A., & Oppenheim, R. 1989. *Tools and methods for the improvement of quality*. Homewood, IL: Irwin.
- Glynn, M., Lant, T., & Mezias, S. 1991. Incrementalism, learning, and ambiguity: An experimental study of aspiration level updating. *Academy of Management Best Paper Proceedings*: 384–388.
- Gruska, G. F. 1981. *Theory D: An overview and commentary*. Dearborn Heights, MI: Multi-face.
- Hackman, J. R., & Oldham, G. R. 1980. *Work redesign*. Reading, MA: Addison-Wesley.
- Hackman, J. R., & Oldham, G. R. 1976. Motivation through the design of work: Test of a theory. *Organizational Behavior and Human Performance*, 16: 250–279.
- Hackman, J. R., & Oldham, G. R., Janson, R., & Purdy, K. 1975. A new strategy for job enrichment. *California Management Review*, 27(4): 57–71.
- Hahn, C. K., Kim, K. H., & Kim, J. S. 1986. Costs of competition: Implications for purchasing strategy. *Journal of Purchasing and Materials Management*, 22(3): 2–7.
- Hall, R. H. 1983. *Zero inventories*. Homewood, IL: Dow Jones-Irwin.
- Hauser, J. R., & Clausing, D. 1988. The house of quality. *Harvard Business Review*, 88(3): 63–73.
- Helmer, O., & Rescher, N. 1959. On the epistemology of the inexact sciences. *Management Science*, 6: 25–52.
- Hodgson, A. 1987. Deming's never-ending road to quality. *Personnel Management*, July: 40–44.
- Huber, G. 1991. Organizational learning: The contributing processes and the literatures. *Organizational Science*, 2: 88–115.
- Imai, M. 1986. *Kaizen (Ky'zen): The key to Japan's competitive success*. New York: McGraw-Hill.
- Johnson, D. W., & Johnson, R. T. 1989. *Cooperation and competition: Theory and research*. Edina, MN: Interaction.
- Johnson, R. T., & Johnson, D. W. 1979. Type of task and student achievement and attitudes in interpersonal cooperation, competition, and individualization. *Journal of Social Psychology*, 108: 37–48.
- Johnston, C. G., & Daniel, M. J. 1991. Customer satisfaction through quality. *Canadian Business Review*, 18 (Winter): 12–15.
- Jolson, M. A., & Rossow, G. L. 1971. The Delphi process in marketing decision making. *Journal of Marketing Research*, 8: 443–448.
- Kast, F. E., & Rosenzweig, J. E. 1969. *Organization and management: A systems approach*. New York: McGraw-Hill.
- Kelly, J. 1974. *Organizational Behavior* (rev. ed.). Homewood, IL: Irwin.
- King, B. 1989. *Hoshin planning: The developmental approach*. Methuen, MA: GOAL/QPC.
- Kuhnert, K., & Lewis, P. 1987. Transactional and transformational leadership: A constructive/development analysis. *Academy of Management Review*, 12: 637–647.
- Lant, T. K., & Mezias, S. J. 1992. Managing discontinuous change: A simulation study of organizational learning and entrepreneurial strategies. *Strategic Management Journal*, 11: 147–179.

- Lascelles, D., & Barrie, D. 1990. Quality management: The chief executives' perception and role. *Journal of European Management*, 8: 67-75.
- Lascelles, D. M., & Dale, G. B. 1989. The buyer-seller relationship in total quality management. *Journal of Purchasing and Materials Management*, 25(3): 10-19.
- Lawrence, P., & Dyer, D. 1983. *Renewing American industry*. New York: Free Press.
- Leonard-Barton, D. 1988. Implementation as mutual adaptation of technology and organization. *Research Policy*, 17: 251-267.
- Lewis, C. I. 1929. *Mind and world order*. New York: Scribner.
- Likert, R. 1967. *The human organization: Its management and value*. New York: McGraw-Hill.
- Locke, E. A. 1976. The nature and causes of job satisfaction. In M. D. Dunnette (Ed.), *Handbook of industrial and organizational psychology*: 1297-1349. Chicago: Rand McNally.
- Locke, E. A., & Latham, G. P. 1984. *Goal setting: A motivational technique that works*. Englewood Cliffs, NJ: Prentice Hall.
- Luthans, F., & Thompson, K. R. 1987. Theory D and O.B. Mod.: Synergistic or opposite approaches to performance improvement? *Journal of Organizational Behavior Management*, 9: 105-124.
- March, J. 1988. Variable risk preferences and adaptive aspirations. *Journal of Economic Behavior and Organization*, 9: 5-24.
- March, J. 1981. Footnotes to organizational change. *Administrative Science Quarterly*, 26: 563-577.
- March, J., & Simon, H. 1958. *Organizations*. New York: Wiley.
- McGregor, D. 1960. *The human side of enterprise*. New York: McGraw-Hill.
- Michaels, J. 1977. Classroom reward structures and academic performance. *Review of Educational Research*, 47(1): 87-99.
- Misterek, S. A., Anderson, J. C., & Dooley, K. J. 1990. The strategic nature of process quality. *Proceedings of the National Decision Sciences Institute Conference*: 1517-1519.
- Mitchell, T. R. 1979. Organizational behavior. *Annual Review of Psychology*, 30: 243-281.
- Mitroff, I. I., Betz, F., Pondy, L. R., & Sagasti, F. 1974. On managing science in the systems age: Two schemas for the study of science as a whole systems phenomenon. *Interfaces*, 4(3): 46-57.
- Mizuno, S. 1988. *Management for quality improvement: The seven new QC tools*. Cambridge, MA: Productivity Press.
- Mohr, L. A. 1991. *Social episodes and consumer behavior: The role of employee effort in satisfaction with services*. Unpublished doctoral dissertation, Arizona State University, Tempe.
- Morgan, G. 1986. *Images of organization*. Beverly Hills, CA: Sage.
- Muth, J. 1986. Search theory and the manufacturing process function. *Management Science*, 32: 948-962.
- Nelson, D. 1975. Scientific management in transition: Frederick W. Taylor at Johnstown, 1896. *Pennsylvania Magazine of History and Biography*, 94(October): 460-475.
- Nord, W. R., Brief, A. P., Atieh, J. M., & Doherty, E. M. 1990. Work values and the conduct of organizational behavior. In B. M. Staw & L. L. Cummings (Eds.), *Work in organizations*: 255-296. Greenwich, CT: JAI Press.
- Oakland, J. S., & Followell, R. F. 1990. *Statistical process control: A practical guide* (2nd ed.). Oxford, England: Heinemann Newnes.



- Parasuraman, A., Zeithaml, V. A., & Berry, L. L. 1985. A conceptual model of service quality and its implication for future research. *Journal of Marketing*, 49: 41–50.
- Pfeffer, J. 1981. Management as symbolic action: The creation and maintenance of organizational paradigms. In L. L. Cummings & B. M. Staw (Eds.), *Research in organizational behavior*, vol. 3: 171–222. Greenwich, CT: JAI Press.
- Pfeffer, J., & Salancik, G. R. 1978. *The external control of organizations: A resource dependence perspective*. New York: Harper & Row.
- Porter, L., Steers, R., Mowday, R., & Boulian, P. 1974. Organizational commitment, job satisfaction, and turnover among psychiatric technicians. *Journal of Applied Psychology*, 59: 603–609.
- Reynolds, P. D. 1971. *A primer in theory construction*. Indianapolis, IN: Bobbs-Merrill.
- Ring, P., & Van de Ven, A. H. 1994. Developmental processes of cooperative interorganizational relations. *Academy of Management Review*, 19: 90–118.
- Rucinski, D. W. 1991. SPC—More than quality control. *Quality*, 30(October): 43–45.
- Schein, E. H. 1992. *Organizational culture and leadership* (2nd ed.). San Francisco: Jossey-Bass.
- Scherkenbach, W. W. 1986a. *The Deming route to quality and productivity: Road maps and roadblocks*. Rockville, MD: Mercury Press/Fairchild.
- Scherkenbach, W. W. 1986b. Performance appraisal and quality: Ford's new philosophy. *Quality Progress*, 18(4): 40–46.
- Senge, P. 1990. *The fifth discipline*. New York: Doubleday.
- Shaw, M. E. 1958. Some motivational factors in cooperation and competition. *Journal of Personality*, 26: 155–169.
- Shewhart, W. A. 1925. The application statistics as an aid in maintaining quality of a manufacturing product. *Journal of the American Statistical Association*: 546–548.
- Shewhart, W. A. 1931. *Economic control of quality of manufactured product*. New York: Van Nostrand.
- Shewhart, W. A. 1939. *Statistical method: From the viewpoint of quality control*. Washington, DC: The Graduate School, The Department of Agriculture.
- Snell, S. A., & Dean, J. W., Jr. 1992. Integrated manufacturing and human resource management: A human capital perspective. *Academy of Management Journal*, 35: 467–504.
- Sooklal, L. 1991. The leader as a broker of dreams. *Human Relations*, 44: 833–856.
- Sower, V. E. 1990. *The consequences of implementing statistical process control*. Doctoral dissertation, University of North Texas, Denton.
- Starbuck, W. H. 1992. Learning by knowledge-intensive firms. *Journal of Management Studies*, 29: 713–740.
- Steenkamp, J. 1989. *Product quality: An investigation into the concept and how it is perceived by consumers*. Assen/Maastricht, the Netherlands: Van Gorcum.
- Steers, R. 1977. Antecedents and outcomes of organizational commitment. *Administrative Science Quarterly*, 22: 46–56.
- Taguchi, G. 1979. *Introduction to off-line quality control*. Tokyo: Japanese Standards Association.
- Taylor, F. W. 1911. *The principles of scientific management*. New York: Harper & Brothers.

- Tersine, R. J., & Riggs, W. E. 1976. The Delphi technique: A long-range planning tool. *Business Horizons*, 19(2): 51–56.
- Tjosvold, D., & Deemer, D. 1980. Effects of controversy within a cooperative or competitive context on organizational decision making. *Journal of Applied Psychology*, 65: 590–595.
- Tornow, W. W., & Wiley, J. W. 1991. Service quality and management practices: A look at employee attitudes, customer satisfaction, and bottom-line consequences. *Human Resource Planning*, 14(2): 105–115.
- Trist, E. L. 1971. Critique of scientific management in terms of socio-technical theory. *Praxeologia*, 39-40: 159–174.
- Tse, D., & Wilton, P. 1988. Models of customer satisfaction formation: An extension. *Journal of Marketing Research*, 25: 204–212.
- Tushman, M. L., & Romannelli, E. 1985. Organizational evolution: A metamorphosis model of convergence and reorientation. In L. L. Cummings & B. M. Staw (Eds.), *Research in organizational behavior*, vol. 7: 171–222. Greenwich, CT: JAI Press.
- Van de Ven, A. H. 1989. Nothing is quite so practical as a good theory. *Academy of Management Review*, 14: 486–489.
- Van de Ven, A. H., Angle, H., & Poole, S. 1989. *Research on the management of innovation*. New York: Harper & Row.
- Van de Ven, A. H., & Rogers, E. 1988. Innovations and organizations: Critical perspectives. *Communication Research*, 15: 632–651.
- Vardeman, S. B. 1986. The legitimate role of inspection in modern SPC. *American Statistician*, 40: 325–328.
- Wall, T. D., Corbett, J. M., Martin, R., Clegg, C. W., & Jackson, P. R. 1990. Advanced manufacturing technology, work design, and performance: A change study. *Journal of Applied Psychology*, 73: 691–697.
- Wall, T. D., Jackson, P. R., & Davids, K. 1992. Operator work design and robotics system performance: A serendipitous field study. *Journal of Applied Psychology*, 77: 353–362.
- Walton, M. 1986. *The Deming management method*. New York: Putnam.
- Wanous, J., & Lawler, E. 1972. Measurement and meaning of job satisfaction. *Journal of Applied Psychology*, 57: 95–105.
- Warfield, J. 1976. *Societal systems: Planning policy and complexity*. New York: Wiley.
- Weber, M. 1958. *The Protestant ethic and the spirit of capitalism*. New York: Scribner.
- Whetten, D. A. 1989. What constitutes a theoretical contribution? *Academy of Management Review*, 14: 490–495.
- Williamson, O. E. 1985. *The economic institutions of capitalism*. New York: Free Press.
- Wollack, S., Goodale, J. G., Wijting, J. P., & Smith, P. C. 1971. Development of the survey of work values. *Journal of Applied Psychology*, 55: 331–338.
- Wrege, C., & Greenwood, R. 1991. *Frederick W. Taylor, the father of scientific management: Myth and reality*. Homewood, IL: Business One, Irwin.
- Wright, T. 1936. Factors affecting the costs of airplanes. *Journal of Aeronautical Sciences*, 3(2): 122–128.
- Yelle, L. 1979. The learning curve: Historical review and comprehensive survey. *Decision Sciences*, 10: 302–308.
- Yoshida, K. 1989. Deming management philosophy: Does it work in the United States as well as in Japan? *Columbia Journal of World Business*, 24(3): 10–17.

**John C. Anderson** received his Ph.D. from the University of Minnesota. He is an associate professor of operations and management science at the Carlson School of Management at the University of Minnesota, and he is the current President Elect of the Decision Sciences Institute. His teaching and research interests involve quality management, operations strategy, and operations analysis.

**Manus Rungtusanatham** is a Ph.D. candidate in operations and management science within the Carlson School of Management at the University of Minnesota. His research interests include quality management and operations management. He will be joining the University of Wisconsin-Madison as an assistant professor.

**Roger G. Schroeder** received his Ph.D. from Northwestern University. He is a professor of operations and management science at the Carlson School of Management at the University of Minnesota, and he is Co-Director of the Quality Leadership Center. His research interests include quality management, manufacturing strategy, and world-class manufacturing.